COMMITTEE ON INTERNATIONAL RELATIONS

Science, Technology, and American Diplomacy

An extended study of the interactions of science and technology with United States foreign policy

Volume II

COMMITTEE PRINT

U.S. House of Representatives

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CHAPTER 9—THE EVOLUTION OF INTERNATIONAL TECHNOLOGY

I. Introduction

The focus of this chapter is on technology: it is intended to delineate the important ways in which technology influences diplomacy; to show technological change as a process producing effects that diplomats must deal with; and to raise questions as to whether and how governments can make purposeful, constructive use of these processes to further diplomatic objectives.

A survey of the history of technology observes that the Industrial Revolution—which might also be called the "Technological Revolution"—was and continues to be a revolution of power, but not only in the power of the machine. "It revolutionized the power of the middle-class employer and the power of labour, the economic power of nations and the power of armaments. But power in itself is neither good nor evil: in the last analysis, its uses are subject to man's good sense or his stupidity. If this is a truism, it is one that man, in the age of nuclear energy, can scarcely afford to ignore." [1]

Similarly, Professor Warner Schilling of Columbia University, who has written extensively in the field of international politics, observes that the industrial revolution changed all the elements of the "international political process" including the structures of states, their policies, and their purposes, expectations, and means.

> Consider the changes in * * * the number, location, and relative power [of states in the world community of nations]. As the industrial revolution transformed the bases of military power and increased its mobility, international relations became global, rather than regional, in scope, and the relations among the members of this global system became continuous, rather than episodic.[2]

Technology as the Underpinning of Diplomacy

The profound influence that technological change has had in the past, and promises to have for the future, implies the need for a strong corps of diplomats trained to anticipate and prepare for the direct and indirect impacts of technology on diplomatic concerns. As William P. Rogers, the Secretary of State, observed to the scientific members of his diplomatic service, January 29, 1970: "Science and

[1] Charles Singer, E. J. Holmyard, A. R. Hall, and Trevor I. Williams, eds. "A History of Technology." Vol. V: The Late Nineteenth Century, 1850 to 1900 (New York, Oxford University Press, 1958), page 840.

[2] Warner R. Schilling. "Technology and International Relations." International Encyclopedia of the Social Sciences. Edited by David L. Sills, (New York, The Macmillan Company and the Free Press. Volume 15), 1968, page 590.

Note: This chapter was prepared in 1970 by Franklin P. Huddle.

technology today have a telling impact on policy decisions in both national and international affairs * * *. We do not have to look far to find examples * * *."

It would be foolhardy in this day and age [the Secretary went on] to set political objectives without an accounting of the technical realities—or to approach technological problems without regard to their political and social implications.

Indeed, the assessment of what science and technology holds for us in the years ahead must be an integral part of today's policy and decision-making machinery. The conduct of our foreign affairs—the formulation of our policies and goals—must reflect the sometimes complex, sometimes subtle, but persistent influence and interaction of science and technology on the affairs of man.

So it is obvious that in forging the capability of the State Department to deal with the problems of the 70s, the professional corps of the Foreign Service and the Department must develop the capacity to keep abreast of these developments and the skills necessary to cope with them.

Diplomacy deals with problems between sovereign nations and with the common concerns of members of the world community of nations. The objective of diplomacy is to reconcile or resolve issues and establish agreements to advance the national interest in a constantly changing world. Changes within the jurisdiction of each member of the world community alter its relations with others. No source of change is more potent than an alteration in a nation's technological condition. It produces changes of many kinds at many levels of impacts and interactions: military, commercial, cultural, political, and scientific; these changes involve many agencies of government, the academic world, private business, and the public at large. Familiarity with technology, and with the nature of its impacts, is thus an indispensable tool of the diplomat. Moreover, the skill with which a nation manages and advances its own technology contributes to the status of its diplomats, and to the options with which they can negotiate. In both senses, national technology confers diplomatic power.

Moreover, it is more than a hypothesis that developments in U.S. technology have bearing on the achievement of such national and international objectives as peace, lessened tension, mutual trade, and easement of the plight of the less developed nations of the world. Accordingly, the Department of State has a cause for concern with the health and vigor of U.S. technology, both generally and with specific reference to technological fields that can be identified as contributing most directly to diplomatic objectives of the United States. The future direction of U.S. technological advances, no less than the Nation's general level of technological competence, has far-reaching consequences beyond its borders. Of great importance also are the uses made of this burgeoning technology, and the organizational arrangements—domestic and international—for overseeing these uses. In these senses, technology is an important basis for national power.

Contemporary Importance of Technology

Technology is a general term covering a wide variety of scientific and technical activities and products. In its simplest usage, it merely signifies "tools." At the other extreme, it conveys the broad meaning of "how man works" [3] and indeed "denotes the broad area of purposeful

[3] Peter F. Drucker. "Technology, Management, and Society: Essays by Peter F. Drucker." (New York, Harper and Row, Publishers, 1958, reprinted 1970), page vii.

application of the contents of the physical, life, and behavioral sciences." [4]

In Part I of this study, technology was described as "the cutting edge of science." It is the point in the system of scientific inquiry and application at which tangible and material impacts occur upon human affairs, and the point at which economic and political decisions are required. Expressed another way, technology is the rational use of knowledge about man's universe, while science is the process of discovering additional pieces of that knowledge.

Notable changes have taken place, over the past several decades, in the role of technology in the United States. The years 1950–1970 might perhaps be described as a "Golden Age of Technology" in this country. The changes can be described along five general headings of *pace*, *size*, *complexity*, *variety or scope*, *and range* and *pervasiveness of impacts*.[5]

PACE

Speaking as Special Assistant to the President for Science and Technology, in 1960, George B. Kistiakowsky declared: "What is new today is the rapidity with which the developments of science are altering the human condition, the rapidity with which policy, particularly foreign policy, must adjust to the changes being wrought by the pace of scientific advance. Not only adjust—policy must prepare for, must predict, the impact of scientific discovery and must also in some sense attempt to guide it." [6]

The rate at which technological innovations have been introduced into the American culture has been a factor of the large postwar increases in the public investment in scientific research. It has also resulted from large public expenditures in related areas (defense, space, and atomic energy) and supporting fields (communications and information processing). Acceptance of such innovations is a factor, also, of the extensive public education in scientific subjects.

The increased pace of change increases the rate at which international issues, problems, and opportunities arise. It confronts the diplomat with an ever-lengthening agenda, the need for a deeper understanding of the processes of change, and the requirement for a great increase in the orderly flow of exact information concerning its ingredients.

SIZE

Although historical achievements in technology have sometimes approached heroic proportions (the Pyramids, Roman roads, the Great Wall of China, and the Panama Canal, for example), the size and cost of some of the modern technological systems is quite unprecedented. Most notable are those in the field of military hardware,

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[4] Erich Jantsch. "Technological Forecasting in Perspective: A framework for technological forecasting, its techniques and organisation; a description of activities and annotated bibliography by Erich Jantsch, consultant to the OECD. (Paris, Organisation for Economic Co-operation and Development, 1967), page 15.

[5] This enlarges somewhat on a statement by Herman Pollack, (then) Acting Director, International Scientific and Technological Affairs, Department of State, at a Colloquium on Science and Human Affairs, University of Illinois, May 17, 1967. He said, in part: "We are in the midst of a technological revolution without precedent in its combination of scale, pace, and impace on the offices of men. The crucial element in that combination is pace. . . ."

[6] Address to American Physical Society and American Association of Physics Teachers, reprinted in "Department of State Bulletin," (February 22, 1960), page 276.

such as the Minuteman complexes, the DEW Line, air defense systems, the Polaris system, and nuclear test detection systems. Others include spacecraft like the Apollo series, global communications networks, air traffic control systems, a global weather forecasting network, the Interstate Highway System, electric power grids, and the complexes of multipurpose dams on the Tennessee and other major rivers.

The willingness and ability of American society to concentrate resources on major technological systems like these has been a striking phenomenon of recent years. Moreover, each of these large endeavors produces in its wake an array of lesser innovations useful elsewhere, and a technological "multiplier" effect analogous to the Keynesian economic multiplier seems to result, raising the general level of the Nation's technological culture to new orders of capability.

Large technological projects of an inherently international character impose burdens on the diplomat. Problems and benefits must be shared equitably by many nations. Acceptance of roles of participation must be negotiated. New mechanisms of diplomacy are required.

COMPLEXITY

The historical evolution of technology appears to have followed a series of cycles. An initial stage was the development and use by man of simple manual tools. Then the effectiveness of the tools was multiplied by the use of energy sources—horses, wind, waterpower, steam, and electricity. Progressively, tools became more highly specialized and explicit in purpose. Then, tools of different functional purpose were integrated into large systems—such as the assembly line, railroad and telephone systems, and petroleum pipelines and refineries. The most recent step has been the introduction of computers into these large systems, to automate the making of routine decisions in their management. These systems have now become so complicated in design and function that even to build them has come to require elaborate systems of planning and control, and these have also required the assistance of computers.

Particularly in the fields of military weaponry and space exploration have systems of extreme complexity emerged. A typical air defense system might extend over a thousand miles, with hundreds of persons in each of dozens of stations, served by electronic sensors, telephone lines, computers to convert signals into readable forms, cathode ray tubes to display information visually, and computers to translate information into instructions for actions to be taken by interceptors, ground-to-air missiles, and other tracking stations. Equally complex is the arrangement of a manned space flight. Taken together, the computer and electronic communications have greatly enlarged man's ability to design and operate complex and far-flung systems.

The evolution of the systems concept imposes burdens and offers opportunity to the diplomat. On the one hand, complexities of systems design present formidable obstacles to quick understanding of these large enterprises. On the other hand, it has been suggested that the disciplines and orderly methodologies they require can make a direct contribution to the processes of diplomatic analysis and problem solving.

VARIETY OR SCOPE

The variety of technological innovations to which the individual citizen is today exposed seems to have increased by orders of magnitude in the past quarter-century. This increase seems to be attributable, again, to the heavy and rising public investment in basic and applied physical science, to heavy developmental outlays in the high technology of military and space programs, to the initiative of entrepreneurs in effecting lateral transfers of new hardware to consumer markets, and to the receptivity of a technically literate and affluent consumer market. The innovative trend is indicated by the automation and productivity of agriculture and industry; the great variety of consumer goods in the home; the elaboration of hardware for recreational purposes; the introduction of computers into banks, brokerage houses, ticket officers, the management of credit cards, and other services; the elaborate expansion of hardware and technological systems into group medical practice and hospitals, school systems, and law enforcement administrations; and the great range of different vehicles in service in the air, on the highways, and in shops, airports, heavy construction projects, and urban areas.

While the scope of diplomacy has not excluded attention to all these topics, there is a tendency for technology to make them more salient. Assigning priorities among a growing array of salient developments becomes increasingly difficult as a problem of formulating and implementing foreign policy.

RANGE AND PERVASIVENESS OF IMPACTS

The effects of an onrushing technology on the United States and in its relations with other countries are virtually without limit. Historical concepts of war, and of the military base for diplomacy, have been unseated by atomic weapons and their long-range delivery systems.

Industrial productivity, supported by technological innovations, has risen so impressively in relation to hours of work that a "post-industrial" condition can be foreseen in which standards of living will no longer be limited by the length of the work week.

Consumption of industrial materials continues to rise, to support present high levels of industrial output, so that the future adequacy of minerals and fuels is increasingly in question.

Consumption of electrical energy to run all the appliances and durable goods in the household, and for all manner of industrial applications, has been doubling every decade in the United States, and seems destined to continue to double at this rate, at least through 1990. Impacts of power generation on environmental quality are a source of growing public and professional anxiety.

Imperfections in technology are coming increasingly under attack: in terms of pollution of the air and surface waters; in terms of noise, radiation, and thermal effects; and in terms of massive quantities of waste products to be disposed of, and minute additions of toxic materials that progressively accumulate in the environment. Agricultural technology has enabled the highest rate of per-worker productivity in all history, but at a cost of heavy uses of chemicals, some of which re-

main indefinitely in the environment. A further cost or hazard results from agricultural simplification—the reduced variety of crops—such that any attacking blight or pest that technology cannot control might wipe out a large fraction of the Nation's food supply.

Technology of health and medical practice has imposed increasing burdens of knowledge on medical practitioners and increased costs on those treated, as well as on society at large. The same problem of information overload confronts technologists in most other fields; indeed, the public at large is exposed to more choices, more solicitation and appeals for attention, and more stimuli, than ever before.

As standards of material well-being in such affluent countries as the United States, Japan, the Scandinavian countries, and those of Western Europe, continue to rise, their condition becomes the source of envy and the target of the aspirations of less developed countries of the world. Defects perceived by the developed countries in their own technologies tend to be discounted by those less developed.

Continued growth of technology and productivity, with their concurrent imperfections and environmental effects, cannot reasonably be expected to go on indefinitely. In countries with less advanced technologies and production systems, the United States is today a much-admired model for emulation. Global growth in the uses and defects of technology is in prospect, strongly supported by positive programs for the export of U.S. technology and by the efforts of the less-developed countries to increase their own technological sophistication through schools, universities, and institutes. The impacts of this growth on a finite world are sobering; to the extent that adverse effects of technology are attributed to the United States as the foremost technological nation, the consequences of this technological leadership seem to pose awkward problems for future diplomacy. However, for the present, the main theme is one of enthusiastic emulation.

National Infrastructures of Technological Growth

The rate at which a nation's technology grows, intensifies, integrates, and comes to dominate its culture, depends in large measure on a combination of foundational elements or "infrastructure." Marked differences are evident among nations as to the completeness with which this infrastructure is developed, and accordingly as to their relative prospects for rapid technological advance. The extent of attention given to this infrastructure, historically, seems to have been more accidental than consciously directed. However, since about 1955, there has been a growing appreciation of the importance of the infrastructure for the evolution and strengthening of a nation's technology.

Infrastructure encompasses many elements. A nation must be able to feed itself, for example, but unless the productivity of its agriculture is such that one family can feed several by its efforts, there will be no food available for those who leave the farm for the urban factory or to sell abroad to buy machinery with. In the United States, a single farm worker—statistically—feeds something like 30 to 40 persons. To increase agricultural productivity requires mechanization, agricultural science, and capital; this set of requirements in turn suggests the need for credit institutions, agricultural training programs, research institutes (to provide information pertinent to the crops produced in the country concerned), an agricultural marketing system, and so on. Other elements of infrastructure are arrangements

for broad public education, a strong national health program, training in entrepreneurial and managerial skills, sophistication in the handling of industrial machinery, a national standards laboratory, and many other basic institutions. Rail and highway networks are of great importance to unify a national market and to open up the hinterland to the global network of ocean freight.

Of course, as a practical matter, the infrastructure contains a host of other ingredients, such as the abundance of technological artifacts for youth to experiment with, the level of technology in the home with reference to such features as the American "do-it-yourself" craze, the wide availability of popular science literature, the American consciousness of the importance of the worker-manager and worker-company relationship, the speed with which technology finds its way into toys and recreational hardware, the institution of the "science fair," and many more.

There are many ways in which diplomacy and technological infrastructure are related: in the formulation of plans with or for developing countries for aiding them to build their own infrastructure, in dealing with developed countries on issues of comparative excellence and competition in infrastructure-building, in exchange of information on measurement of aspects of infrastructure, and in resolving conflicts in foreign trade resulting from differential costs based on different levels of infrastructure, and so on.

Interactions of Technology with Diplomacy

The uses of technology have involved or affected relations between nations in many ways. The essence of technology is power: to increase the production of some manufactured good, to contrive some military weapon of surpassing potency or effectiveness, to perform some socially necessary or desired function, to demonstrate some demanding feat of skill, to secure resources and convert them into artifacts that modify the human environment in purposeful ways. The relations between nation states constitute an endless bargaining process in which the currency is power. A nation that consciously and dynamically lays the groundwork for technological advance, encourages technological skills, rewards innovation, and systematically increases the variety, depth, sophistication, and universality of its technology, is in a stronger bargaining position than a nation that does not. Technology increases the range of options open to a nation in its internal affairs and in its alternatives abroad. Selection and negotiation of courses to support foreign policy, which is the task of diplomacy, is broadened, strengthened, and often made more flexible, by the achievements of technology.

On the other hand, not all the outcomes of technology are equally felicitous. A nation achieving a relatively high level of technological power may have the effect of encouraging other nations to combine forces to reduce its bargaining power. A nation generous with its technological innovations (for example), the British in 1825–1850 or so, with their export of railroad locomotives and rolling stock) may combine benefits in one industry with injury to another. (In the British case, the effect was to stimulate tonnage imports of agricultural products from the United States to the disadvantage of British farmers). Even if a nation bends every effort to achieve technological superiority, its lead over competitor nations will be only marginal at best because other nations will quickly duplicate its successes without

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involving themselves in the costs of its failures. Moreover, technological leadership, though gained at great cost, can be quickly lost if a nation relaxes from the effort even momentarily. For example, the United States pioneered the metallurgical technology in titanium, only to see Japanese metallurgists winnow the best information available and proceed to improve on it—efficiently and at low additional cost. Semiconductor technology followed a similar course. The whole history of textiles has been a succession of international transfers of technology, with improvements occurring after almost every transfer.

Qualitative differences in the directions taken by a nation's technology can have important differences in the effect on quantity and intensity of diplomatic interactions. The relative power resulting from the British steel industry and the Chinese ceramics industry is obvious. Nations emphasizing maritime technologies increase the frequency of international contacts. Mass production of low cost items results in a need to export and often in an accompanying need for ever-increasing external sources of raw materials.

From the literature of science and technology, and of diplomatic discussion, it is possible to delineate a long list of technological-diplomatic problems, issues, and concerns, of which the following are illustrative:

INSTITUTIONAL MATTERS

Technological institutions to aid the less developed nations and to further U.S. technological relations with countries phasing out of the AID program;

Opportunities for creative technological relationships and the evolution of suitable, mutually-supported institutions with nations on the geographical and ideological periphery of the Soviet Union;

Coordination of the multifarious technological programs, interests, and institutions of the United Nations, and also the many regional treaty organizations, European Community and Western Hemisphere organizations, and the like;

Resolution of policy issues associated with the development of high-technology-oriented, multinational corporations.

SUBSTANTIVE TECHNOLOGICAL MATTERS

Development of plans for international cooperation to exploit satellites for communications, meteorological research and forecasting, earth resources surveys, geographic mapping, navigation, pollution detection, early warning of plant and forest diseases and insect infestation, and other purposes;

Technological and environmental problems of the Arctic regions;

Development of quick-response arrangements on an international basis to combat the spread of epidemics (whether afflicting man, animals, or plants), to disseminate curative and preventive technologies, to assure global availability of curative agents and instruments, to enable rapid mobilization of medical teams for emergencies, and to eliminate sources of endemic diseases;

Formulation of policies for the international exchange and use of government-owned patents, the protection of privately owned patents, and the exchange of trade secrets and other "intellectual property," especially where international consortia or multinational corporations are involved;

The bearing of the rate of technological advance in the United States, both absolutely and relative to particular countries and groups of countries, on U.S. diplomacy and diplomatic objectives;

The importance for U.S. objectives of the fact that U.S. technological achievement is not uniform across all of industry, but ranges from the high extremes of computers and control instruments to the relatively lower level of achievement in the steel industry and textiles.

Diplomatic Need for a Coherent Policy Toward Technological Change

The question to be explored in this chapter pertains to the international role, past and prospective, of technology itself as an aspect of the national culture and power. What does it mean for the future role of the United States in relation to the community of nations? What could it mean? In what ways can and should technology be exploited for diplomatic purposes? What are the costs of this exploitation, and are they tolerable?

Technology is a concept in which every citizen is involved. It is capable of being influenced by Government action. It is a source of national strength and wealth. It requires elaborate institutional arrangements, and the more sophisticated it becomes the more complex and far-flung are the arrangements needed to manage it. Technology has been shown capable of advancing U.S. foreign policy objectives, but it is neither infallible nor invariably beneficial.

The question, then, is how to determine what the Federal policy should be with respect to technology, for purposes of U.S. diplomacy. It is certain, in any event, that technology will continue to advance. Once set in motion, it has a momentum of its own. The question is whether and how the dynamics of this changing feature of the American culture can be guided and directed to serve the objectives of U.S. international relations. Implicit in this question is the further issue of whether such diplomatic gains should be pursued or abandoned when they are found to conflict with domestic or regional programs. What sacrifices are necessary? Are they tolerable? Who should decide? Who should determine the rules of the game—the criteria and values on which the choice is made? What organizational resources are available to make these decisions? Are they adequate for the purpose? What else needs to be done?

The hypothesis of this chapter is that technology is a primary source of national power and diplomatic influence. The section to follow will discuss briefly some of the historical effects of technology on the world scene and on the emergence of the United States as a world power. Section III, Trends in Contemporary Technology, selects for more extended treatment several important technologies or aspects of technology. Its purpose is to show that as each technology evolved it became internationalized, its substance became the subject of international conversations, its effects extended beyond national boundaries, and an ultimate outcome to be foreseen would be the evolution of a global system incorporating or resolving the technology.

II. Historical Influence of Technology on Diplomacy

Technology today is at once the substance, an instrument, and a complicating factor of foreign policy. It involves every citizen; it can be influenced by government action; it imposes on society the need for

more and more elaborate institutions for its use and control. On the world scene, technology is a source of national strength and wealth; it can advance a nation's foreign policy objectives; but it is often unpredictable and sometimes injurious in its effects. The purpose of this section is to trace briefly the emergence of technology in the Western World, and chiefly in the United States, to provide an overview of the national and international role of technology as an aspect of national culture and power.

In general, it may be said that technology has contributed both divisive and cohesive factors to the spectrum of international politics. The development of military weaponry has increased the power inventory of nations; yet, vigorous development of military hardware by leading protagonists has merely tended to stabilize the balance of power between them. The application and pursuit of technology expands national frontiers, but the quest for resources abroad has tended to stimulate closer economic relations with remote territories. Uneven growth of technology in developing countries has raised living standards, but has also generated tensions as human expectations have outrun rewards.

The Industrial Revolution as a Global Process

Early in the industrial revolution, a race began for both overseas markets for manufactured goods and supplies of needed raw materials. In this race the process was one of commercial penetration, followed by military enforcement of commercial rights. It is described as follows:

> Conscious of their unassailable position, merchants demanded commercial privileges, and disputes over them often led to wars. From military victories followed the necessity to assume administrative and political authority. Thus, granted the immense European naval and military superiority, European control of the Far East was an almost inevitable consequence of Europe's commercial intrusion in the fifteenth century. Conquest, like missionary effort, was an aspect of the boundless energy of the west.
>
> It was the western ascendancy in warlike affairs, ship-building, and navigation that first impinged upon the East. [Products of artistic quality and craftsmanship did not emerge from the application of western technology.] . . . The huge, basic steps in technological progress seem to be linked with the satisfaction of the most elementary and insatiable human needs. Water- and wind-power were first applied to the grinding of corn, then to fulling cloth, then to mining and metallurgy. Steam-power went first to the mines, then to the mills. Mass-production methods appear first in ship-building yards, then in armament factories. Modern chemical industry begins with the 'heavy' chemicals, and so on. . . . The superiority of the West lay in its greater use of power and machinery, in its chemical industry, and, in a few respects, in its applications of natural science. These advantages enabled Europe to produce more goods more cheaply, and so gradually to raise its standard of living to an unprecented level, while dominating the commerce of the world and drawing to itself every necessary raw material.[7]

British and German Technological Supremacy

From the close of the Napoleonic Wars to about 1885, England remained dominant technologically and industrially over the other nations of Europe, and indeed the rest of the world. Factors behind this leadership included: the proximity of coal and iron at the outset of the age of steam; superior flexibility in the availability of accumulated capital for investment; and early developments in machine tools

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[7] Charles Singer, E. J. Holmyard, A. R. Hall and Trevor I. Williams, eds. "A History of Technology." Vol. III: From the Renaissance to the Industrial Revolution, 1500—1750. (New York, Oxford University Press, 1957), pages 709–711.

and precision metal-working. However, between 1870 and 1895, Germany passed the British and assumed world technological leadership.

In Germany the advent of the railway age resulted in the iron-ore deposits becoming, for the first time, economically linked with coal in that country. The era of 'blood and iron' was dawning. By 1866 Prussia had replaced Austria as leader of the German-speaking peoples. Four years later, a pretext had been found for war against France, and Bismarck's concept of a unified Germany had materialized. In achieving military victories the Prussian armies were considerably aided by their technological advantage in small arms. . . . Emergence of a united Germany and its acquisition by conquest of the low-grade phosphoric iron ores of Lorraine had a dominating significance in world events for the next three-quarters of a century. The Gilchrist and Thomas process, invented in England in 1879, permitted the first use of the iron ores of Lorraine and Luxemburg in the manufacture of steel. The new powerful and energetic Germany was not long in rivalling Britain's early lead in steel production. By 1895 the British output was surpassed by the German.[8]

German emphasis in education was on technological skills and innovation. "The United Kingdom, on the other hand, was by then lagging technologically, especially in the newer fields of electrical engineering, organic chemical manufacture (particularly of dyestuffs), and the motor-car industry. . . . Politically, at that time, German progress in arms manufacture—typified by the mighty Krupp works and great naval yards—seemed the most serious consequence of her industrial expansion." [9]

Technological Support for Germany's Struggle for Power

On the eve of World War I, Germany's energy showed itself in many ways: in ambitious plans for a railroad line to the Middle East, construction of a modern war fleet, development of African colonies, and the prospect of a technological hegemony over the European Continent. When the war broke out, Germany's superior technology very nearly enabled her to overmatch the combination of England, France, Italy, and Russia. In World War I, German submarines threatened England's command of the sea. German chemistry enabled her to produce synthetic nitrate fertilizer and synthetic nitrate explosives to frustrate the British blockade. German metallurgical skills enabled her to substitute available metals for those deemed indispensable.

At this time, Imperial Germany led the world in most branches of the physical and biological sciences, and many fields of technology. Her collapse in 1918 was only partial, but the two decades that followed were marred by social upheavals, runaway inflation, political instability, and finally a dictatorship too erratic in its concepts to exploit systematically the undoubted talents of its people in science and technology.

By the close of World War I, moreover, the industrial technology of the United States—in quantity if not quality—had overtaken Germany's. From then on, the United States assumed world technological leadership and provided the standard of achievement toward which the developed and developing nations of the world came to aspire. Yet, even in the period of decay, after 1939, the technological gains of Germany disturbed the world by the disclosure of the V–2 ballistic rockets, one of the major achievements in World War II.

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[8] "A History of Technology," Vol. V: The Late Nineteenth Century, 1850 to 1900, op. cit., pages 820–21.
[9] Ibid., pages 821–822.

U.S. Rise to Technological Maturity

Many factors, some geographic or historical and some sociological or economic, contributed to the emergence of the United States as the most dynamic technological nation of the world. An unpeopled continent with rich natural resources and temperate climate was settled by immigrants who tended to be self-selected for initiative, education, independence, and political sophistication. A chronic labor shortage automatically placed value on labor-saving devices and machinery. These combined to sustain rapid progress in technological innovation toward high manpower productivity and swift economic growth.

Foremost among the new Nation's needs were roads, canals, and a postal system, all of which the early Government undertook to provide. Later, the railroad and telegraph were eagerly seized upon to link up throughout all parts of the Nation the flow of goods and information.

The American Civil War had a profound effect on technology. For the first time, ". . . the technological resources of a whole nation were ultimately mobilized to overwhelm an opponent. There was mass-production of weapons and ammunition, of uniforms and boots; canned food was supplied to armies transported for the first time by rail." [10]

The revolutionary nature of "mass production" made it the "greatest contribution of America to the development of technology." Eli Whitney, inventor of the cotton gin,[11] is also credited with the key technological developments that paved the way for modern mass production. There were four steps in this process: interchangeability of parts, specialization of production function, the conveyor belt, and mechanical instrumentation. The first two of these were demonstrated at Whitney's arms plant in Connecticut, and the third came much later in the Dearborn plant of Henry Ford. The fourth step, which is still evolving, consists of instrumented controls, computers, computer software, and mechanical slaves, all to replace human operators.

Rostow describes functionally the passage of the United States through the stages of economic growth:

> Steel launched this great expansion, and railway steel remained an important category of use; but in these decades, mass-produced lighter engineering products came into their own: agricultural equipment, the typewriter, and those two almost universal harbingers of the age of durable consumers goods—the sewing-machine and the bicycle. Above all, with the railways mainly laid by the 1880s, the nation became a unified Continental market with powerful incentives within it to organize production and distribution in vast centralized bureaucratized units.
>
> Much in this industrial surge was based on radical improvements in the metal-working machine tool, which comes as close to being a correct symbol for the second phase of industrial growth as the railway is for the first. And, by the 1890s, electricity, chemical, and automobile industries, which were to play an extremely important role in the third phase, were commercially in being, the first two rooted in new and expanding fields of science and technology.[12]

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[10] Ibid, page 819.

[11] Of this 1793 invention, the History observes that it had "led to a great increase in the size of cotton plantations, [and had] affected directly the lives of every man and woman, black and white, in the Southern States, and ultimately, through the slavery question and the Civil War, the whole of the North as well." (Ibid., page 818.)

[12] Walt W. Rostow. "The United States in the World Arena: An Essay in Recent History." (New York, Harper and Row, Publishers, 1960), page 7.

Trends in Industrial Research and Scientific Management

With the opening of the Twentieth Century, two important new trends heightened the intensity of U.S. exploitation of industrial technology. One was the appearance of the large industrial laboratory and the other was the rapid spread of the doctrine of "scientific management" by the Taylor Societies. The first development, epitomized by the Bell Telephone Laboratory at Murray Hill, N.J., and the General Electric Company laboratory at Schenectady, N.Y., proposed to shorten the time sequence between basic scientific discoveries and their commercial application. For the first time the tools and methods of science were employed by industry to "invent to order."

Operating in another direction, the concept of scientific management involved the application of the quantitative scientific method to the actions and behavior of production-line workers as well as to the flow of materials and parts through industrial processes. It focused attention on "time and motion studies" to discover ways to reduce input costs and increase output of product. An important supplement to this program of industrial efficiency was the campaign by Herbert Hoover, as Secretary of Commerce in the early 1920s, to encourage the reduction of waste in industry and the adoption of industrial standards and standardized methods of all kinds. The great industrial laboratories made products better and scientific management made them lower in cost.

Maturing of the American Technological Posture

World War II dramatized the importance of science for military power, but as a practical matter it was technology that proved itself of importance. Trained American scientists, with an impressive supplement of refugee and British scientists, were able to turn themselves into technologists to serve a great national and international purpose. In 1945, when the scientists called attention to the opportunities of the "endless frontier" of science, and urged its public support, they based their claim on the proposition that investment in research and education in the sciences would automatically reward society—would stimulate innovation, and develop opportunities for an expanding economy—in addition to its having military implications. When their appeal was heeded, beginning about 1950, a veritable explosion, scientific and technological, took place.

Pursuing this course, and combining a high consumption economy with a heavy emphasis on scientific innovation, the United States, by 1970, had built a technological structure that included the following principal elements:

A large number of very large, efficient, highly productive, geographically extended business enterprises with families of satellite suppliers of materials, components, and specialized services, comprising complex, interconnected, production-distribution-service enterprises;

Separation of business ownership from business management;

A great increase in policy, planning, and administrative staff in the management of enterprises of all kinds.

The commercially-oriented part of this technological structure achieves high levels of mass production at low cost, based on high levels of productivity of its labor. There is also a "high technology"

part of this structure (specifically, the aerospace and military systems industry) which is characterized by low production of items of high quality and performance; workers in this industry include a high proportion of scientific and technological professionals, skilled in solving complex and difficult problems.

The outbreak of the Korean War was the signal for a great increase in military research and development. Demonstration of the feasibility of the hydrogen bomb accelerated efforts to exploit its high potency in an array of sophisticated attack systems, and at the same time to devise countermeasures against these same systems in the hands of an adversary. With the exhibition of advances by the Soviet Union in rocketry and spacecraft, the efforts of the United States were redoubled. To recapture the lead in space technology, the United States invested some $60 billion in the Apollo and other large programs of research, technological development, design, and system-building.

Other programs of science and technology were concurrently expanding, such as the support of basic science by the National Science Foundation, basic research installations in high-energy physics sponsored by the Atomic Energy Commission, medical research in the National Institutes of Health, interdisciplinary research in the basic sciences and programs to create new scientific "centers of excellence" with support by the Advanced Research Projects Agency of the Department of Defense, research in meteorology by the Environmental Science Services Administration, water desalting studies in the Department of the Interior, and so on. Servan-Schreiber sums up the consequences of this ferment in these words:

> During the *past ten years*, from the end of the cold war and the launching of the first Sputnik, American power has made an unprecedented leap forward. It has undergone a violent and productive internal revolution. Technological innovation has now become the basic objective of economic policy. In America today the government official, the industrial manager, the economics professor, the engineer, and the scientist have joined forces to develop coordinated techniques for integrating factors of production. These techniques have stimulated what amounts to a permanent industrial revolution.[13]

Diplomatic Implications of U.S. Technological Maturity

At the beginning of the present century, when the United States was at the threshold of technological maturity, the nation was confronted by three options:

> * * * To expand its power on the world scene; to soften the harshnesses of industrialization through the devices of the welfare state; to elevate the standard of mass consumption.[14]

This author concludes that the United States "opted" rather wholeheartedly for the third course.[15]

There were several diplomatic consequences of the U.S. decision to opt for a high-consumption economy: (1) As raw material resources at home were quickly consumed, American industry looked increasingly abroad for sources to make good a growing list of deficiencies. Heavy U.S. investments were made to develop overseas sources of chrome, manganese, bauxite, tungsten, and other metals needed by American

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[13] J.-J. Servan-Schreiber. "The American Challenge." Translated from the French by Ronald Steel. (New York, Atheneum, 1968), page 27.

[14] Rostow: "The United States in the World Arena: An Essay in Recent History," op. cit., page 7.

[15] Ibid., page 8.

industry. (2) Production of industrial goods in increasing volume exceeded the domestic capacity to consume, and led to progressive penetration of foreign markets. (3) Lagging sectors of the U.S. economy sought protective tariffs and agricultural producers relied increasingly upon Government subsidies and assistance to maintain "parity" with the industrial sector of the economy.

These developments brought the United States into the tangled maze of international monetary relations, currency exchange problems, tariff negotiations, and questions of trade regulation. The need grew for commercial representation in foreign ports, for commercial and technological intelligence about agricultural production and mineral discoveries abroad, and for information about export and import regulations and trade practices.

World War II marked a revolutionary phase in the growth of U.S. diplomacy. Before the war, the style of the Nation's diplomats was that of an "observant wary minor power, with no bargaining instruments to bring to bear. . . ." But, "With the fall of France in 1940 and the British demonstration of military viability in the autumn, the United States turned to the task of bringing its assets to bear in relation to its interests on a worldwide basis; and thus was launched the third and truly revolutionary phase of the American diplomatic tradition." [16]

The primary basis for American diplomatic resources was the combination of industrial productivity and military potency displayed in that war. Characteristic of the war was the emphasis on science and technology.

> The experience of the Second World War was distinctive in three respects. First, military technology became linked to one area of science virtually at the level of fundamental science—atomic physics. Second, military technology became linked to several areas of rapidly developing technology . . . notably electronics, rockets, and jet turbines. In all of these areas major new engineering (rather than fundamental scientific) breakthroughs were in the process of developing in the interwar years; and military technology . . . accelerated their unfolding practical possibilities. . . .
>
> The third characteristic . . . was simply that the scale on which first-rate minds were mobilized exceeded anything in past experience; and this yielded a flow of technological developments derived from all levels of science and technology and applied over the full range of military activity on a unique scale. Like modern industry, modern warmaking came to build into its institutional structure the process of purposeful invention and innovation; and thus in quite new ways and on a quite new scale, a partnership was launched between the professional military men and the men of science and engineering.[17]

Following the close of the war, the shapers of American foreign policy found themselves confronted with an amazing array of unresolved problems and alternatives. Collapse of the German Reich had left a power vacuum in war-torn Central Europe, and the United States accepted the obligation to aid the belligerent Powers to repair the destruction of their technological structures and infrastructures.

An initial diplomatic effort to achieve multinational cooperation through the United Nations failed with the withdrawal of the Soviet Union from the wartime alliance, the collapse of Nationalist

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[16] Ibid., pages 34–5.
[17] Ibid., pages 59–60.

China, the rejection of the U.S. proposal to transfer an atomic monopoly to international control, and the rise to power of an inward-looking Labour Government in the United Kingdom.

The first manifestation of U.S. technological diplomacy after the war was the highly successful Marshall Plan to restore European industry. Early in this program, the United States scored a technological coup by the Berlin Airlift, which demonstrated the capability of preserving a large city's viability by air shipments alone. However, elsewhere U.S. employment of technology as an instrument of foreign policy enjoyed only limited success.

Frustration of U.S. Efforts to Wield Technological Power

The outbreak of the Korean War in June 1950 was the signal for an intensification of military research and development, and vigorous expansion in industrial capacity. However, this war (like the Vietnamese conflict later on) was to demonstrate the serious, painful, and frustrating limitations of technology in waging a limited war against a highly organized and resourceful, if technologically unsophisticated, adversary.

The Soviet Union had quickly caught up with the United States in the development of fission weapons, and was nearly even also in fusion (hydrogen) bombs. But in the United States, progress in nuclear development had not been matched by progress in the development of delivery systems. "Thus, at a decisive period, when Russian science was organized in an all-out effort to close the gap between Soviet and American strength, there was a substantial deterioration in the efficacy with which the pool of American science and technology was applied to military problems."[18] This trend was to change abruptly, with the evidence of Russian advances in nuclear delivery capability.

> There is no clear analogy in American history to the crisis triggered by the launching of the Soviet earth satellite on October 4, 1957. This intrinsically harmless act of science and engineering was also, of course, both a demonstration of foreseeable Soviet capability to launch an ICBM and a powerful act of psychological warfare. It immediately set in motion forces in American political life which radically reversed the Nation's ruling conception of its military problem, of the appropriate level of the budget, and of the role of science in its affairs. The reaction reached even deeper, opening a fundamental reconsideration not only of the organization of the Department of Defense but also of the values and content of the American educational system and of the balance of values and objectives in contemporary American society as a whole.[19]

The most direct response, in the United States, was an expansion in outlays for space activities. These virtually doubled in each fiscal year after Sputnik, until 1961; they peaked at $7,688.5 million in 1966. Military R&D similarly rose: peaking in the Korean War period (fiscal year 1953) at a little more than $1 billion, rising again to $3 billion in the fiscal year 1957, to $5 billion in 1959, and continuing to rise thereafter to a peak of $8 billion in 1967.[20]

World admiration for U.S. achievements in manned lunar missions was tempered by reservations over U.S. inability to solve such domes-

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[18] Ibid., page 248

[19] Ibid., page 366.

[20] U.S. National Science Foundation. "Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1968, 1969 and 1970." Vol. XVIII. (Washington, U.S. Government Printing Office, 1969), pages 248–9, (NSF 69–31.)

tic problems as pollution, racial tension, crime, and highway accidents; the limitations of technology for the waging of limited war were also to be noted. The application of U.S. technology in support of world health seemed to offer great opportunities, accompanied by awkward side effects. For example, the insecticide DDT played an important role in malarial control and resultant population increase, but raised its own questions as to its ecological consequences.

Various nations, developed and developing, became seriously concerned over the net emigration to the United States of technologically skilled persons.

The territorial sovereignty concept in international law came increasingly in question with the evolution of high flying aircraft, observation satellites, satellite communications, the Antarctic Treaty [21] (in which, as in the later agreement for lunar exploration, a condition of universal extraterritoriality was to prevail), and the issue of the ownership of the ocean floor.

Related to the sovereignty question also was the rise of the multinational corporation, resulting mainly from the opportunity seized by American entrepreneurs to exploit U.S. computer and electronic technologies in European markets.

Relieving and also complicating the emerging problem of world population control was the "Green Revolution"—by which the evolution of new kinds of seeds significantly increased the farm labor productivity of developing countries. This innovative development seemed to offer at least a breathing space in which to search for solutions of the great future problem of balancing food and population.

Thus, by the close of 1970, it was evident that U.S. technology had not been an unqualified success in furthering either U.S. foreign policy objectives or the aspirations of the world at large. The undoubted promise of technology had not achieved fulfillment. It was not clear why. Was it because technologists were unable to produce unflawed innovations? Were the diplomats unable to specify the performance of technologies for global effects? Was there an insufficient coupling of technologists with diplomats to achieve proper teamwork toward a successful product? Where did—and do—the weaknesses lie?

III. Trends in Contemporary Technology

This section considers the evolution of atomic weapons and delivery systems, space developments, agriculture, and the technological infrastructure. These elements, chosen more or less arbitrarily, illustrate a wide range of national and international issues of technology evident in the world today.

Four trends are to be observed: (1) the important ways in which evolving technologies add to the problems and issues confronting the diplomat, (2) the ways in which technology tends to draw nations together in international enterprises, (3) the emergence of many positive values and serious dangers of technology that are of concern to many nations, and (4) the need generated by technology for explicit governmental plans and programs to ensure that its consequences over the globe are compatible with U.S. foreign policy.

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[21] Antarctic Treaty. Signed at Washington, December 1, 1959.

Achievement of Overwhelming Nuclear Force

Probably the most salient and far-reaching technological achievement of the present century is the atomic bomb. Traditionally, military power supplied the principal support of the diplomat at the bargaining table. But the undeniable force of nuclear weapons has been of uncertain value in this role. These weapons are so destructive that even the threat of their use has doubtful credibility. Accordingly, the capability of a nation to produce a bomb, while it accords the achieving nation technological distinction as a member of the "Nuclear Club", does not automatically confer significant advantages of negotiation in diplomacy. Nor does diplomatic advantage flow from the further capability of delivering a large number of atomic bombs accurately on remote targets by intercontinental guided ballistic missiles. The ability of the United States and the Soviet Union to wreak destruction on any nation has not, for example, enabled resolution of conflicts in Vietnam or the Middle East, persuaded a settlement of the Kashmir issue, quieted dissonance in Cuba, or made a viable instrument of peacekeeping out of the United Nations.

Many aspects of atomic technology present intractable problems of contemporary diplomacy. The enormously destructive force of a hydrogen bomb explosion has made general war unthinkable as a rational course. Possession of a monopoly of nuclear weaponry from August 1945 to October 1949 seemingly gave little advantage to American diplomats and generated many problems. One can only surmise what might have happened without them, but their conjectural benefits were accompanied by unmistakable diplomatic costs.

During the monopoly period, the first issue was the possibility of international control and ownership of atomic technology; a move by the United States to bring this about was abortive. The next issue was the desirability of sharing atomic technology with allies of the United States; the outcome of this issue was not only unfruitful but even disadvantageous:

> When President Truman's proposal of July 14, 1949, to continue joint undertakings with the United Kingdom was rejected in a meeting of leading officials at the White House, the decision was "resented by the British Government as a repudiation of the close relationship that had existed during the war. . . ." [22]
>
> Rejection of the French request for assistance in atomic weapons and energy programs ". . . affected the entire range of our diplomatic relations with the central nation of the Common Market and of NATO and the NATO military forces." [23]

According to a French military analyst—

> From 1945 to 1953 or 1954, a period characterized by the American atomic monopoly, Soviet expansion in Europe was limited only by United States negotiation and, later, by the North Atlantic treaty. Hitherto everything had occurred as though Moscow deliberately ignored American military possibilities, while Washington took no further account of the decisive nature of the means the West then possessed to oblige the Communist menace to withdraw. Each side had been the dupe of the atom: the Soviets, in their ignorance, not fearing it; and the Americans not realizing the advantage their monopoly might have given them.[24]

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[22] David E. Lilienthal. "Change, Hope, and The Bomb." (Princeton, New Jersey, Princeton University Press, 1963), page 121.

[23] Ibid., pages 122–3.

[24] Pierre Gallois. "The Balance of Terror: Strategy for the Nuclear Age." (With a foreword by Raymond Aron, Translated from the French by Richard Howard.) (Boston, Houghton Mifflin Company, 1961), page 23.

When the Soviet Union broke the atomic monopoly, late in 1949, the response of the United States was to proceed with the development of fusion weapons, weapons for limited nuclear warfare, and studies of air defense.[25] Diplomatically, the Soviet Union exploited its possession of atomic weapons as an advantage:

> Each visible stage of the increase of Soviet power has provoked and justified new pressures. After the first Russian atomic explosion of 1949, it appeared possible to shift from the cold war in Europe to the warm war in Asia. After Sputnik I and the Soviet ballistic missiles came the Berlin ultimatum, the campaign of visits, the demonstrations of the inanity of the atomic armament . . . and then the offer of a disarmament plan which would permit the numerically superior side to impose its own laws.[26]

Nevertheless, the withdrawal by the U.S.S.R. of nuclear aid and technicians from China seems to have been a factor in precipitating what has proved to be a persistent disaffection toward the U.S.S.R.

The outcome of this tremendous technological effort by the two rival forces is now that neither can exploit the force of the weapon, or even threaten seriously to do so.

THE PROBLEM OF STABILIZING DETERRENCE

The mutual threat of nuclear attack seems to have had a stabilizing effect on United States-U.S.S.R. relations since 1955, or thereabouts, and the development of intercontinental and submarine-launched missiles has apparently strengthened this effect. This technological impasse was described in 1957 by Henry Kissinger.

> The essence of the nuclear stalemate is that it keeps the two superpowers from launching an all-out war because each can force the other to pay an exorbitant price for victory.[27] [Accordingly] The destructiveness of modern weapons deprives victory in an all-out war of its historical meaning. Even the side which inflicts a greater devastation than its opponent may not retain sufficient resources to impose its will.[28]

The existence of atomic weapons and delivery systems apparently means that under conditions of general conflict, there can be no "total victory" and that only limited conflicts for limited gains are feasible. This kind of conflict, limited war, involving the renunciation of total victory, is repugnant to our military thought with its emphasis on breaking the enemy's will to resist and its reliance on the decisive role of industrial potential." [29]

The various alternatives that have been advanced for the U.S. posture include nuclear superiority, nuclear sufficiency, nuclear parity, and perhaps a fourth category involving an assured and adequate "post-attack" striking capability—consisting of weapons of low vulnerability and high probability of penetration of an adversary's territory.

Maintenance of the deterrent posture can apparently take any of these forms. There appears to have been a tendency for both the United States and the Soviet Union to reject the fourth category,

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[25] Rostow, "The United States in the World Arena: An Essay in Recent History," op. cit., pages 248–9.
[26] Gallois, op. cit., page 231.
[27] Henry A. Kissinger, "Nuclear Weapons and Foreign Policy." New York. (Published for the Council on Foreign Relations by Harper and Brothers, 1957), page 125.
[28] Ibid., p. 90.
[29] Ibid., pages 86–7.

and to strive for a more commanding position in arms, although the policy of the Nixon administration has been explicitly to seek "sufficiency rather than . . . the meaningless 'will of the wisp' of nuclear superiority." [30] As President Nixon told his press conference, January 27, 1969:

> Our objective in this administration . . . is to be sure that the United States has sufficient military power to defend our interests and to maintain the commitments which this administration determines are in the interest of the United States around the world.
>
> I think "sufficiency" is a better term, actually, than either "superiority" or "parity." [31]

In announcing his decision on the antiballistic missile system, in his press conference March 14, 1969, the President disclaimed any thought that it was aggressive in concept.

It would be merely a "safeguard of our deterrent system which is increasingly vulnerable due to the advances that have been made by the Soviet Union since the year 1967 when the Sentinel program was first laid out." [32]

The President's concept of "sufficiency" required a good understanding of the adversary's diplomatic motivations and purposes and a reliable set of offensive weapons to make it certain—

(a) that the consequences of their use would be unmistakably disastrous to an adversary;

(b) that the known diplomatic objectives of the adversary would not justify any serious *risk* of invoking this retaliatory mechanism.

Whether because or in spite of the vigorous programs of military technological development of the United States and the Soviet Union, both of the Great Powers have maintained their respective nuclear capabilities in some sort of balance. There is some assurance that the stability of the mutual deterrent is unlikely to be upset by further innovations. Jerome B. Wiesner, who had been science adviser to President Kennedy, expressed the opinion in early 1969 that "In my judgment there is no immediate danger of this stability being upset . . ." [33] On the same occasion, George B. Kistiakowsky, who had earlier been President Eisenhower's science adviser, declared:

> Mutual strategic deterrence provides whatever stability there is to nuclear peace. Beyond this necessary but static role, nuclear weapons have almost ceased to be a useful instrument of national policy; their possession provides few additional foreign policy options.[34]

In the Department of Defense, Harold Brown, as Secretary of the Air Force, declared May 14, 1968: "There can be no successful aggression by means of strategic war today." And in the Department of State, U. Alexis Johnson, Under Secretary for Political Affairs, said

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[30] Herbert Scoville, Jr. "The Politics of the ABM Debate: The View From the Arms Control and Disarmament Agency." Prepared for The American Political Science Association [Convention's] Panel on the Politics of the ABM Debate. (Mimeo, September 1970), page 7.

[31] "The President's News Conference of January 27, 1969." Weekly Compilation of Presidential Documents, (February 3, 1969, Volume 5, Number 5), page 178.

[32] "Deployment of the Antiballistic Missile System." *In* "The President's News Conference of March 14, 1969." Weekly Compilation of Presidential Documents, (March 17, 1969, Volume 5, Number 11), pages 401–2.

[33] U.S. Congress. House. Committee on Foreign Affairs. "Strategy and Science: Toward a National Security Policy for the 1970's." Hearings before the Subcommittee on National Security Policy and Scientific Developments of the . . . 91st Congress, first session. March 11, 13, 18, 19, 24, and 26, 1969. (Washington, U.S. Government Printing Office, 1969), page 9.

[34] Ibid., page 40.

March 26, 1968: ". . . There seems little likelihood that either side can break out of this situation of mutual deterrence and achieve a marked strategic advantage."

PARAMOUNTCY OF OFFENSE

Throughout the history of atomic weaponry one consistent theme has been the superiority of offense over defense. As a practical matter, the stability of the mutual nuclear deterrent rests on the assured ability of an attacked nuclear power to retaliate. Dr. Herbert York in testifying for the Test Ban Treaty took the position that ". . . it is simply easier to build devices that will penetrate a ballistic missile [i.e. assure that the missile warhead reaches its target] than it is to build an anti-missile which can cope with it." [35]

Similar confidence in the offense was expressed by Dr. Harold Brown, as Secretary of the Air Force. He declared, May 14, 1968, that "The Soviets could develop and deploy means to penetrate our defense at substantially lower cost than we could build it."

He did, however, hold out hope that eventually "lesser levels of ABM defense, located around our missile fields, could serve to make an attack on our retaliatory force more difficult." [36]

The vulnerability of the United States to ballistic missile attack was also confirmed by Dr. John Foster, the present Director of Defense Research and Enginering:

> The likelihood of large and sophisticated attacks with the deployment of significant U.S. defenses increases the technical uncertainty of the defensive system. Even with an ABM deployment we would have to expect that in an all-out exchange, dozens of their warheads would likely explode in our cities.[37]

Earlier, Secretary McNamara had stated that "none of the [ABM] systems at the present or foreseeable state of the art would provide an impenetrable shield over the United States." [38]

An analysis of future weapons and space systems by Harold A. Linstone, Associate Director of Development Planning-Systems Analysis, Lockheed Aircraft Corp., March 13, 1969, came to a similar conclusion. He described ten technological options at the disposal of the designers of offensive weapons, and concluded: "This diverse menu of options to maintain a second strike capability in the face of technological changes also shows the difficulty of providing an airtight defense against the offensive arsenal of a technologically alert and capable opponent, i.e., the Soviet Union." [39]

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[35] Dr. York's qualifications included: his position at that time as Chancellor of the University of California (San Diego), and his previous service as the first director of the Lawrence Radiation Laboratory at Livermore, and as the first Director of Defense Research and Engineering, during the Eisenhower administration. (U.S. Congress. Senate. Committee on Foreign Relations. "Nuclear Test Ban Treaty." Hearings before the . . . 88th Congress, first session on Executive M. 88th Congress, 1st session, The treaty banning nuclear weapon tests in the atmosphere, in outer space, and underwater, signed at Moscow on August 5, 1963, on behalf of the United States of America, the United Kingdom of Great Britain and Northern Ireland, and the Union of Soviet Socialist Republics. August 12, 13, 14, 15, 19, 20, 21, 22, 23, 26, and 27, 1963. (Washington, U.S. Government Printing Office, 1963) page 763.)

[36] Quoted in "U.S. Strategic Forces." *In* "Secretary Brown On U.S. Strategic Forces." Extension of remarks of the Hon. Charles H. Wilson. Congressional Record, (May 20, 1968), page E4377. Dr. Brown had succeeded Dr. York as Director of Defense Research and Engineering.

[37] Quoted in "The Proposed ABM System." Discussion on the floor of the Senate. Congressional Record, (June 13, 1968), page S7227.

[38] Statement by Secretary of Defense Robert S. McNamara. *In* Ibid., pages S7235–6.

[39] Harold A. Linstone. "Future Weapons and Space Systems—Comments on Technological Forecasts for the Late 1970's and Beyond." *In* House "Strategy and Science: Toward a National Security Policy for the 1970's." Hearings, op. cit., page 46.

President Nixon, after an examination of the ABM issue, declared March 14, 1969:

> Although every instinct motivates me to provide the American people with complete protection against a major nuclear attack, it is not now within our power to do so. The heaviest defense system we considered, one designed to protect our major cities, still could not prevent a catastrophic level of U.S. fatalities from a deliberate all-out Soviet attack. And it might look to an opponent like the prelude to an offensive strategy threatening the Soviet deterrent.[40]

A DISSENTING VIEW OF DETERRENT STABILITY

The durability of the deterrent and the effect of technology on arms control negotiations (currently, the so-called SALT or "Strategic Arms Limitations Talks") between the two super-powers were both called into question by Dr. York in a recent article in *Science*. He noted that there had been evidence, beginning around 1960, of a "major Soviet effort in the ABM field" which had precipitated a "technological contest between missile defense and missile offense . . ." The principal technological outcome of the contest was the "multiple warhead idea" or "MIRV". The Soviet Union had deployed about 70 ABM interceptors, he said, and the response of the United States was to deploy MIRVs, which would mean a net increase of around 5000 in the number of warheads aimed at Russia. The Soviet response to this response was a multiple warhead development of their own, based on large SS–9 missiles, said to contain three separate warheads of five megatons each. The U.S. response to the SS–9 development was to deploy the Safeguard ABM system to defend the Minuteman force. He concluded:

> ABM and MIRV are thus inseparable; each one requires and inspires the other. Separately or in combination, they create uncertainty in each of the nuclear powers about the capability and even the intentions of the other. These uncertainties eventually lead in turn to fear, overreaction, and further increases in the number and types of all kinds of weapons, defensive as well as offensive.

Moreover, Dr. York went on, the "ABM is a low-confidence system." Its use would require a quick response or "launch-on-warning" doctrine. He declared: "The decision will have to be made on the basis of electronic signals electronically analyzed, in accordance with a plan worked out long before by apolitical analysts in an antiseptic and unreal atmosphere. In effect, not even the President, let alone the Congress, would really be a party to the ultimate decision to end civilization."

Even if the U.S. technology was equal to the task of designing fail-safe electronic responses to control the ABM and the other elements of the defense system, Dr. York questioned whether the Soviet Union would be sufficiently competent. "Do they have the necessary level of sophistication to solve the contradiction inherent in the need for a 'hair trigger' (so that their system will respond in time) and a 'stiff trigger' (so that they will not fire accidentally?) How good are their computers at recognizing false alarms? How good is the command and control system for the Polaris-type submarine fleet they are now

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[40] U.S. President (Richard M. Nixon). "Ballistic Missile Defense System. Statement by the President Announcing His Decision on Deployment of the System, March 14, 1969." *In* Weekly Compilation of Presidential Documents (Vol. 5, No. 11, March 17, 1969), page 406.

rapidly, if belatedly, building? Will it be 'fail-safe'?" The point was that "unfavorable answers to these questions about *their* capability will mean diminished national security for *us*."[41]

A more hopeful view of the arms race was voiced by Herbert Scoville, Jr., of the Carnegie Endowment for International Peace, in September.[42] He suggested that "The resumption of new construction on Soviet SS–9 missile sites * * * may well have been occasioned by a Soviet decision under pressure from the military to emulate the stated US policy of pressing forward with all programs until agreements had been reached at SALT." Soviet awareness of the hazards of the present situation was shown in a statement attributed to Foreign Minister Gromyko (quoted in Dr. York's article in *Science*) to the effect that:

> The command and control systems for arms are becoming increasingly autonomous . . . from the people who create them. Human capacity to hear and see are incapable of reacting to modern speeds. The human brain is no longer capable of assessing at sufficient speed the results of the multitude of instruments. The decisions made by man depend in the last analysis on the conclusions provided by computers. Governments must do everything possible to be able to determine the development of events and not to find themselves in the role of captive of events.

There appear to be at least six principal diplomatic effects of nuclear arms technology: (1) Unlimited general war is an impractical and irrational enterprise and is not regarded as a realistic alternative to diplomatic agreement as was pre-atomic warfare; (2) possession of nuclear arms and delivery systems is essential to preservation of the mutual deterrent posture of the two superpowers and pursuit of nuclear technology is essential in maintaining the balance of terror, a form of stability; (3) deployment of new weapons is a competitive activity in which both sides lose, which inhibits beneficial diplomatic processes, and which obstructs efforts toward agreement in the control of arms; (4) technological developments by either party are of intense interest to the other; (5) the dangers in this relationship are so evident that formal means of direct communication have been judged necessary to reduce the possibility of a triggering misunderstanding of intentions; and (6) the condition of world peace, once only a preferable alternative, has become a paramount and imperative goal of diplomacy.

The Diplomatic Significance of Space Technology

When the Soviet Union launched Sputnik I, the first manmade Earth satellite, October 4, 1957, and followed this with a second successful launch of Sputnik II, November 3, the Russian achievements "caused a great deal of turmoil in the United States." It was a "real jolt to the complacency of the American people."

> In true American tradition, a great clamor went up as to why the Soviet Union was ahead of the United States, who was to blame for the situation, and what was to be done about it.[43]

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[41] Herbert F. York. "ABM, MIRV, and the Arms Race." Science, (July 17, 1970, Volume 169), pages 257–60.

[42] Dr. Scoville is currently with the Carnegie Endowment for International Peace. Earlier he was Assistant Director for Science and Technology. U.S. Arms Control and Disarmament Agency. His views were expressed in a paper delivered in September before a panel of the American Political Science Association in Los Angeles.

[43] U.S. National Aeronautics and Space Administration. Scientific and Technical Information Division. Office of Technology Utilization. "Venture Into Space: Early Years of Goddard Space Flight Center." Prepared by Alfred Rosenthal. (Washington, U.S. Government Printing Office, 1968), pages 21, 23. (NASA Sp–4301).

The Soviet achievement carried the implication that the Soviet Union had mastered the primary technology required for an intercontinental ballistic missile. At one stroke, this achievement erased the issue of the "Bomber Gap," created a "Missile Gap," rendered obsolete the elaborate early warning system of the United States against bomber attack, reduced the warning time of an attack from hours to minutes, and raised the issue as to whether manned strategic bombers would not soon be obsolete. It gave a practical demonstration of the possibility and advantages of technological surprise. And, finally, it raised the prestige of the Soviet Union as a technological power of the foremost rank.

The U.S. response was enactment of Public Law 85–568, the National Aeronautics and Space Act, approved July 29, 1958. From this point on, the American space program was launched on an arduous and costly technological course for more than a decade of competition with the Soviet Union; it was to embrace a tremendous range of scientific investigations, technological concepts, and practical applications. Most importantly, for the purposes of this study, it was a form of activity of inherent importance in international relations: its achievements were prestigious and enabled the United States to recover and even raise its diplomatic stature; its operations were obviously global in nature and required the cooperation of many nations; and the exploitation of its technological capabilities offered attractive rewards to many nations, developed and undeveloped alike.

While space was later to be formally abjured as a military combat regime, satellites obviously offered great advantages for surveillance (which would contribute to the stability of the mutual deterrence evolving between the United States and the Soviet Union). Surveillance from space also offered a way out of the awkward impasse presented by Soviet reluctance to admit any form of external inspection as an adjunct of arms control agreements.

THE SPACE RACE WITH THE SOVIET UNION

There are many descriptions of the space race that began in 1957 and reached a dramatic climax with the first manned lunar landing, in July 1969. Comparison of U.S. and Soviet achievements in this race are difficult because the goals of the two programs are somewhat divergent.

Among the Soviet goals have been the development of FOBS (a "fractional orbital bombardment satellite"), the achievement of a completely mechanized and unmanned vehicle to obtain geological specimens and return with them from the Moon to the Earth, a heavy emphasis on manned Earth-orbiting satellites to conduct experiments in the near-space environment, and various surveillance and weather satellites as well as some not yet explained.

By contrast, one set of U.S. goals has included a series of progressions all directed toward the climax of landing a man on the Moon and returning him safely to Earth. Another set of objectives has been aimed at making practical use of space technology in the form of satellites to enable global electronic communications, survey the Earth, facilitate navigation, study the weather, and perform various other useful functions.

Both countries have made extensive use of satellites for purposes of military surveillance, planetary exploration, probes of deep space, and scientific observations from the space environment.

MEASURES OF PROGRESS IN SPACE TECHNOLOGY

One measure of success is the comparative national effort invested in it. In rough terms, it appears that the total effort in both the United States and the Soviet Union is about even.[44] Another measure is the recognition, worldwide, of space achievements. Although the Soviets scored first, and remained well in the lead for 7 or 8 years thereafter, the U.S. moon landing reversed the relationship decisively. Moreover, U.S. practice in announcing nonmilitary launches in advance and admitting to failures has added credibility to U.S. announcements of successes. Advance announcements are also important in enabling the world—in effect—to participate as an observer of each major U.S. endeavor.

As to numbers of satellites carrying out a mission successfully, the Soviet practice of not announcing failures makes comparison difficult. Numbers of known launches and numbers of satellites actually orbited or dispatched on missions are roughly comparable.

With respect to the utility of the space program—the commercial or economically beneficial uses of satellites—it would appear that the United States has a lead. The Syncom series of synchronous orbiting communications satellites, developed first by the United States, has provided the technological basis for global telephone and television systems that have now become an important and expanding commercial activity. Similarly, the world has been invited to share the benefits of the U.S. series of Tiros weather observation satellites. However, the Soviets have entered vigorously into both of these fields and apparently intend to match U.S. efforts in the forthcoming program of Earth resources satellite surveys.

DIPLOMATIC ASPECTS OF THE SPACE RACE

The National Aeronautics and Space Act of 1958, in its declaration of policy (Sec. 102-a) stated: "The Congress hereby declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." Such activities, moreover, should be conducted so as to contribute to ". . . cooperation by the United States with other nations and groups of nations . . ." in the work and the enjoyment of its benefits. (Sec. 102–c–7) To this end:

> SEC. 205. The Administration, under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate.

By 1970, the United States had entered into 250 international project agreements with some 74 nations under the space program.

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[44] U.S. Congress. House. Committee on Science and Astronautics. "Review of the Soviet Space Program: With Comparative United States Data." Report of the . . . . Prepared by the Science Policy Research Division, Legislative Reference Service, Library of Congress. 90th Congress, first session. (Washington, U.S. Government Printing Office, 1967), pages 83–4. [Committee Print.]

The non-military part of the U.S. space program is operated on a virtually open basis with "international exchange of personnel, visits, combined experiments, shared tracking, and many other joint activities." By contrast, the Soviet Union's combined military-civilian program has lacked any convenient way of arranging for international cooperation.

It has been only in the last year [1966] that it has held a meeting of bloc countries to consider joint scientific experiments, and has negotiated with France a plan to put up a payload in about 1972. Most earlier Soviet cooperation consisted of a one-way flow of optical tracking reports from many bloc and associated countries to Moscow in support of Soviet studies.[45]

Nevertheless, the inherently international nature of space activities offers encouragement for the evolution of cooperative programs; informal understandings and the exploitation of practical applications seem to be on the increase, and may pave the way for more formal arrangements. For example:

. . . In scientific circles, the Russians have appeared at meetings in the West including the United States, and have permitted Americans to go to meetings in Russia at which technical papers have been given on each side. Through COSPAR (the Committee on Space Research of the International Council of Scientific Unions) both countries and others have met to exchange flight data on a routine basis. On the political level, both have also filed flight data at the United Nations, and it was through the U.N. that the recent space treaty was negotiated. . . . Agreements have been negotiated which call for an exchange of space-gathered weather data, with data passed over the so-called "cold line" between Moscow and Suitland, Md. This same agreement has called for exchange of geo-magnetic data, and also the joint preparation of a book on space medicine. . . .

About the only other international activity of the Russians has been their exchange of television between Moscow and Paris. They have suggested to the Japanese they may also wish to exchange programs. For a long time they opposed the international consortium plan for communications satellites as unnecessarily dominated by the United States.[46]

From time to time, both the United States and the Soviet Union have made overtures toward cooperation in their space programs. The USSR delegate Kuznetsov to the U.N. General Assembly announced, October 6, 1959, that his country would propose:

The calling of an international conference of scientists under U.N. auspices, on the question of exchange of experience in the study of outer space." [47]

The most positive suggestion, however, was that offered by President Kennedy in September, 1963. This was an evident move to maintain the momentum toward detente that had begun with his speech at The American University, June 10, and seemed likely to be furthered by anticipated favorable Senate action on the Test Ban Treaty.[48] Accordingly, on September 20, 1963, the President went before the United Nations General Assembly to propose a global program in space, rather than a competition between the two leading contenders:

Why . . . should man's first flight to the moon be a matter of national competition? Why should the United States and the Soviet Union, in preparing for such expeditions, become involved in immense duplications of research, construction, and expenditure? Surely we should explore whether the scientists and

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[45] Ibid., page 82.
[46] Idem.
[47] Eugene B. Skolnikoff. "Science, Technology, and American Foreign Policy." (Cambridge, The M.I.T. Press, 1967), pages 29–30.
[48] Senate approval of the Treaty came on Sept. 24.

astronauts of our two countries—indeed, of all the world—cannot work together in the conquest of space, sending some day in this decade to the moon not the representatives of a single nation but the representatives of all of our countries.[49]

Nothing came of this dramatic attempt to exploit space technology for diplomatic gain.

COMMUNICATIONS SATELLITES

Many proposals have been advanced for ways to use Earth satellites for practical purposes, as distinguished from research. These proposals fall generally into three categories of satellite use: as point sources or relay points for global communications systems; as stations to exploit the properties of the space environment; and to perform surveys from a truly global vantage point.

One of the earliest and most significant practical uses of satellites was for global communications. The commercial practicality of satellites for this purpose was accelerated by the development of synchronous satellites, which moved through space at the precise rate required for them to remain fixed above a pre-selected point on Earth's Equator. From this position, a satellite had many advantages for global communications: to relay voice communications from point to point, to distribute television programs from one continent to another, to broadcast programs directly, and to provide information for air traffic control. Other satellite functions—not necessarily requiring synchronous satellites—include the providing of position data and communications for aerial navigation, air transport separation standard management, position determination, collision avoidance, and search and rescue information.

A legislative action to provide an administrative instrument for the management of commercial space communications was the Communications Satellite Act of 1962, approved August 31, 1962, Public Law 87–624 (76 Stat. 419).

Subsequently, an agreement was entered into, August 20, 1964, for international cooperation of the parties in the design, development, construction, establishment, maintenance and operation of the space segment of a global commercial communications satellite system, which had as its objective the achievement of basic global coverage in the latter part of 1967. The concept was that this agreement would be an interim arrangement and that recommendations would be forthcoming after the system became operational, for either (a) continuance of the interim program on a permanent basis or (b) a permanent international organization supported by an international administrative and technical staff.

FEASIBLE FUNCTIONS OF SURVEILLANCE SATELLITES

While synchronous satellites appear to be the principal foundation element of global communications technology, satellites in uniform circular orbit closer to Earth seem most useful for many possible surveillance functions. Apart from their obvious advantages in arms inspections and military operations, surveillance satellites are already useful for many commercial services and give promise of still greater

[49] U.S. Arms Control and Disarmament Agency. "Documents on Disarmament, 1963." (Washington, U.S. Government Printing Office, 1964), page 529.

future benefits over a wide range of applications. A NASA study in 1967 listed some of these as follows:

hydrology (river forecasting and flood warning)
tracking of migratory fish, animals, and birds
iceberg reconnaissance
mapping of land areas and ocean bottoms
tsunami warning
earthquake prediction
air pollution monitoring and forecasting
weather forecasting
support for weather modification (precipitation enhancement, hail and lightning suppression, fog dispersal, and storm modification)
earth resources surveys (agricultural and mineral).

WEATHER FORECASTING BY SATELLITE

A measure of the possible economic advantages of weather forecasting was developed by a panel of the National Academy of Sciences, in 1965, which suggested that upwards of $2 billion "could be saved by farmers, fuel producers, public utilities, builders, and water managers if they were equipped with better forecasting tools." [50] International cooperation in this field has been quick to develop. For example, in a letter to Chairman Khrushchev, March 7, 1962, President Kennedy suggested "the joint establishment of an early operational weather satellite system" to provide global weather data for use by any nation.

To initiate this service, [the President continued] I propose that the United States and the Soviet Union each launch a satellite to photograph cloud cover and provide other agreed meteorological services for all nations. . . . This immensely valuable data would then be disseminated through normal international meteorological channels and would make a significant contribution to the research and service programs now under study by the World Meteorological Organization in response to Resolution 1721 (XVI) adopted by the United Nations General Assembly on December 20, 1961.[51]

Khrushchev agreed. In his reply, March 20, 1962, he said:

Precise and timely weather prediction would be still another important step on the path to man's subjugation of the forces of nature; it would permit him to combat more successfully the calamities of the elements and would give new prospects for advancing the well-being of mankind. Let us also cooperate in this field. [52]

Good progress appears to have been made in this subject. By April, 1967, the National Aeronautics and Space Administration was to report:

One of the political benefits of weather satellites has been in fostering cooperation with other nations, particularly between the United States and the Soviet Union. An example of this is the 1962 agreement with the United States and the U.S.S.R. The agreement stated in part: "In the field of meteorology, it is important that the two satellite launching nations contribute their capabilities

[50] National Research Council. Committee on Oceanography. "Economic Benefits from Oceanographic Research, A Special Report." (Washington, D.C., National Academy of Sciences-National Research Council, 1964), page 37. (Publ. 1228.)
[51] Department of State Bulletin, (April 2, 1962), pages 536–7.
[52] U.S. Congress, Senate, Committee on Aeronautical and Space Sciences. "Documents on International Aspects of the Exploration and Use of Outer Space, 1954–62." Staff report prepared for the use of the . . . . (Washington, U.S. Government Printing Office, May 9, 1963), page 250.

toward the establishment of a global weather system for the benefit of other nations." The first major activity in this area was the installation of the "cold line" between Moscow and Washington for the exchange of meteorological data. For many months only conventional data flowed across the line. However, in August 1966 the Russians began to exchange satellite cloud pictures and infrared data over the coldline from information provided by Cosmos 122. This exchange terminated after a few months presumably due to failure of Cosmos 122, and was resumed in March 1967, immediately after the launching of Cosmos 144: This two way exchange is still in progress.[53]

The cooperative international program known as "World Weather Watch," under the aegis of the World Meteorological Organization (WMO) also relies extensively on satellites. It envisions a cooperative effort among the nations of the world to develop a global system for complete surveillance of the atmosphere and for the rapid dissemination of weather information on a world wide basis. To support the program of WMO, President Johnson, by letter of October 23, 1964, instructed Secretary Luther Hodges of the Department of Commerce, to "take such action as you may deem necessary to bring the interested Federal departments and agencies into closer consultation and coordination with regard to international activities in meteorology and the formulation of U.S. international meteorological policies and programs to insure that the United States will continue to make a significant contribution. . ." [54]

EARTH RESOURCES SATELLITE SURVEYS

Of possibly great significance is the use of satellites for surveys of global resources of agricultural and mineral wealth, and for the management of these resources. On this subject, a NASA report has spelled out the advantages of gathering information about Earth resources.

Accurate, timely, and broad-scale surveys of agricultural and forestry resources on a periodic basis by Earth-orbital remote sensing will become increasingly important in future years. These techniques combined with automatic pattern recognition methods will yield information necessary to allow improved productivity, development, and utilization of agricultural resources on a worldwide basis.[55]

These, said the report, should yield information useful with respect to soil classification, land use capability and changes, natural vegetation, range surveys, crop identification, crop disease and insect invasion detection, flood control survey, watershed and hydrologic studies, recreation site evaluation, wildlife habitat studies, forest species identification, forest fire detection, forest disease and insect invasion detection, soil conservation programs, irrigation development, agricultural development projects, and crop acreage control programs.

With respect to geology and mineral resources, the report suggested a number of possible applications of satellite data, such as: geologic mapping, mineral resource investigations, thermal activity in connection with volcanic eruptions, observations of magnetic and gravity

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[53] U.S. National Aeronautics and Space Administration. Space Applications Programs Office, Office of Space Science and Applications, Office of Technology Utilization. "A Survey of Space Applications . . . for the benefit of all mankind." (Washington, U.S. Government Printing Office, April 1967), pages 90–91. (NASA SP–142.)

[54] Department of State Bulletin (November 30, 1964), pages 792–4.

[55] National Aeronautics and Space Administration. "A Survey of Space Applications '. . . for the benefit of all mankind.' " Op. cit, page 5.

fields on a global basis, tectonic analysis of earthquake belts, data useful in planning and site selection for large engineering works, and continuous mapping of "subaqueous deposition, channel filling and excavation, effects of floods and other natural changes" in large coastal deltas.

President Nixon has given support to the Earth resources satellite program. Addressing the United Nations General Assembly, September 18, 1969, he announced that ". . . we are now developing [such] satellites with the first experimental satellite to be launched sometime early in the decade of the seventies." These would be capable of yielding such data as the location of schools of fish in the oceans, the location of mineral deposits on land, and the health of agricultural crops.[56] Subsequently, the U.N. was notified (a) that a detailed description of the U.S. program had been presented to the U.N. Secretary-General for dissemination to all U.N. members, (b) that an international workshop would be convened on Earth-resources-survey systems in the spring of 1971, (c) that various opportunities for education and training in the technologies involved would be made available by the United States to nationals of U.N. members, and (d) that the United States proposed to ". . . invite potential international users to work with us as we explore, from the standpoint of their needs and problems, the best ways of approaching such technically difficult matters as data processing, interpretation, and dissemination." Although warning that there were many constraints and obstacles to be overcome in this program, one study concludes that "the 1970's could become a decade of international space cooperation." [57]

GROWING IMPORTANCE OF SPACE-DIPLOMACY

Manifestly, the new technology of space has many implications for diplomacy. It afforded a new and relatively non-controversial area of opportunity for joint US-USSR action. It was inherently global. It offered economic advantages and opportunities to all countries. It demonstrated U.S. leadership in practical application of a dramatic new technology. As a communications link it brought the entire world closer together. It offered promise of solving such grave global problems as arms inspections, pollution detection, and resource inventory. At the same time, it raised a host of legal and diplomatic questions as to sovereignty of near space, content of global television programs, the equities of developing countries in an activity beyond their limited means, and the rights of nations and individuals to use information secured by satellite.

The Interaction of Agricultural Technology with Diplomacy

The ideal state for Thomas Jefferson was a community of small, independent land-holders, deriving their income and subsistence from the soil. Something of this philosophy persisted in the United States

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[56] "The President's Address to the 24th Session of the General Assembly. September 18, 1969." Weekly Compilation of Presidential Documents, (September 22, 1969, Volume 5, Number 38), page 1281.

[57] John Hanessian, Jr. and John M. Logsdon. "Earth Resources Technology Satellite: Securing International Participation." Astronautics and Aeronautics. (August 1970, Volume 8), pages 56, 60.

long after the reality had waned. Jefferson saw agriculture as the most virtuous of employments: "When we get piled upon one another in large cities, as in Europe, we shall become corrupt as in Europe, and go to eating one another as they do there."[58] It was better, he said, "to carry provisions and materials to workmen there, than bring them to the provisions and materials, and with them their manners and principles."[59]

On the other hand, Alexander Hamilton, while granting the preeminence of agriculture, nevertheless considered industry important for "augmentation of the Produce and Revenue of the Society." Inherently, he said, division of labor made for a more productive and prosperous society; mechanization increased productivity and employment opportunities; immigration would be encouraged; and a market would be provided for surplus agricultural products.[60]

Application of the scientific method to agriculture was generally favored in the early Republic. Jeffersonians saw in it a means by which the individual could improve his lot; Hamiltonians considered it a means to a prosperous and expanding economy.

MODERN CONTRAST WITH JEFFERSONIAN IDEAL

The application of technology to agriculture—scientific farming—has had precisely the opposite effect from that Jefferson sought. The subsistence farmer has been replaced by the large farm as the primary source of food and natural fiber. The small farmer is waging a desperate rearguard action, finding it increasingly difficult to compete. Farming as a way of life is reserved for an ever-dwindling percentage of the population in the United States. Those remaining on the farms—who are still able to succeed—are doing so by specialization. The fact is that the farmer today is a part of a larger industrial system of mutual interdependence. He does not eat his own wheat; he does not grow his own truck; he relies heavily on the Government to supplement his own uncertain income. All these characteristics are in stark contrast with the Jeffersonian ideal.

Initially, the application of technology to farming in a new, unpeopled continent where land was abundant meant that the skillful farm manager could expand his acreage and his production per acre. Additional acreage was made available for cultivation by impounding streams in arid regions and irrigating the land. Higher agricultural productivity was achieved by supplemental irrigation. Farms around urban areas, to provide milk and truck garden products, grew along with the urbanization of the country. Production of large volume commodities—wheat, corn, cotton, rice, and the like—was increasingly concentrated on very large farms. These were able to make heavy use of specialized farm machinery (powered first with animals, then with

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[58] "Letter to James Madison, December 20, 1787." *In* "The Complete Jefferson: Containing his Major Writings, Published and Unpublished, except His Letters." Assembled and arranged by Saul K. Padover. (New York, Tudor Publishing Company, 1943), page 123.

[59] *In* Padover, Ibid., pages 678–9.

[60] Alexander Hamilton. "Report on Manufacturers." *In* "The Reports of Alexander Hamilton." Edited by Jacob E. Cooke. (New York, Harper Torchbooks, Harper and Row, Publishers, 1964), pages 118, 128.

steam and later with internal combustion engines), chemical fertilizers and pesticides, aircraft to sow seed and spread chemicals, and mechanical contrivances to convert many different crops into standardized marketable units. Among the most important of technologies were the discoveries in plant and animal genetics.

As a consequence of technology, agriculture in the United States became increasingly divided into two distinct categories: one was an industrial business and the other a precarious way of life, yielding barely enough product with Government assistance to maintain the capital and the soil.

At first, the numbers of farms increased as land was opened to purchase, homesteading, and subdivision of unmanageable land grants. This process continued up to around 1935, when the number of farms peaked at 6.8 million. Thereafter the number started to decline to 3.7 million in 1962, with 1 million forecast by 1980. Significantly, the number of farms of 1000 acres or larger rose from 29,000 in 1880, to 81,000 in 1930, and to 131,000 in 1954.[61] "By 1959 these big units, which were only 3.7 percent of all farms had acquired 49 percent of all the land and their average size had reached 4,048 acres—more than six square miles apiece." They averaged annual sales of $94,000, had an average value of $220,000, and produced almost one-third of all crops and livestock. By 1963, the top three percent of all farms was producing more than the bottom 78 percent.[62]

POLITICAL AND ECONOMIC TRENDS

The political role of the farmer and the response of the Congress to the needs of the farmer appear to have been affected by the technological revolution in agriculture. Around 1800, something like 90 percent of all citizens of the United States lived on farms. Much of the legislation between 1800 and 1900 had a rural or agricultural bias, including the Northwest Ordinance, creation of the Department of Agriculture, the land grant colleges, the Homestead Act, railroad land grants and subsidies, the Interstate Commerce Commission, and sustained support for agricultural research.

But urbanization began to take its toll before the end of the century. By about 1890, the Nation was divided 50–50 between urban and rural populations, and thereafter the disproportion proceeded swiftly. By 1970 it was approaching 95 urban and five rural. Concern for the non-agricultural sector was indicated in the creation of Departments of Commerce, Labor, and Housing and Urban Development.

The gross value of agricultural production in the United States climbed steadily throughout the latter half of the 19th century—from $4.1 billion annually during the decade 1869–1878 to $8.4 billion in the years 1897–1901. Thereafter, it remained fairly constant through 1936 ($9.8 billion), and then began to creep upward again, reaching $14.1 billion in 1955.[63] It is interesting however, to compare farm and nonfarm productivity during these years. (See table 1)

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[61] "Series K 61–72. Farms and Land in Farms, by Size of Farm: 1880 to 1954." *In* U.S. Department of Commerce. Bureau of the Census. "Historical Statistics of the United States. Colonial Times to 1957." (Washington, U.S. Government Printing Office, 1960), page 279.

[62] Edward Higbee. "Farms and Farmers in an Urban Age." (New York, The Twentieth Century Fund, 1963), page 3.

[63] "Series F 44–48. Gross Domestic Product Originating in Private Farm and Nonfarm Sectors and Government, in 1929 Prices: 1869–1955." *In* "Historical Statistics of the United States: Colonial Times to 1957." op. cit., page 140–1.

TABLE 1.—GROSS DOMESTIC PRODUCT, PRIVATE FARM AND NONFARM SECTORS, SELECTED YEARS[1]

[Billions of 1929 dollars]

Years	Farm	Nonfarm
1869–78	4.1	6.8
1897–1901	8.4	27.4
1936	9.8	83.2
1941	12.3	116.4
1955	14.1	198.8

[1] Source: Adapted from "Historical Statistics of the United States: Colonial Times to 1957," op. cit.

Accordingly, "There is, in the mid-1960's, virtually no theoretical limit to possible increases in agricultural productivity over the next several years, although gains in productivity will tend to level off . . ."[64]

A contemporary analysis suggests that this leveling-off process is at hand as man begins to take account of some of the adverse consequences of farm technology. This concern for the environment—

> * * * would operate to protect and improve man's environment, to render technological developments more sophisticated and more costly, to increase the cost of producing food, to slow the rate of output expansion and to drive farm prices upward. This, indeed, would be a new era for farmers of the developed world.[65]

The great expansion in U.S. agriculture during the 19th century had important impacts on Europe. The industrial revolution brought to that continent a population increase of more than 200 million, and European agriculture was unequal to the task of feeding those in its cities and industries. Accordingly: "By the close of the century, the gravity point of world agriculture shifted decisively from Europe to the United States: the significance of [the vast expansion of acreage] brought under cultivation in the United States, in the period 1860–1900, was tremendous." [66]

SOME DIPLOMATIC CONSEQUENCES OF AGRICULTURAL CHANGE

During the 19th century, despite the progressively smaller percentage of the U.S. population engaged in agriculture, the Nation's highly technological farms became progressively more significant as a factor on the world scene. Four aspects of technology related to agriculture have emerged as important for present and future diplomacy:

1. The population explosion, worldwide, will necessitate resort to the best available technology on a worldwide basis, if famine is to be averted. Technology employed on U.S. farms is not necessarily appropriate elsewhere; what is more likely to be needed is the building of the same kinds of research institutions in developing countries that were created in the United States during its initial period of growth. The question remaining is whether there is time for such a long-range approach.

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[64] Wayne D. Rasmussen. "Scientific Agriculture." *In* Melvin Kranzberg and Carroll W. Pursell, Jr., ed. "Technology in Western Civilization. Volume II: Technology in the Twentieth Century." (New York, Oxford University Press, 1967), page 353.

[65] Willard W. Cochrane. "American Farm Policy in a Tumultuous World." [From Minnesota Agricultural Experiment Station Misc. J. Series No. 7325.] *In* "Commercial Farm Policy." Extension of remarks of the Hon. Donald M. Fraser. Congressional Record. (October 14, 1970), pages E 9404–9. The quotations appear at page E9406.

[66] George Borgstrom. "Food from the Sea." *In* Technology in Western Civilization. Volume II: Technology in the Twentieth Century." Op. cit., page 424.

2. The use of U.S. agricultural surpluses abroad as an instrument of diplomacy presents increasingly awkward and complicated problems of balancing such factors as—

(*a*) Domestic U.S. prices of farm products;

(*b*) Specific quantitative requirements of countries for U.S. aid;

(*c*) Humanitarian considerations of urgent need, and the desirability of maintaining emergency reserves of food stocks;

(*d*) The question of obligations of nations receiving U.S. aid in the form of agricultural surpluses;

(*e*) Distinctions between "assistance" and "dumping"; and

(*f*) Effects of U.S. food contributions on the agricultural economies of developing nations.

3. The need also exists to encourage increased agricultural productivity in developing countries to provide an agricultural surplus for export against the purchase of industrial and social overhead capital, and to enable labor in these countries to leave the farm to accept industrial employment. This concept is firmly associated with that of balanced economic growth. Involved also is the question of devising or applying agricultural technology in these countries. On this subject, the President's Task Force on Science Policy has warned:

> Advanced agricultural techniques which are of great importance in the United States may have little or no effectiveness in a country where the pointed stick is one of the most widely used farm implements.
>
> The Task Force believes that much greater emphasis must be placed on the transfer of research and development capabilities, rather than of technology itself, if we hope to increase the effectiveness of our assistance to underdeveloped countries. We must place stress on the transfer of methods for technical research and education within the ethnic and environmental framework of the receiving country itself, rather than within our framework.[67]

4. The impact on the environment of measures to increase agricultural productivity raises another set of questions. Whether couched in Jeffersonian terms or in those of contemporary "environmentalists," objections can be foreseen to the application abroad of technologies judged injurious in the United States. For example, one report of the President's Science Advisory Committee urged restraint in the use of pesticides as "toxic to beneficial plants and animals, including man" while another called for a sixfold increase in U.S. shipments of these chemicals to the developing world.[68]

There are many other questions concerning the interaction of farm technology, and resulting agricultural productivity, with diplomacy. What diplomatic consequences might be foreseen for possible breakthroughs in the technology of tropical agriculture, that might yield vast increases in foods from tropical rain forests? How dependent is the world's second-largest nation, India, on relief shipments of U.S. food, and what are the effects of this reliance on U.S. foreign policy goals and decisions? To what extent is food a legitimate instrument of foreign policy; is it—like atomic weapons—too decisive and

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[67] U.S. The President's Task Force on Science Policy." "Science and Technology: Tools for Progress." The Report of the President's Task Force on Science Policy." (Washington, U.S. Government Printing Office, April 1970), page 41.

[68] Chapter Fifteen. "The Insecticide, Fungicide and Rodenticide Act of 1947." *In* U.S. Congress. House. Committee on Science and Astronautics. "Technical Information for Congress." Report to the Subcommittee on Science, Research, and Development of the. . . . 91st Congress, first session. Prepared by The Science Policy Research Division, Legislative Reference Service, Library of Congress. April 25, 1969. House Document No. 91–137. (Washington, U.S. Government Printing Office, 1969), page 409.

repugnant a compulsion to be employed? To what extent are the chemical technologies used in modern agriculture necessary to feed the world, and to what extent do they affect the environment so adversely as to require international agreement to halt their widespread use?

Supporting Elements of National Technological Change

National ability to exploit technology for specific fields of production depends on many supporting conditions that need to develop along with the technology they support. Authorities differ as to the precise range of these elements and as to their relative importance. Those cited may be considered illustrative of the general range of elements of the technological "infrastructure."

DIFFERENT VIEWS OF "INFRASTRUCTURE"

Barbara Ward stresses the idea of equality, the idea of progress, the fact of human population increase, and the application of science and capital to nearly all forms of human activity.[69]

David C. McClelland suggests that an important element is the attitudes and quality of the leaders and managers of industry and commerce in a nation:

> The crucial issue [seems to be] what kind of men are in which sector. . . . What kind of men are available for leadership positions in economic organizations in various countries? For in the long run it is they, and their primary concerns, whether for achievement, affiliation, power, or something else, that determine the rate at which the economy of their country develops.[70]

In a later discussion, Miss Ward suggests that the availability of capital to support the process of technological development is crucial:

> The world economy is the creation of technology. Technology in turn is the creation of two factors which first appeared in a decisive alliance, inside the Atlantic community. One, of course, is experiment leading to invention. The other is capital or savings.[71]

Walt W. Rostow relates the acquisition of capital to agriculture:

> Technically, the preconditions for sustained industrialization have generally required radical change in three nonindustrial sectors. First, a build-up of social overhead capital, notably in transport. . . . Second, a technological revolution in agriculture. . . . Third, an expansion in imports financed by the more efficient production and marketing of some natural resources plus, where possible, capital imports.[72]

Martin Goland, President of Southwest Research Institute, enumerate six essential ingredients of technological evolution:

> First, the technical knowledge which makes new technology possible;
> Second, a social climate which is receptive to a more material way of life;
> Third, a political and governmental structure which encourages new technology;
> Fourth, the availability of the necessary labor and management skills, coupled with an entrepreneurial attitude;
> Fifth, the availability of venture capital; and
> Sixth, an effective distribution and marketing system.

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[69] Barbara Ward. "The Rich Nations and the Poor Nations." (New York, W. W. Norton and Company, Inc., 1962), pages 13–6.

[70] David C. McClelland. "The Achieving Society." (New York, The Free Press, 1961), page 300.

[71] Barbara Ward. "Technological Change and the World Market." *In* U.S. Congress, House. Committee on Science and Astronautics. "Applied Science and World Economy." A Compilation of Papers Prepared for the Ninth Meeting of the Panel on Science and Technology, 1968. (Washington, U.S. Government Printing Office, 1968), pages 7–9.

[72] W. W. Rostow. "The Process of Economic Growth." Second Edition. (New York, W. W. Norton and Company, Inc., 1962), page 313.

Science and engineering, he notes, ". . . which are normally thought to be the backbone of technology, actually represent only one-sixth of the process." [73]

W. Arthur Lewis suggests that in any specific case systematic analysis is required to determine which elements of infrastructure are needed, should be accorded priority, and should be related to other elements of growth of a national economy.[74]

Infrastructure requirements deemed necessary by U.S. industrial managers, according to a recent United Nations survey, are listed in descending order as follows:

1. Availability of labour
2. Convenience of markets
3. Availability of property
4. Costs of labour
5. Availability of raw materials
6. Degree of unionization
7. Co-operativeness of local area
8. Location of management
9. Suitability of climate
10. Costs of transportation
11. Adequacy of power
12. Location of industry centre
13. Adequacy of transportation
14. Decentralization of operation
15. Favourability of tax structure
16. Extent of financial aid.

It is to be noted that this list suggests the relative importance of trained labor as the paramount ingredient of the infrastructure.

EDUCATION AND TRAINING

In his study, Lewis suggests a quantitative relationship between education and such other elements of development as agricultural and industrial occupations. He suggests as a rough approximation the following table:

TABLE 2.—SUGGESTED REQUIRED LEVELS OF SCHOOL ENROLLMENT

Percent of occupied in agriculture	Percent completing secondary school	Percent completing higher education
70	6	0.8
60	9	1.1
50	13	1.6
40	18	2.3
30	21	2.6

[73] Martin Goland. "What Makes Technology Run?" *In* House. Committee on Science and Astronautics. "Applied Science and World Economy." A Compilation of Papers. . . . Op. cit., pages 87–8.

[74] W. Arthur Lewis. "Development Planning: The Essentials of Economic Policy." (New York, Harper and Row, Publishers, 1966), pages 97–8, and generally 97–111.

Education has long been recognized by students of the development process as a paramount element of the technological infrastructure.[75] The characteristic pattern of education in the United States, by comparison with several nations of Western Europe, was discussed by the U.S. delegation to the 6th session of the Industry Committee of the Organization for Economic Co-operation and Development, March, 1968. It noted that *diversity* of educational backgrounds, characteristic of the United States, ". . . seems to be an advantage, for broad possibilities of matching the education of workers with educational requirements for specific types of work." Conversely, the uniformity of educational attainment in Western Europe made for reduced flexibility and adaptability of labor in those countries.

It was also important, said the OECD Committee report, that industry and the universities maintain contact "so that the former can make known its requirements and the latter make known what they can offer." [76]

At the other extreme, Paul G. Hoffman, Managing Director of the United Nations Special Fund, declared: "Of the 1,300 million people living in the less developed countries for which the United Nations has some responsibility, almost half cannot read or write." [77]

HEALTH

Health as an essential element of the "living infrastructure" was stressed by Dr. M. G. Candau, Director-General of the World Health Organization, who told the United Nations Conference on the Application of Science and Technology, 1963, that "the health of a people is among its greatest assets, and an indispensable source of its wealth." [78]

> In the past [Candau continued], neglect of these obvious facts has had unfortunate consequences. . . . History is full of the records of the effects of killing and disabling diseases. Malaria has destroyed civilizations; great pestilences like plague have brought misery, poverty, and the destruction of society in their train; poisons like opium and alcohol can eat insidiously into the life and prosperity of a community.[79]

According to W. Arthur Lewis, the principal opportunities for social investment were in public health:

> The spectacular fall in the death rate over the past hundred years owes very little to curative medicine. The great killers have been wiped out at relatively small cost, using the services of only a handful of doctors, either by improvements in the water supply—which have curbed cholera, typhoid and dysentery—or by environmental sanitation which has materially reduced the incidence of

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[75] United Nations. "Science and Technology for Development. Volume I. World of Opportunity." Report on the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas. (New York, United Nations, 1936), page 56. The quotation is by Professor M. S. Thacker, president of the United Nations Conference on the Application of Science and Technology for the Benefits of the Less Developed Areas, at Geneva, Switzerland, in February, 1963. At the same conference, Professor V. K. R. V. Rao, director of the Institute of Economic Growth, in the University of Delhi, India, declared that "Even if we could get all the capital in the world, that would not give us the kind of rate of economic growth that we want." What was important was the "human factor"—the development of human resources. He declared: "The human being has got to be trained, has got to acquire knowledge, and has got to be given the capacity, and organized to use that knowledge." (Ibid., page 59.)

[76] Organisation for Economic Co-Operation and Development. "United States Industrial Policies." Observations presented by the U.S. Delegation before the Industry Committee at its 6th Session, March 1968. (Paris, Organisation for Economic Co-Operation and Development, 1970), page 64.

[77] Ibid., pages 62–65.

[78] United Nations. "Science and Technology for Development. Volume I. World of Opportunity." Op. cit., page 58.

[79] Ibid., p. 56.

malaria, yellow fever and tuberculosis—or by vaccination—which has nearly eliminated smallpox, diphtheria and poliomyelitis. One can see this by comparing statistics for developed and underdeveloped countries. The death rate is now about the same in Jamaica as in the United States.[80]

POWER

Three interlocked networks of technology provide an indispensable underpinning for all raw material supply, transfer of materials and products, manufacturing, and marketing. These are the networks of power, transportation, and communications. With respect to power—

It was the accessibility of fossil fuels and metallic ores in Britain, Europe, North America and the USSR which, first with the steam-engine and later with the oil-engine, gave countries there the impetus of industrialization which now rates them as "highly developed." Countries which, during the nineteenth century and the first half of this century, had not accessible energy resources and contiguous minerals of this kind could not have comparable industries and, whatever their innate capacities, remained the suppliers of raw materials and food for the factories and workers of the geologically favored nations.[81]

A recent Congressional report describes the impact of energy on transportation and production technology in these terms:

Today human labor provides energy for far less than 1 percent of the work performed in factories, refineries, and mills in the production of their products. Literally, our economy and our way of life could not continue without use of vast amounts of energy.

One measure of this situation is the increase in the total power for all engines, turbines and work animals over the past 3 decades. [There has been an] increase from 2.7 billion horsepower available in the United States in 1940 to 17.9 billion in 1968. Of this, engines in trucks, buses, and automobiles accounted for by far the largest part, increasing from 2.5 billion horsepower in 1940 to 16.9 billion horsepower in 1968. Over the same period, the power of electric generating stations increased from 53 million horsepower to 371 million horsepower.[82]

Characteristically, developing countries are deficient in electric power and also in fuel for either electric or steam power.[83]

TRANSPORTATION

Transportation facilities are of similar importance. In the words of Hilaire Belloc, "A road system, once established, develops at its points of concentration the nerve centers of the society it serves; and we remark that the rise and decline of a state are better measured by the condition of its communications—that is, of its roads—than by any other criterion." [84]

A geographic analysis of transportation stresses that good transportation ". . . permits the development of regional specialization in production."

Unless goods could be readily moved from places of excess to regions of deficiency, each region would be compelled to produce all the kinds of things

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[80] Lewis. "Development Planning: The Essentials of Economic Policy." Op. cit., page 111.
[81] United Nations. "Science and Technology for Development. Volume I. World of Opportunity." Op. cit., page 10.
[82] U.S. Congress. Joint Economic Committee. "The Economy, Energy, and the Environment." A Background Study prepared for the use of the . . . By the Environmental Policy Division, Legislative Reference Service, Library of Congress, September 1, 1970. 91st Congress, 2d session. (Washington U.S. Government Printing Office, 1970), page 1. [Joint Committee Print.]
[83] United Nations. "Science and Technology for Development. Volume I. World of Opportunity." Op. cit., page 82.
[84] Hilaire Belloc. "The Road." (New York, Harper and Brothers, 1925), Introduction.

needed in just the right quantities—no more and no less than could be consumed at home. Where communications are adequately developed, however, there is no such inhibiting influence, and regions are permitted to specialize in those types of production that they are best fitted by natural endowment or cultural heritage to do and at the same time neglect those for which they are less well equipped.[85]

Historically, transportation investment was an important characteristic of the American system as it approached technological leadership. According to one early study—

We [i.e., the United States] have built almost as many miles of railroad as the whole of Europe, and consequently have used in their construction almost as many rails, and now use almost as many railroad cars and locomotives. At the close of 1881 this country had 100,000 miles of railroad, Europe had about 106,000 miles, and all the rest of the world had about 45,000 miles. The United States had nineteen miles of railroad to every 10,000 of population, while Europe had a little more than three miles to the same population.[86]

In the developing countries, transportation is a foremost need and the most expensive element of technological infrastructure.

Transport costs form by far the largest single element in building up the economic infrastructure. It has been estimated that they represent as much as 30 per cent of the cost of finished goods in countries with a high cost-structure, and in areas where the population is widely scattered and industrial activity is dispersed, expenditure on transport equipment and operations can amount to 33⅓ percent and more of the national income.[87]

COMMUNICATIONS

Communication is even more widely varied in character. One view is that "the prime function of communications is to bridge the gap between the leaders and the masses and thus to enable the people to participate in the modern world." From this point of view—

The importance of an effective communications system to assist in establishing the new outlook and attitudes is obvious. Furthermore, if a nation expects to exist as such and to maintain a place in the modern world it must create and maintain a system commensurate with its larger expectations. In short, communications must be an integral part of the national economy.

UNESCO has suggested that efficacious mass communications can be assured when for every 100 inhabitants of any country there are at least 10 copies of a daily newspaper, 5 radio sets, 2 cinema seats and 2 television receivers. This minimum has not been attained by 2,000 million people; one hundred States in Asia, Africa and Latin America fall below this level.

Vast disparities are evident between nations, as to their use of mass communications. "For example, Australia with an annual income of more than $US800 *per caput*, has about the same population as Tanganyika with only $US100 of such income but has nearly 900 times the newspaper circulation and perhaps 750 times as many radio receivers."

Increasingly the United States has seen the evolution of a truly national system of telecommunications. Into this complex is now being introduced the transmission of television programs and the facilities of the digital computer as a repository and source of electronically

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[85] Vernor C. Finch and Glenn T. Trewartha. "Elements of Geography." (New York, McGraw-Hill Book Company, Inc., 1936), page 653.

[86] Benjamin Rand, compiler. "Selections Illustrating Economic History Since the Seven Years' War." (Cambridge, John Wilson and Son, 1895), page 435.

[87] United Nations. "Science and Technology for Development. Volume I. World of Opportunity." Op. cit., pages 135–6.

communicated information. The national management of information as an adjunct of the national communications net makes for a closer integration of national technology and other forms of social organization. The still more recent development of communications satellites extends the reach of this national network to other nations and can be expected to effect a similar integration of culture, technology, knowledge, and trade on a virtually global basis.

INTERNATIONAL ASPECTS OF INFRASTRUCTURE

The foregoing discussion of the importance of infrastructure as the basis of a nation's technology indicates the complexity of a total national system of industry and commerce. Human resources are suggested as more important than material wealth. Science contributes to technological systems as a necessary, but insufficient, condition. In short: "The advance of scientific technology can only be part of a concerted national programme of educational, economic, industrial and social change." [88]

Although the total pattern of a nation's infrastructure is a matter of primarily domestic concern, there are many international aspects to the separate ingredients. Even the total pattern is of some concern internationally; within a developing country, for example, if U.S. policy calls for a program of aid to help with its industrialization, the improvement of these conditions of growth become a U.S. problem. Even the definition of the components of the infrastructure in order to assure their proper recognition and support becomes an international problem, to be studied in AID, in the United Nations, in the various specialized U.N. agencies, in O.E.C.D., and elsewhere.

In addition, the various elements of infrastructure discussed in this subsection have their own international aspects. Thus, education and training raises questions involving the gain or loss of trained manpower, the planning of institutions to train technicians for international service, establishment of standards of comparative national educational achievement, exchange of educational personnel, and dissemination of knowledge.

Although health is primarily a domestic problem, it has vast implications for diplomacy: the wealthy nations of the world ignore the health problems of the less developed nations at their peril. Modern transportation systems make possible the global spread of infectious disease with great speed. Pockets of disease and disease vectors serve as natural time bombs, threatening danger at any time. Drugs and sera—their development, production, and availability in time of need—are of concern to all nations. Organizations for the detection of disease and medical problems cannot be other than international. Similarly, the world as a global unit is concerned with the total availability and distribution of trained public health and medical services, and with the standards of health and medical care.

International transfer of electric power is of no great consequence but the transfer of power technology—particularly atomic power—is of wide international concern. Control of the facilities, the fuel, and the processing of spent fuel elements are all international problems.

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[88] Ibid., page 53. The statement is by Professor P. H. S. Blackett.

Supplies of coal, natural gas, petroleum, and other fossil fuels are not uniformly distributed among the nations of the world and raise questions of international adjustment and accommodation. The global problems of air pollution and disposal of radioactive materials are also closely related to power generation.

Ground transportation is already an international network in Europe and North America; similar networks are of increasing importance in Africa and South America. Air transportation is clearly global, with enormous problems of safety standards, prevention of dissemination of disease vectors, standardization of operational training, specialized international language and codes, procedures for international air shipment, security of air cargoes, international sales of aircraft and engines, and—most recently—the competitive development of three large supersonic transport aircraft.

Communications networks are inherently global, and promise to become more so with the advent of communications satellites for telephone, radio, and television. Some of the international diplomatic aspects of this subject will be discussed in a later study. Involved are allocation of the electromagnetic spectrum, content of international television programs, standardization of codes and procedures, and many more. The role of the computer in association with international communications has yet to be defined, but appears certain to be a major one. Also of importance is the economic power of the large corporations specializing in the development and production of communications and computer hardware; this field of activity received primary attention in the French study of the penetration of Europe by American corporations.[89]

Recapitulation: Diplomatic Consequences of Technology

It is no easy matter to inventory the myriad of international consequences flowing from the four kinds of technology discussed in this section. Foremost, perhaps, is the conclusion that international competition for primacy among nations is to a very large extent a technological race.

Nuclear weapons and atomic power have profoundly influenced the international scene in many subtle and unexpected ways: creating the need for a deeper mutual understanding between the superpowers as a means toward their mutual security; creating opportunities for large multipurpose projects to open desert regions of the world to habitation; and generating a host of international agencies and activities to control and exploit this still new product of science.

Space exploration has led to a similar need for closer understanding and cooperation among nations, as well as conferring prestige and power upon the leaders in this technology. The securing of various new benefits by all nations from space technology requires cooperative agreement and joint action. Planet Earth has been shown visibly and coherently as a single unit whose artificial divisions by mankind can be ignored in the global study of weather, resources of land and ocean, and even the superficial changes brought about by industry, agriculture, and human settlement.

The mundane field of agricultural technology, among the first attempted by man, has also generated its worldwide conflicts and ten-

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[89] J. J. Servan-Schreiber. "The American Challenge," Op. cit.

sions as well as offering solutions to global problems. It has required study by international bodies, international exchange of information, negotiation to resolve new issues, and an awareness of the value of cooperation among governments as well as among peoples.

Even the primarily domestic aspect of technological infrastructure is found to have significant international aspects. Programs in technical assistance, international activities in education and health, exchange of technical information about transportation, communications and power, all provide a basis for closer relations among governments and individuals.

Some aspects of infrastructure are themselves taking on an international character, such as air transportation and satellite communications. These can serve both to help and hinder the work of the diplomat: While information can now be transmitted virtually instantaneously, to facilitate long-range bargaining, the time available for decision-making has decreased. The traditional conduct of secret, official diplomacy tends to be nullified by radio and television propaganda and by educational, cultural, and scientific exchanges. Swift transit of trouble-shooting negotiators to points of tension by air transport or for consultation with national leaders is counteracted by the ability of trouble-makers and dissident groups to use these same means of travel.

It seems evident that modern diplomats and policy-makers require special training in understanding and using technology, and in formulating plans that involve the new uses or development of new kinds of technology. Parliaments are called upon to evaluate and approve agreements and treaties with a technological content. New information is needed for assessing the relationship between technological information and practical politics.

IV. The Internationalization of Technology

The preceding section (III) demonstrated a consistent series of trends in nuclear weaponry and atomic power, space development, agriculture, and technological infrastructure. In each case, the evolving technology generated problems for diplomacy, postulated international enterprises, attracted international interest, and implied a need for the design of a U.S. policy to ensure that the development and its international consequences served U.S. foreign policy goals.

The question to be explored in the rest of the chapter is whether future technology can be purposefully exploited to serve the purposes of diplomacy. The discussion in this section will describe the processes by which technology becomes internationalized, i.e., managed and applied internationally. The concluding section will identify some of the major issues in the use of international technology to advance the foreign policy of the United States.

Assessment of National and International Technology

Since 1966, numerous articles and papers have offered proposals for institutions to monitor and control the imperfections of modern technology.[90] There are many notions as to the definition and solution of

[90] U.S. Congress. House. Committee on Science and Astronautics. "Technology Assessment: Annotated Bibliography and Inventory of Congressional Organization for Science and Technology." Prepared for the Subcommittee on Science, Research, and Development, 91st Congress, second session. July 15, 1970. (Washington, U.S. Government Printing Office, 1970), 92 pages. [Committee Print.]

this broad problem. Some critics attack technology itself as the villain. Others charge society with using technology improperly. However, there appears to be a consensus that beneficial technological innovations tend to have unexpected, unplanned, and adverse secondary consequences.

In some cases, a defective innovation is questioned at the outset, but eagerness for its adoption is so great that it is rushed into wide use without adequate testing or assessment. (Such was the case with enzymes for stain removal.[91]) In other cases, a technology meets conventional tests and is later found to be defective in ways that conventional testing had not disclosed. (This was the case with the drug, Thalidomide.[92]) Still other technologies reveal flaws when the mass effect of their wide public use magnifies their imperfections. (Examples are the automobile and DDT.) Technological shortcomings also result from many kinds of interactions, of one technology with another, or of some technology with an "eco-system," or a subtle effect that innovative technology is needed to detect, and so on.

Since the only justification for the adoption of a technology is its benefits to man, it is appropriate for society to be assured that the benefits overweigh the costs. Assessment will also be concerned with seeking out alternative ways of increasing the benefits or reducing the costs.

The need for an assessment institution is intensified in cases where different persons or groups receive the benefits of a technology from those who bear the costs of the adverse secondary consequences of the technology. Problems arise, for example, when a plant dumps polluting waste into a stream that impairs the value of the water for downstream users, or when a smoke plume dirties clothes and houses downwind. This circumstance can be international as, for example, when plants at Niagara Falls send smoke into Canadian communities.

Sometimes it is unclear as to whether a consequence is adverse or not: for instance, there is no agreement as to whether the waste heat from a power plant dumped into a lake or bay is thermal *pollution* or thermal *enrichment*. The adverse consequences can appear as a tenuous chain of circumstances: as an example, the DDT spread on a bean field may destroy a nearby hive of honeybees, and thereby prevent pollination of a fruit orchard a half-mile away, raising the price of fruit in a city 50 miles away. The wide dissemination of lead in gasoline and paints, the general use of asbestos in brake linings and household insulation, and the use of toxic chemicals as plastic additives are all viewed as general hazards to mankind.

Proposals to institutionalize the assessment of beneficial and adverse impacts of technology have included establishment of assessment units in various technologically-oriented departments and agencies, establishment of an independent agency or board in the form of a regulatory agency, the creation of an advisory body to the Congress, and

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[91] ". . . A clothes-washing compound featuring an enzyme for protein stain removal could be and was developed, manufactured, advertised, distributed, and sold—and then pumped into sewage treatment plants all over the country in a matter of weeks—with no formal consideration of the possible consequences of a new ingredient." U.S. (President Nixon's) National Goals Research Staff. "Toward Balanced Growth: Quantity with Quality." Report of the National Goals Research Staff. July 4, 1970. (Washington, U.S. Government Printing Office, 1970), page 126.

[92] See Chapter Fourteen. "Thalidomide: The Complex Problem of Drug Control In a Free Market." *In* House. Committee on Science and Astronautics. "Technical Information for Congress," Op. cit., pages 375–85.

various combinations of these.[93] An analysis of 14 cases of congressional decisionmaking on technological issues since 1945 has shown that there are available no standards and no systematic procedure for this task. It was observed that there was a need for early identification of technological issues to enable their orderly analysis before political pressures could operate to obscure or bias the findings.[94]

INTERNATIONAL ASPECTS OF TECHNOLOGY ASSESSMENT

Because of the widespread interest in the subject of technology assessment in the United States, it was only to be expected that interest in it would go abroad. According to John Lear:

> The technology-assessment idea is * * * being pursued on the international front: in UNESCO, in the Organization for Economic Cooperation and Development (OECD), in the Council of Europe, and in the North Atlantic Treaty Organization (NATO).[95]

One of the more perceptive statements on the subject was offered by Anthony Wedgwood Benn, Labour Government Minister of Technology in the United Kingdom. He wrote that it was necessary to "* * * identify the main problems facing society and [to] find ways and means of converting these needs into real demands which can be met best by the use of technology." [96]

In the 14 case studies referred to above, there were five that were primarily international in scope,[97] and another three cases with substantial international implications.[98] An increasing number of technological developments are appearing that seem to have international aspects. For example:

> The developed nations in Europe and elsewhere have a special responsibility to the less developed ones. We advise them to industrialize cleanly in order to escape what we are suffering, yet they turn and ask us why they should handicap their products in the world market while we continue to be dirty. We can do no less than make a determined effort to clean up internationally.[99]

With the appearance of technologies of global impact and influence, the question of international regulation begins to be asked:

> As technology has made the world more a "village world," there has been a growing tendency since the foundation of the United Nations for international bodies to concern themselves with matters . . . which were formerly held to be the exclusive province of a nation-state. It is in the fields of science and technology

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[93] For a summary of some of these proposals, see: Franklin P. Huddle. "Government Technology Assessment: The Role of the Social Sciences." Panel-Round Table at Annual Meeting of the American Political Science Association." October 2, 1970. (Multilith. Science Policy Research Division, Legislative Reference Service, Library of Congress, 1970), 45 pages. (70–246 SP.)

[94] See: House. Committee on Science and Astronautics. "Technical Information for Congress," op. cit., especially pages 519–521. This reference states that "The hypothesis is this: If an issue can be certified for congressional study at an early point and surveillance maintained over it by skilled people, the process of maturation can occur without consuming congressional time and attention, until the need for action is manifest. Issues might then be dealt with by the Congress on an orderly time schedule, with less reliance on crash decisionmaking and a reduced frequency of sudden sensational alarms." (Page 519.)

[95] John Lear. "Predicting the Consequences of Technology." Saturday Review. (March 28, 1970), page 46.

[96] Anthony Wedgwood Benn. "Technology and the quality of life." Technology plus Society. (May 1970, Vol. 6, No. 1), page 7.

[97] These were: the Test Ban Treaty, the Point IV Program, the Peace Corps, the Thalidomide Case, and Camelot.

[98] These were: the control of pesticides, high energy physics, and the Mohole project.

[99] Frank Fraser Darling. "Thinking planet-wise." New Scientist, (April 16, 1970), pages 106–108. Dr. Darling is a member of the standing Royal Commission on Environmental Pollution of the U.K.

that this need for international rather than national action is most strongly felt, and for many reasons.

These reasons were: the traditionally international character of science, the need for international cooperation in inherently global activities such as civil aviation, the need for control of dangerous technologies like atomic energy, and the regulation of global dissemination of pollutants. With respect to the last item, the author observes:

> Combating pollution will inevitably require international rather than national regulation as its starting point. First, pollution originating in a single nation-state might well spread, through one of the components of the environment such as the air or oceans, into the territories of other nation-states. Secondly, in the context of current patterns for modernization of economies by the export from the most advanced countries of capital equipment for technological manufacturing, a plant which fails to contain adequate anti-polluting equipment will spread pollution by the very fact of its export. Thirdly, the measures to combat pollution need to be internationally prescribed and enforced for they will undoubtedly affect costs, and states which fail to observe them will gain a competitive advantage over those who do.[100]

As a corollary of the author's third point, U.S. insistence on the incorporation of anti-smog devices on American cars for domestic use might be regarded as a form of trade barrier by nations exporting cars to the United States, unless such devices are freely available under cross-licensing arrangements.

SUGGESTIONS FOR INTERNATIONAL INSTITUTIONS

A proposal has been advanced for an international assessment agency under the aegis of the United Nations, in an article by Dennis Livingston of Case Western Reserve University.[101] His plan relies on three propositions: (1) there is already a considerable assessment activity in international bodies, (2) adverse secondary consequences of technology are often international in their impacts, and (3) assessment of technology is involved in the processes of aid to developing countries, with respect to their own policies in the adoption of technology, in evaluation of imported technology, and in evaluating technological trends and their social consequences in the developed countries. Professor Livingston cites numerous instances of assessments under existing international arrangements, such as:

Outer space;
Pollution abatement;
Civilian nuclear reactors;
Resources management;
International brain research;
Nuclear energy research;
Research in the "planetary biosphere";
Safeguards for nuclear reactors and materials;
The seabed; and
Oil pollution on the high seas.

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[100] Allan McKnight. "International Regulation of Science and Technology," International Journal, "Autumn, 1970," pages 745–746.

[101] Dennis Livingston. "International Technology Assessment and The United Nations System." American Journal of International Law, (September 1970, Vol. 64), page 163–172.

Other items might well have been added to this list, such as:

Control and testing of proprietary drugs;
Uses of nuclear explosions for civil purposes;
Weather modification, control, and prediction;
Persistent pesticides;
Communications satellites;
Genetic engineering;
Arms control;
Aircraft noise and environmental effects;
Human resources management: the international movement and concentrations of scientific and technological talent;
Inadvertent weather modification; and
Control of infectious disease and disease vectors.

Accordingly, Professor Livingston proposes the creation of an "International Technology Assessment Board, charged with four functions: (1) contracting out specific technology assessment studies, (2) liaison and cooperation with national technology assessment bodies, (3) issuance of an annual report on the use of science and technology for mankind, and (4) provision of fact-finding and mediation services. He elaborates on all of these, but his comment on the fourth point is especially illuminating:

> This is a function not contemplated in the reports for a U.S. assessment agency, but potentially useful on the international level. Some of the important disputes among states involve disagreements about the anticipated effects of large-scale technological projects, particularly the multi-utilization of international river systems and the carrying out of space experiments. . . . [Provision of such services] would not be unprecedented. ICSU's Committee on Space Research established a Consultative Group on Potentially Harmful Effects of Space Experiments. . . . At the adjudicatory level, several cases of air and water pollution exist in which states claimed damages resulting to their territories by the harmful activities of neighboring states, with the issue resolved by tribunals or courts.[102]

It is not evident whether or not the world is yet ready for an international agency of technology assessment. Indeed, in the United States the issue as to the desirability of a domestic agency for this purpose has not yet been resolved. Nevertheless, sentiment seems to be increasing in the direction of some sort of international concordance regarding the global impact of technology. For instance, the first annual report of the Council on Environmental Quality[103] tabulated international agencies currently engaged in "international cooperation on environmental matters," in many of which the United States was a participant. These included:

A. The United Nations:
Economic Commission for Europe (ECE);
Intergovernmental Maritime Consultative Organization (IMCO);
U.N. Educational, Scientific and Cultural Organization (UNESCO);
World Health Organization (WHO);
Food and Agriculture Organization (FAO);
World Meteorological Organization (WMO);
International Atomic Energy Agency (IAEA); and
U.N. Conference on the Human Environment.

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[102] Ibid., pages 166–170.

[103] U.S. President's Council on Environmental Quality. "Environmental Quality: The First Annual Report of the Council on Environmental Quality together with The President's Message to Congress." (Washington, U.S. Government Printing Office, 1970), pages 199–209.

B. Other Intergovernmental Bodies:
NATO Committee on Challenges of Modern Society (CCMS);
Organization for Economic Cooperation and Development (OECD);
Organization of African Unity (OAU);
Organization of American States (OAS); and
Council of Europe.

C. Bilateral Cooperation (with the United States): Japan; Germany; France; Soviet Union; and Canada.

D. Nongovernmental Organizations:
International Biological Program of International Council of Scientific Unions; and
International Union for Conservation of Nature and Natural Resources (IUCN).

In this same context, Senator Warren Magnuson has proposed the creation of a "World Environmental Institute" to serve as a central information center for all nations.

> Every nation—regardless of its form of government or its international and domestic policies—could consult the Institute for expert advice on all forms of environmental problems. The Institute would serve both as a research center and as the repository of that worldwide pool of knowledge and talent. Through the use of computers, any country could obtain a thorough guide to the scientists and scientific studies around the world that relate to a particular environmental problem.
>
> Under the auspices of the Institute [Senator Magnuson continued], a continual exchange of scientists and technological information between the countries of the world would be possible on a non-political basis—not simply on the unilateral scale of today but on a multilateral level never dreamed of before. Task forces could be set up—consultants who would work as a team and on request visit the distant parts of the globe to undertake special projects.[104]

THE ASSESSMENT ROLE OF INTERNATIONAL LAW

Just as the legal profession has taken an increasing interest in technology assessment as related to the processes of law in the United States, the role of international law has also been seen as importantly linked to the global function of technology assessment. Herman Pollack, director of the Bureau of International Scientific and Technological Affairs of the Department of State, suggests the need for "systematic technological assessment" at the international level, where it—

> * * * also encompasses an evaluation of the adequacy of international law, arrangements and institutions for the management of technologies which are inherently international in their scope, such as those relating to weather modification and communications.[105]

Mr. Pollack's point was enlarged on in an article by C. Wilfred Jenks, Principal Deputy Director-General, International Labour Office. He declared that "the progress of advanced technology poses immediate practical problems of legal regulation and legal liability.

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[104] "A World View of the Environment." Remarks of Sen. Warren G. Magnuson before the second annual International Geoscience Electronics Symposium, Washington, D.C. April 16, 1970. *In* "Senator Magnuson's Plan for a World Environmental Institute." Remarks of the Honorable Mike Mansfield on the floor of the Senate. Congressional Record, (April 23, 1970), page S6069.

[105] Testimony before Subcommittee on Science, Research, and Development, House Committee on Science and Astronautics, July 28, 1970. (Mimeo), page 7.

The question becomes that of whether we can foresee and take effective action concerning these problems before they become insoluble or whether law must always lag behind life. It took the *Titanic* disaster to produce the Safety of Life at Sea Convention. It has taken the *Torrey Canyon* disaster to prompt vigorous action concerning the oil-pollution risk from giant tankers. Must the progress of the law to cope with the new problems arising from the progress of science and technology always wait upon disaster? There are clearly fields, notable among them that of nuclear energy, in which the consequences of disaster may be so far-reaching that the failure of the law to keep in step with life may involve not merely frustration, hardship and injustice, but the collapse of the whole legal order.

He noted that there were prototypes such as the U.N. Conventions on the Law of the Sea, the Antarctic Treaty, the Moscow Nuclear Test Ban Treaty, the Nuclear Liability Conventions, and the Space Treaty. Others were needed, such as an Open Depths Treaty, an Arctic Treaty, a Radioactive Pollution Treaty, and a World Weather Treaty. Indeed—"We may . . . within the next few years need a Sonic Boom Treaty, a Center of the Earth Treaty, a Cybernetics Treaty and a Molecular Biological Treaty." However, he questioned whether it would be adequate to deal separately with each of these problems. They were all "aspects of the broader problem of the role of law, internationally as well as nationally, in the social control of the new relationship between man and his environment created by contemporary scientific and technological progress." Accordingly—

The social control of science and technology takes its place with the renunciation of force as an instrument of national policy, the promotion of economic stability and growth, the protection of civil liberties and the progress of social justice among the major objectives of policy which are giving altogether new dimensions to international law in our time and gradually but relentlessly transforming it from a law between States only and exclusively into the common law of mankind.[106]

The need for a general strengthening of institutions for international assessment and control of technology was seen by Allan McKnight, formerly Inspector-General of the International Atomic Energy Agency:

If the scale of international regulation of science and technology increases (and this writer believes that it must), then the content of the business of our institutions must change. These consequential changes will include:

(*a*) much closer links between foreign ministries and the scientific community,

(*b*) much greater concern within scientific communities with regulation of activities rather than positive conduct of activities,

(*c*) a larger component of scientific skills and knowledge within foreign ministries,

(*d*) a deeper concern with regulation within the governing bodies and secretariats of international organizations,

(*e*) closer links all over between scientists, technologists, politicians, and lawyers,

(*f*) above all, a logical process for achieving international regulation.[107]

The Internationalization of Military Technology

Of the three options that Rostow sees as open to a technologically advanced nation[108] the first seems to have been largely blunted by technology itself. In the face of a nuclear weapons capability, military conquest in the future dare not be too ambitious; war must be

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[106] C. Wilfred Jenks. "The New Science and the Law of Nations." International and Comparative Law Quarterly. (April 1968, Volume 17), pages 328–332.

[107] McKnight. "International Regulation of Science and Technology," op. cit., pages 752–3.

[108] These were: military expansionism, achievement of a high-consumption economy, and development of the welfare state; see page 14.

limited in scope and for limited objectives. Nuclear missiles have demonstrated their negative value to assure inaction; but they do not appear useful as a means of positive action. Nevertheless, a long chain of diplomatic exchanges have resulted from this ultimate weapon. For example:

A considerable amount of the business of the United Nations has been concerned with nuclear disarmament, nuclear limitation, and arrangements for the regulation of atomic power operations.

A lively dialogue has continued between the United States and the Soviet Union to develop international understanding as to the limits of military commitment short of nuclear confrontation. The mutuality of interest in avoiding nuclear exchange, or for that matter the serious threat of such an exchange, has led to an increase in exchange of views and even to the provision of a technological mechanism (the "Hot Line") for emergency consultation between Chief Executives of the two powers.

Worldwide surveillance has been established, in the form of seismic and air-sampling detection systems, to detect nuclear weapons tests.

Nuclear-armed bases on the territories of a number of aligned States have been negotiated for.

Extensive negotiations have been undertaken toward the goal of refusing the admission of nuclear weapons to entire continents (in particular, Africa and South America).

FACTORS OF SUB-NUCLEAR TECHNOLOGY

Though strategic war has apparently been eliminated as a viable instrument of policy, capabilities still exist in most States for the conduct of limited, sub-nuclear war. Nuclear powers maintain these capabilities to enlarge their power options, to influence the course of combat among States where their interests are involved, and to stabilize or otherwise affect the military balance of strength among lesser powers. Technology is also involved extensively in these activities in ways that are of diplomatic concern. For example:

—There is considerable agitation over the U.S. use of herbicide technology in Vietnam, and a more general concern as to what kinds of technology ought to be foresworn by belligerents under international law.

—Extension of U.S. arms technology and even the development of international technological standards of armaments to the many participating countries have resulted from the various regional treaties of mutual security (NATO, SEATO, OAS, etc.).

—Construction of large, expensive, air-defense networks has occurred or is in process in many countries (employing U.S. technologies for radar, computers, display tubes, and various subsystems of active defense).

—Various forms of U.S. military assistance have been provided by negotiation, such as supply of combat aircraft, ground support equipment, ordnance, and communications; training arrangements have also been provided in the use and maintenance of the equipment, and in basic science and technology to understand its operation and design.

—The deployment of U.S. troops abroad, and their use in association with indigenous troops or people has had the derivative effect of being a technological training device.

—The wide deployment of U.S. troops and the Fleet means that U.S. service people are frequently in a position to aid local populations in time of emergency or natural disaster, or even as a routine activity, with the effect of demonstrating the operational utility of U.S. technology in the process.

There is one body of opinion that holds that the role of subnuclear conflict is tending to diminish. The rationale behind this view is that as the spheres of influence of the Great Powers become more sharply defined, both functionally and territorially, there will be less and less occasion for initiatives and ventures involving the productive use of force. It will be in the interest of these Powers, also, to try to damp out any violent quarrels among lesser States, in order to avoid the possibility of nuclear confrontation.

The implication of this trend—to the extent that the hypothesis is valid—would seem to be that a principal remaining avenue for the exercise of national influence is in competitive technology. This view is expressed in the following passage by Victor Basiuk of the Institute of War and Peace Studies at Columbia University:

Over the centuries, nonmilitary technology has been one of the major causes of change in the distribution of world power. In recent times, nations have grown powerful thanks in large part to the peace-time technologies which made it possible for them to become great industrial centers. Military power usually followed in the wake of industrial capability. . . . There is no sign of the emergence of a stalemate to prevent nonmilitary technology from effecting changes in the distribution of power of nations and regions.

The evolution of nonmilitary technology suggests at least one important conclusion. Because nonmilitary technology now occupies a larger part of the spectrum of technologies capable of changing the distribution of world power and because its share of the non-stalemated spectrum is growing, its importance promises to be greater than it was heretofore.[109]

However, even under this hypothesis, there are many points of international contact involving technology in which U.S. military and paramilitary agencies can participate. For example, a report by the U.S. Coast Guard of its "involvement in international affairs" lists 20 international agencies and 15 international activities in which it is a participant. Among the international programs are Loran stations, the ocean station program, the automated merchant vessel report (AMVER) system, training of foreign nationals, and sea-air rescue technology and studies. Of the AMVER program, the Coast Guard reports:

Close liaison with foreign embassies, foreign governments, foreign shipping interests, foreign communications representatives and foreign airlines is required to encourage participation in the AMVER program and to arrange for the necessary communications for exchanging the ship reports and passing surface pictures. General instructions for participation in AMVER have been reproduced in twelve foreign languages. The International Radio-Medical Center, Rome (CIRM ROMA) is an active interested correspondent. . . .[110]

By various agreements or treaties, the Coast Guard has established its Loran stations on the territories of 14 countries, and provides technical assistance and replacement parts to 43 Loran stations manned by host nations.

What has been said about the far-flung international contacts of the Coast Guard on technological matters applies with greater force

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[109] Victor Basiuk. "Technology and World Power." Foreign Policy Association, Headline Series. (April, 1970), page 53.

[110] U.S. Department of Transportation. Coast Guard. "Participation in International Affairs." [1968.] (Mimeo, May 22, 1968), pages A–2, B–2, B–5, and B–7. (CG–389.)

for the three military departments and for the Department of Defense generally.

The Increasing Scope of Global Technology

The growth has been described of international participation in Earth satellite systems for global communications, resource surveys, weather prediction, navigation, and other useful services derived from the space program. One effect of this activity has been to advertise globally the technological accomplishments of the United States in a difficult and costly field. Another effect has been to encourage a global attitude toward the Earth itself—perceiving it as itself a "space ship," whose passengers share its fate, irrespective of country or region. A third effect is to tie together into single systems global communications, transportation systems, resources, environmental effects, and weather and climate. International participation in space projects is demonstrably being stimulated by the opportunities for tangible benefit as well as by the prestige they afford.

As technologies grow in size, cost, complexity, sophistication, and range of effects, they may tax the willingness (if not indeed the physical means) of individual nations to support their development. This effect has already been observed in the case of the Concorde supersonic transport aircraft, whose development is currently being shared by France with the United Kingdom. As Basiuk notes—

> First, confronted by rising costs and problems of increasing scale, even the superpowers individually may lack the capability of taking advantage of the full potential of future technology. This factor will increasingly generate pressure for international cooperation among the middle-rank powers (e.g. Britain, France, Germany, Japan), between the superpowers and the Western European powers and Japan—and perhaps between the superpowers themselves. Second, some forms of future technology such as large-scale climate modification, will require international cooperation not so much because of the costs involved but because more than one geographic region will be affected and the participation of those concerned will be essential.[111]

Numerous proposals for large-scale international technologies or developments have been advanced in recent years. Among the more notable have been proposals for damming the Bering Straits, for large-scale transfer of water from Canada to the Great Basin of the United States, large agro-industrial-nuclear desalinization projects for desert regions, and systematic extraction of materials from the sea bed. Leadership in large international projects of technology contributes to diplomatic influence at the same time that diplomatic skills are needed in the design and construction of international consortia to execute such projects.

HAZARDS OF ECONOMIES OF SCALE

The exploitation of economies of scale has led to remarkable increases in the size of many technological installations. With increased size may also come the possibility of danger to nearby populations or to the environment from technical flaw, operating error, act of Nature, or even sabotage. The oil spill at Santa Barbara and the Torrey Canyon episode illustrate these dangers. A number of tragic aircraft accidents in recent history serve to highlight the possibility that as

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[111] Basiuk. "Technology and World Power," op. cit., page 16.

aircraft continue to grow in size and passenger capacity the numbers wiped out in single disasters will likewise increase. Safety of mankind and his environment, in the face of this growth of technological units, calls for an increase in intergovernmental relations to enforce uniform standards of design reliability, uniform codes of operating behavior, and reasonable standards of environmental quality. It would seem that closer international ties are postulated not only to construct the supersize units of present and future technology but also to protect mankind and his world from their faults.

The Internationalization of Commercial Technologies

Many international networks have been constructed that involve the exploitation by private companies of innovative products with world markets. Servan-Schreiber regards these networks as essentially American-built and American-dominated (thanks to the superior public education, management training, and scientific infrastructure in the United States). Being alien to Europe, these networks are also—in his judgment—potentially inimical and divisive.

Accepting the Servan-Schreiber thesis, and declaring the existence of a "technological gap" between Western Europe and the United States, Aurelio Peccei declares that technological change is bringing about disruptions that threaten "assured and possibly total disaster." He cited as the special advantages possessed by the United States in achieving its superior technological posture in industry the following:

U.S. lead in computer technology
U.S. lead in atomic energy, aircraft, and space
U.S. lead in comprehensive communications systems
Greater U.S. effort in research and development
Greater size of American firms, with superior profit picture
Superior U.S. managerial skills
The flow of European scientists to the United States
Higher U.S. expenditures on education (especially technical)
Mobility of movement geographically and institutionally
Superior communications among and within institutions
Absence of trade barriers within a large market area
Flexibility and adaptability of social and economic institutions.

According to Peccei, Americans refuse to admit to the existence of this gap, and this conflict in views "has been a point of contention at the countless meetings and conference devoted to the subject in the last few years." [112]

A rejoinder to the Servan-Schreiber thesis is presented by John B. Rhodes, who declares that the capabilities of the industry of Western Europe and the United States are both "being matched or surpassed in many products by those of Japan," that many new manufacturing centers were emerging outside the United States, that "There are few goods available to the American consumer that are not produced at competitive prices in Europe," and that on balance "the odds favor a significant role for European industry even in those fields [such as atomic energy and space] where it now seems far behind."

In less limited fields, the resilience of industry in Europe has been remarkable. . . . The European automobile industry is vital and growing even after some 50 years of competition from General Motors and Ford. IBM has been successful in Europe, but not noticeably more so than in the United States, and is bound to face increasing competition in the years ahead both abroad and at

[112] "The Transatlantic Cleavage—The Technological Gap." From the Atlantic Union. *In* "The Transatlantic Cleavage—The Technological Gap." Extension of remarks of the Hon. Howard W. Robison, Congressional Record, (September 30, 1970), pages E8785–89.

home. In fields such as power generation, primary metals, road and rail transportation, consumer durables, and communications, European companies are among the world leaders.[113]

AMERICAN HIGH-TECHNOLOGY BIAS

Another American view, by Arnold Kramish, suggests that not only does a technological gap exist, but that it is likely to persist. He observes: (1) ". . . At any given moment, the rate of a nation's technological growth is proportional to the external pressures, and to a vague factor incorporating national awareness and will." and (2) ". . . The United States will never be content with anything less than a position of world technological leadership, a position which is reinforced by her determination to maintain strategic superiority over any other country. She will thus continue to have a high investment in esoteric or pioneer forms of technology." [114]

It was this U.S. preoccupation with strategic (i.e., military) hardware that diverted American technologists from "prosaic problems such as those of improving old processes or dealing with air pollution and waste disposal." He noted that the British had perfected an American invention of "float glass" and today enjoy a strong international position in a lucrative field. "Why was not this process developed in the United States, since it was American in origin?" Kramish's explanation is that Europeans have a greater interest in increasing the efficiency and productivity of commonplace processes, rather than risking development of "frontier" technology.[115]

TABLE 3.—HOW TRADE FOLLOWS RESEARCH AND DEVELOPMENT

[A comparison of competitive trade performance in 18 U.S. industries with research and development]

Industry	U.S. exports as percent of exports by 10 leading industrial countries, 1962	Scientists and engineers in R. & D. as percent of employment, January 1961
Aircraft	59.52	7.71
Office machinery	35.00	5.09
Drugs	33.09	6.10
Other machinery	32.27	1.39
Instruments	27.98	4.58
Chemicals, except drugs	27.32	3.63
Electrical equipment	26.75	4.40
Rubber	23.30	2.95
Motor vehicles	22.62	1.14
Petroleum refining	20.59	2.02
Fabricated metal products	19.62	0.51
Nonferrous metals	18.06	0.69
Paper and allied products	15.79	0.47
Stone, clay, glass products	15.22	0.60
Other transport equipment	13.71	0.46
Lumber and wood products	11.68	0.08
Textile mill products	10.92	0.29
Primary ferrous metals	9.14	0.43

Source: D. Keesing, The Impact of Research and Development on United States Trade, International Economics Workshop, Columbia University, February 1966. (As reproduced in: Christopher Layton. "European Advanced Technology, A Programme for Integration" (London, George Allen PEP, 1969), p. 278.)

[113] " 'The American Challenge' Challenged." Harvard Business Review, (September–October, 1969), pages 46–49, 52.

[114] Arnold Kramish. "Atlantic Technological Imbalance: An American Perspective." Defense Technology and the Western Alliance. Institute for Strategic Studies, (occasional paper, 1967). Mr. Kramish is author of Atomic Energy in the Soviet Union (1959) and The Peaceful Atom in Foreign Policy (1963); he is co-author (with E. M. Zuckert) of Atomic Energy for Your Business (1956).

[115] Ibid., page 4.

That American export trade reflects this bias toward "exotic" technological products is confirmed by several sources. One confirmation is presented in Table 3. A similar view was recently offered by Patrick E. Haggerty, chairman of Texas Instruments, Incorporated. He asserted that only in technology-intensive products does the United States have a favorable commercial balance in its trade with the rest of the world. This balance (for such products) amounted to $8 or $9 billion annually. Mr. Haggerty's main thesis, however, was that ". . . even in technology-intensive products, and after our tremendous national expenditures for research and development, our lead over our industrial competitors and customers in the industrialized world is narrowing rapidly." [116]

However, in the field of computers, which are widely considered "among the most significant indicators of the new technology," the United States has installed 56,000 compared with 20,000 in Western Europe, 5500 in the Soviet Union, and 6000 in Japan. "A look ahead to the late 1970s is instructive, when the United States will have about 100,000 of a world total of 215,000 computers, Western Europe 50,000, the USSR 35,000, Japan 20.000, and the remaining three-quarters of the world only 10,000." [117]

By comparison, long-established technologies appear to be lagging in the United States. According to Walter J. Campbell, editor of Industrial Week, American steel production—while still leading the world—had declined in world markets from 57 percent to 31 percent and domestic sales from 99 percent to 90 percent, from 1950 to 1969. Quantitatively, while U.S. production of steel had risen during this period from 96 million tons to 141, Japan's steel production had increased from 5 million tons to about 90 million. Similarly, the automobile industry, which in 1950 supplied more than 75 percent of the world market, now served only 34 percent.[118]

THE SPREAD OF MULTINATIONAL BUSINESSES

Too much should not be made of visible trade balances. Trade statistics do not reflect the fact that many American corporations are doing business on foreign soil and are actually contributing to trade deficits in particular areas. The Servan-Schreiber thesis relies heavily on the fact of the extensive penetration of American corporations into European countries, either through wholly-owned subsidiaries or in consortia with European partners.

There has indeed been a great outward movement of U.S. capital in recent years. During the 15-year period after 1950, external U.S. investments tripled and investment in Europe rose more than tenfold.

Information on the *number* of American firms operating in Europe is more difficult to obtain than information on the flow of funds. One survey shows that there were over 3,700 "new operations"—acquisitions, expansions of existing plant, or new establishments—by American firms in Europe in the eight years 1958–65, of which over 2,800 were in the countries of the EEC [Common Market]

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[116] Testimony before Subcommittee on Science, Research, and Development, House Committee on Science and Astronautics, on National Science Policy, (Mimeo, August 13, 1970).

[117] Lee Stull, "Continuity and Change in the International Environment." Foreign Service Journal (January, 1970), page 17.

[118] Walter J. Campbell, "Shrinking Share." Industry Week, (October 19, 1970), editorial page.

and most of the remainder in the United Kingdom and Switzerland. More than 60 per cent of these operations represented new establishments, 20–30 per cent were acquisitions, and the remainder were expansions of existing direct investments. [It is probable that] many American firms began operations in the European market for the first time.[119]

NATIONAL CONTROL OF INTERNATIONAL CORPORATIONS

The study identifies three sets of problems "created for national control by the international mobility of business"; these are:

Problems created, or allegedly created, by the foreign-owned enterprise for the countries in which investment takes place; problems created for the country of the parent firm; and problems created for host countries by the government of the home country.

Under the first heading are complaints "that foreign firms do not export enough, that they give preference to suppliers in the home country and hence enlarge imports, that they ignore local employment practices, that they do not contribute to local charities, that they rob the country of research, that they interfere with national planning."

Under the second heading (control problems for the home country) is the allegation that high mobility of these business establishments offers the possibility of escape from both taxation and regulation, including disclosure of operations.

Under the heading of inter-governmental problems is the comment that "In order to make its regulations effective in the face of international mobility . . . a country may be tempted to reach out to its firms operating abroad. This involves the unilateral extension of jurisdiction into areas of potential conflict with other jurisdictions."

COMMERCIAL TRANSFERS OF TECHNOLOGY

On the subject of international technological transfer, the study reports:

National differences in technological skills and knowledge, like national differences in the capital stock available per worker, can provide the basis for profitable specialization and trade. But as in the case of capital, technical knowledge is traversing national boundaries with increasing speed and in increasing volume. The movement of technology is often associated with direct investment abroad; indeed, the rationale for the investment may be special technical knowledge embodied in a patented process or product. But increasingly technology moves by itself, disembodied from capital movements. In 1965, for example, residents of the United States earned over $1 billion in royalties and licensing fees (excluding movie royalties), largely earnings on technical know-how, and over $300 million of this was not associated with American direct investment operations abroad.

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The extensive trade in technology has two implications: first . . . differences in production possibilities based on technology will gradually disappear over time; second, countries such as the United States, which have relied extensively on new products for a strong export position, will find it increasingly difficult to do so, since the new techniques of production may move in international trade as easily as the new products themselves.[120]

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[119] Richard N. Cooper, "The Economics of Interdependence: Economic Policy in the Atlantic Community." A volume in the series "The Atlantic Policy Studies". (New York, Published for the Council on Foreign Relations by McGraw-Hill Book Co., 1968), pages 82, 85.

[120] Ibid., pages 105–106.

One characteristic of multinational corporations with American participation is that the research and development function cannot easily be decentralized and ". . . most companies carry out the bulk of it in the United States." Coordination of international R&D encounters differences in product needs and standards of technical proficiency, as well as difficulties in communication. One solution has been the use of technical specialists or technical liaison groups who go the corporate rounds to keep management, new product development, and national sales outlets in touch.[121] One industrial machinery corporate executive (international operations) described a formal arrangement in his organization to achieve this coordination by means of formalized technical meetings of technical executives drawn from his far-flung subsidiaries:

> One of the major communication devices we have established is an international engineering conference, which is held every 18 months on an alternating basis here at our home office and at one of our overseas locations. This conference is attended by the managing directors and chief engineers of all our international associates. All of our major manufacturing associates as well as personnel from our engineering department at home office present papers during the week-long conference, outlining product improvements and the results of research and development during the prior 18 months at each of the various locations throughout the world. . . . We make special efforts to ensure that our various operations throughout the world know the research programs that we are working on; and they, in turn, keep us informed of the programs that they are working on.[122]

TECHNOLOGICAL OBSTACLES TO U.S. EXPORT TRADE

The fact that U.S. industries in "non-high-technology" fields lag behind their European counterparts has several explanations: superior attention in Europe to minor improvements on conventional products and processes, tested routines, established markets, and lower wages. However, European industry has begun a vigorous program in one area of general importance: to harmonize technical standards. The general use of the metric system tends to be restrictive to non-users. Now standards are being adopted in Europe for reliability and quality control.[123] In comment on this situation, Ambassador Carl Gilbert, the President's Special Representative for Trade Negotiations, declared:

> For a country which has long pursued a course of minimal Government intervention, except where public health or safety is involved and the Congress has determined there was no acceptable alternative, the standards systems being developed abroad today will, if we desire to participate and to insure that our own products are not placed at a disadvantage, require in all likelihood new forms of government-industry cooperation and new institutions to act on an international basis.[124]

Similarly, Lawrence C. McQuade, as Assistant Secretary of Commerce, called attention to the role of standards as a form of trade barrier:

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[121] Michael G. Duerr. "R and D in the Multinational Company: A Survey." (National Industrial Conference Board, 1970), pages 2, 20, 44–5. (Managing International Business, No. 8.)

[122] Ibid., page 51.

[123] "Competition Comes Home to Haunt Us." Industry Week, (July 6, 1970). page 51.

[124] "U.S. Foreign Trade Policies for the 1970's." Speech delivered September 30, 1970, Raleigh, North Carolina. *In* "The Trade Bill of 1970." Remarks of the Hon. Jacob Javits on the floor of the Senate. Congressional Record, (October 12, 1970), page S 17684.

The American businessman who has been kept out of a foreign market because his product—quality and performance notwithstanding—does not meet foreign standards is well aware that standards can be a crucial factor in international trade. Various groups, including the Panel on Engineering and Commodity Standards of the Commerce Technical Advisory Board (the LaQue Committee), have suggested that the role of the United States in international standardization should be strengthened. Unlike the other industrialized countries, the United States is not represented officially by government delegates in international standardization organizations. This means that we cannot effectively encourage the international adoption of standards which would be more harmonious with American technological and industrial practices. Legislation has been proposed to improve this situation. An international standardization bill pending in Congress would provide grants to qualified standardization organizations for participation in the international standards process and for information activities.[125]

REGIONAL ORGANIZATIONS FOR TECHNOLOGY

The hypothesis appears to be that U.S. technological superiority does exist, that it is a necessary consequence of U.S. concern for national security, and that it has alienated European nations. Apparently, power is equated with high technology rather than with proficiency in the production of glass, textiles, shoes, and the like. To restore the vitality of the NATO Alliance by dealing directly with this source of commercial dissatisfaction was the theme of an analysis by the late Edgar S. Furniss, Jr.[126] He urged that NATO be converted into a truly mutual program of international technological cooperation, with both public and private participation, but emphasizing the latter.

As the substance of technological cooperation under private auspices increases, allies can seize opportunities to support the formation of non-official groupings, still within the Alliance framework. International associations, in turn, could sponsor affiliates within the member states for various aspects of technological cooperation, which would reduce or even replace responsibilities held by governmental agencies.[127]

International Transfer of Technology

The concept of technological assistance to developing countries was advanced by President Truman in his first inaugural address, January 20, 1949, when he declared:

Fourth. We must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas.[128]

It was probably inevitable that the response to this proposal would be a primitive and unsophisticated program. The United States had

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[125] Lawrence C. McQuade, "Transnational Transactions, Technology and the Law: An Analysis of Current Trends. Reprinted from: Denver Law Journal, of the University of Denver College of Law, Summer, 1967. *In* " 'Transnational Transactions, Technology and the Law: an Analysis of Current Trends.' " Extension of remarks of the Hon. John Brademas. Congressional Record, (February 7, 1968), page E624.

[126] "Western Alliance Development and Technological Cooperation." International Studies Quarterly, (December, 1967, Volume 11, Number 4) page 339. The article was originally written for the House Republican Committee on NATO and the Atlantic Community. Furniss was director of the Mershon Center for Education in National Security, Ohio State University.

[127] Edgar S. Furniss, Jr. "A New Task for NATO?" International Studies Quarterly. (December 1967, Volume 11, Number 4), pages 345, 351–2.

[128] U.S. President (Harry S. Truman). Inaugural address, Jan. 20, 1949. *In* U.S. Congress. Senate. Committee on Foreign Relations. Development of technical assistance programs: Background information and documents. Subcommittee on Technical Assistance Programs pursuant to S. Res. 214, 83d Cong. Nov. 22, 1954. 83d Cong. 2d sess., Committee Print. (Washington, U.S. Government Printing Office, 1954), pages 53–54.

had little experience with colonies or undeveloped regions, with language and cultural barriers, with national economic planning, or with the complex phenomenon of technology transfer. The program went forward on the simplistic notion that the developing countries wanted "American know-how" and that sending U.S. experts abroad would provide it.[129]

One difficulty with the program was that its objectives were seen differently by the various groups involved; various of its supporters looked for different outcomes. Was it a humanitarian program to raise living standards in poor countries? Was it intended to effect political stabilization of these regions to halt the spread of communism, under the containment doctrine of the period? Was it to render the political soil less fertile for subversion? Was it to strengthen with gratitude U.S. relations with less-favored nations? Was it to provide assured future sources of essential materials for U.S. industry or possible wartime military requirements? All of these were offered at one time or another during the two years in which the Point IV Program was debated in Congress.

When John F. Kennedy came to the White House in 1961, he called for a sweeping review and revision of the program, and the design of a new effort ". . . tailored to meet the needs and resource potential of each individual country instead of a series of individual unrelated projects." He criticized past efforts because "our development goals and projects have not been undertaken as integral steps in a long-range economic development program."[130] However, again the goals recognized by the President were to develop lagging economies and technologies, without explicit statement as to why this should be done by the United States, or why the United States was the appropriate instrument for raising the technological/economic level of the undeveloped world.

PRESIDENT NIXON'S FOREIGN POLICY

In his special message to the Congress, February 18, 1970, on "United States Foreign Policy for the 1970's", President Nixon further developed the theme of foreign aid and technical assistance. He described the goal of U.S. foreign policy as being the creation of a "durable structure of international relationships which inhibits or removes the causes of war." The means would be (a) partnership with all friendly nations, (2) strength to match the strength of any potential aggressor, but coupled with willingness to accept cooperative arrangements for the control of arms, and (3) willingness to negotiate differences, toward the building of a durable structure of peaceful relations. His criteria were that the specifics of foreign policy needed to be creative, systematic, based on factual knowledge, selective among alternatives, competently responsive to crises while seeking to anticipate them, and—finally—capable of being carried out effectively.

American foreign policy [the President declared] must not be merely the result of a series of piecemeal tactical decisions forced by the pressures of

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[129] Some of the deficiencies of this early program are discussed in Chapter Four—"The Point IV Program: Technological Transfer as the Basis of Aid to Developing Countries," *In* "Technical Information for Congress," op. cit., page 61 sq.

[130] President John F. Kennedy. "Special message to the Congress on foreign aid." March 22, 1961. *In* Public Papers of the Presidents of the United States. John F. Kennedy. Containing the public messages, speeches and statements of the President Jan. 20–Dec. 31, 1969. (Washington, U.S. Government Printing Office, 1962), page 206.

events. If our policy is to embody a coherent vision of the world and a rational conception of America's interests, our specific actions must be the products of rational and deliberate choice. We need a system which forces consideration of problems before they become emergencies, which enables us to make our basic determinations of purpose before being pressed by events, and to mesh policies.[131]

With respect to the Western Hemisphere Nations (emphasized in the message), the President offered the beginning of a comprehensive program with a substantial technological content. He urged that bilateral relations be replaced by a multilateral approach, developed multilaterally. Other points were an increase of trade, eased AID restrictions, establishment of the post of Under Secretary of State for Western Hemisphere Affairs, the support of regional cooperation, and easing of the burden of debt. "To help turn science to the service of the hemisphere," the President proposed:

We will contribute to the support and financing of initiatives in these fields, including research and development, regional training centers, and transfer of technology.

We are developing a program for training and orientation of Latin American specialists in the field of scientific and technical information.

The O[rganization of] A[merican] S[tates] will sponsor a conference next year on the application of science and technology to Latin America.[132]

With respect to general foreign assistance, the President again stressed the importance of multilateral rather than bilateral relations, and of the need for the developing countries to take the initiative in charting their own development strategies. He recalled that, September 18, in his address to the UN General Assembly he had suggested a number of specific undertakings to that body, many of them technological in essence. Then he declared:

In an era when man possesses the power both to explore the heavens and desolate the earth, science and technology must be marshalled and shared in the cause of peaceful progress, whatever the political differences among nations. Innumerous and varied fields—the peaceful use of atomic energy, the exploration and uses of outer space, the development of the resources of the ocean and the seabeds, the protection of our environment, the uses of satellites, the development of revolutionary transportation systems—we are working with others to channel the products of technological progress to the benefit of mankind.[133]

Within the broader context of national science policy, a presidential advisory task force offered a prescriptive formula, April, 1970, for "International Initiatives Utilizing Science and Technology." The formula involved U.S. leadership in large projects, shared efforts on mutual problems, technical assistance where appropriate, and the building of national capabilities for scientific self-help. Excerpts:

—The intrinsic nature of science results in unusual opportunities for international scientific cooperation and assistance.

—Some technological enterprises—the space program, for example—offer unusual opportunities for foreign policy and international initiative.

—Universal human interests crossing all international boundaries—in agriculture, health, clean air and water, education, and communications—all suggest similar though more diffuse opportunities.

—. . . The Federal Government is presently making insufficient use of our extensive scientific and technological capabilities as instruments of foreign cooperation and understanding.

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[131] U.S. President. (Richard Nixon.) "United States Foreign Policy for the 1970's, A New Strategy for Peace." A report to the Congress, February 18, 1970. (Mimeograph), pages 3, 11–13.

[132] Ibid., pages 33–35.

[133] Ibid., pages 78, 82–83.

—The question of international technology transfer—the delivery and application of scientific and technological knowledge, methods, and techniques from one nation to another—is one which the United States should give very searching consideration in its formulation of a more effective science policy.
—. . . It is unlikely that indiscriminate efforts to transfer technology will be effective; technology, to be useful, must be related properly to local environment and cultural and economic restrictions.
—. . . Much greater emphasis must be placed on the transfer of research and development capabilities, rather than of technology itself.
—. . . An enlarged program of educational assistance in areas of science and technology should be made an essential element in our foreign aid program.[134]

President Nixon's message on foreign policy for the 1970s made reference to two studies of foreign assistance. One of these, conducted by a task force under the chairmanship of Rudolph A. Peterson, president of the Bank of America, dealt exclusively with U.S. aid policy. The other, a report by the Commission on International Development, chaired by Lester B. Pearson, former Prime Minister of Canada, was made to the President of the International Bank for Reconstruction and Development (World Bank) and discussed generally what the rich countries and the poor countries ought to do to help the poor countries.

REVIEW OF U.S. TECHNICAL AID PROGRAM

The Peterson Report, March 4, 1970, told the President that "For the first time in history, it appears feasible to approach this world problem [i.e., international development] on a worldwide basis." The report called for a less prominent and obtrusive role for the United States in extending aid to developing countries. It urged greater partnership with developing countries, with the aided countries carrying out more of the strategic planning. It urged repeatedly that bilateral assistance should be reduced and multilateral assistance increased. The goal should be the achievement by the aided countries of a self-sustaining posture of development. To implement the proposed change in emphasis of the U.S. aid program, the task force recommended the establishment of four institutions. These were (1) a U.S. International Development Bank, (2) a U.S. International Development Institute, (3) the Overseas Private Investment Corporation (OPIC) which the task force noted had already been authorized by the Congress, and (4) a U.S. International Development Council.

The Peterson Report strongly emphasized the funding of aid, and devoted less attention to the functional role of technology in the field of foreign assistance. For example, the International Development Council was proposed to correct an executive deficiency which the task force described as follows:

Presidential interests in international development are not adequately served by existing decisionmaking machinery. International development does not receive enough emphasis in the determination of U.S. trade, investment, financial, agricultural, and export-promotion policies. A number of departments and agencies have competing interests and responsibilities in this general area, with the result that too many issues go to the President for resolution. Furthermore, opportunities to take initiatives in policies toward developing countries are sometimes lost.

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[134] U.S. President's Task Force on Science Policy. "Science and Technology: Tools for Progress." The report of the President's Task Force on Science Policy. April 1970. (Washington, U.S. Government Printing Office, 1970), pages 40–42.

The significance of technology in diplomatic relations generally, and with specific reference to the developing countries, has been substantially documented in the present study. Yet, the membership of the proposed Council, as advanced by the Peterson Report, would consist of the Secretaries of State, Treasury and Agriculture, the President's Special Trade Representative, the President of the Export-Import Bank, the Director of the Peace Corps, the President of the (proposed) U.S. Development Bank, the Director of the (proposed) U.S. International Development Institute, and the President of the (pending) Overseas Private Investment Corporation. It does not appear that provision was made for a strong input from the scientific and technological sectors of the Government and its advisory system.

The proposed U.S. International Development Institute would have four principal areas of concern: (1) research on the population problem; (2) research at home and abroad on problems and technologies of development, but emphasizing local institutions in developing countries; (3) training [and strengthening the training function in developing countries] in vocational, commercial, agricultural, industrial, scientific, and professional skills; and (4) support of social development. The Institute would concentrate on a limited number of specific problems, it would work principally and increasingly through private channels, and it would seek to develop self-sustaining and continuing programs in its field.

In substantiation of the second area, research, the report said:

> New technologies are urgently needed to provide breakthroughs in a variety of fields essential to broad-based development. They must be adapted to the needs of the developing countries and related to programs and local institutions that can ensure practical applications and evaluation of results. The successful combination of the development of new seeds for rice and wheat, and the programs to apply them, are a model. The United States should strongly support similar long-range efforts in agriculture, health, education, and other fields through national, regional, and international projects.[135]

The report gave some attention to the need for more coherence in aid programs—

> Bringing coherence to the work of international development organizations is essential to the success of the new approach to foreign assistance we recommend. The various international institutions do not now make up a system. A wide area of overlapping and sometimes competing responsibility exists. The same is true for the individual programs of the industrial countries. . . . Constructing an effective international system and establishing international development priorities in concert with others would do much to advance what must be a global enterprise. (p. 26)

However, in seeming contradiction with the above, the report said:

> The recommended program for reorganizing foreign assistance calls for much smaller field representation than now exists. The [proposed] U.S. International Development Bank and the [proposed] U.S. International Development Institute will need regional representatives and in some cases country representatives, but the principal operating decisions will be made in Washington. (p. 36)

A succinct assessment of the Peterson Report, generally favorable, was offered by John Franklin Campbell, formerly staff assistant to the Under Secretary of State. He interpreted the report to signify

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[135] U.S. President's Task Force on International Development. "U.S. Foreign Assistance in the 1970's: A New Approach." Report to the President From the Task Force on International Development. March 4, 1970. (Washington, U.S. Government Printing Office, 1970), especially pages 4, 29–30, and 34. (Peterson report.)

that ". . . most of the 5,234 U.S. Aid employees abroad [would] come home and that this agency [would] be abolished." Bilateral programs would be administered directly through the economic sections of embassies. In Washington there would be ". . . a modestly staffed development bank and an institute for technical assistance, which would channel most of our future foreign aid through international institutions." This approach, he said, would (a) "remove foreign aid from its cold war context of political expediency," and (b) "promise a more serious aid program which is in accord with the realities of development." [136]

U.N. STUDY OF TECHNICAL ASSISTANCE

In view of the insistence of presidential and presidential advisory sources on multilateral over bilateral approaches to aid, it seems appropriate to examine what the Pearson Report, prepared under United Nations or World Bank auspices, recommends for the international uses of technology. Its stated goals were not dissimilar to those expressed in the Peterson Report: "Concern with the needs of other and poorer nations is the expression of a new and fundamental aspect of the modern age—the awareness that we live in a village world, that we belong to a world community." [137]

And there was also the underlying uncertainty—

> . . . The acceleration of history, which is largely the result of the bewildering impact of modern technology, has changed the whole concept of national interest. Who can now ask where his country will be in a few decades without asking where the world will be? (p. 9)

What needed to be done, therefore, was ". . . to put the less developed countries as soon as possible in a position where they can realize their aspirations with regard to economic progress without relying on foreign aid." (p. 11)

The aid and development strategy proposed in the Pearson Report had 10 elements: To create a framework for free and equitable international trade; to promote mutually beneficial flows of foreign private investment; to establish a better partnership, a clearer purpose, and a greater coherence in development aid; to increase the volume of aid; to meet the problem of mounting debts; to make aid administration more effective; to redirect technical assistance; to slow the growth of population; to revitalize aid to education and research; and to strengthen the multilateral aid system. (pp. 14–21)

In some of these particulars, the Pearson Report and the Peterson Report stress the same points, such as the need for more organizational coherence. However, not all the effects of the existing profusion of agencies were adverse. "The emergence of consortia, consultative groups, and the multilateral procedures of the Alliance for Progress serve very considerably to increase the effectiveness of aid by making it possible for donors, whether bilateral or multilateral, to help recipients develop policies more likely to promote self-sustaining growth." (p. 129)

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[136] John Franklin Campbell. "What Is to Be Done?" Foreign Affairs, (October, 1970), page 97.

[137] Commission on International Development. "Partners in Development." Report of the Commission on International Development. (New York, Praeger Publishers, 1969), page 8. (Pearson report.)

The Pearson Report takes a realistic view of the deficiencies of multinational agencies and programs. There were reasons, it noted, why nearly 90 percent of official development assistance (in 1967) was bilateral. Apart from historical colonial relationships, bilateral aid was often more efficient. Personnel recruitment was less of a problem. Bilateral programs could be more flexible and experimental in their procedures. They could encompass a wider scope of responses to real need. There were also important political considerations:

> Most countries will usually feel that at least some multilateral agencies are unduly dominated by the 'wrong' countries, whether aid-givers or recipients; or that they are following erroneous aid philosophies, either too hard or too soft, too interventionist, or too lax; or that they are simply badly run and that their procedures are slow and expensive. (p. 209)

Reasons in favor of multilateral aid were also set forth. It reduced any overtones of charity or interventionism. It helped provide a framework within which bilateral aid to whole nations could be better integrated into a total program. It would reduce unequal geographical preferences in aid distribution. It would stimulate regional integration among developing countries. It would pave the way for international centers of documentation, advice, and guidance. (pp. 213–214)

The Pearson Report emphasized the need for assistance programs to be controlled and developed within and by the receiving nation. Too often, such programs tended to be an extension of the thought and culture of the donor country. Sometimes a program developed a "life of its own, little related either in donor or recipient countries to national or global development objectives." In particular, the Report recommended that:

> (1) specialists and planners in developing countries consult regularly to determine their priority needs for advisory services, institution building, project aid, and the operation of educational and other public services, and (2) developing countries program technical assistance requirements by spelling out the sequence of operations, the performance objectives of the personnel and of the training schemes, the cost of each stage, and their own commitments to institutional and structural change. (p. 183)

It was also important that technical assistance be used to facilitate the transfer of technology and management. To this end, it was recommended "that international technical assistance be strengthened by the creation of national and international corps of technical assistance personnel with adequate career opportunities." (p. 185)

PRESIDENTIAL POLICY FOR FUTURE TECHNICAL AID

The President acted on the Peterson Report in a message to Congress, September 15, 1970, on "Foreign Assistance for the 'Seventies.'" In it he accepted virtually in full the report's recommendations. With respect to the proposed U.S. International Development Institute, he announced:

> I shall propose establishment [of the Institute] which will bring U.S. science and technology to bear on the problems of development.
>
> The Institute will fill a major gap in the international development network. It will match our vast talents in science and technology with institutions and problems abroad. Research has created the basis for the Green Revolution—the major breakthrough in agricultural production—but continued progress in the 1970's will require the lower income countries to deal with more, and more complex, problems. The Institute will concentrate on selected areas and focus U.S.

technology on critical problems. This requires flexibility, imagination and a minimum of red tape. If we can provide this Institute with the operational flexibility enjoyed by our private foundations, we can make a major contribution to the lower income countries at modest expense.

An Institute, so organized, could

—Concentrate U.S. scientific and technological talent on the problems of development.

—Help to develop research competence in the lower income countries themselves.

—Help develop institutional competence of governments to plan and manage their own development programs.

—Support expanded research programs in population.

—Help finance the programs of U.S.-sponsored schools, hospitals, and other institutions abroad.

—Carry out a cooperative program of technical exchange and reimbursable technical services with those developing countries that do not require financial assistance.

—Cooperate in social development and training programs.

—Administer our technical assistance programs.

—Permit greater reliance on private organizations and researchers.[138]

One innovation proposed by the President that had not been in the Peterson Report was the suggestion that:

As a long-run contribution to the funding of development, the U.S. will seek the utilization of revenues derived from the economic resources of the seabed for development asssistance to lower income countries. I have recently proposed that all nations enter into a treaty to establish an international regime for the exploitation of these vast resources, and that royalties derived therefrom be utilized principally for providing economic assistance to developing countries participating in the treaty.[139]

Assertedly, the new foreign assistance institutions which are proposed to replace the existing AID structure, would also coordinate the funding activities of the various overseas credit institutions supported by the United States. These new institutions would also relate to the assistance operations of the United Nations, and to its lending operations. And, in addition, the evolution of regional institutions (such as the Central American Common Market, the Alliance for Progress, etc.) and regional credit institutions (Central American Bank for Economic Integration, Caribbean Development Bank, Andean Development Corporation, Inter-American Development Bank, Asian Development Bank, etc.), implies the eventual need for a relationship with U.S. institutions for foreign assistance. It seems like a heavy burden of policy planning, for the same agency to administer three sets of relationships, toward three sets of national, regional, and global objectives.

SOME FUTURE PROBLEMS IN TECHNICAL ASSISTANCE

The issue of multilateral versus bilateral aid is complicated by a practical political consideration. Some of the objectives ascribed to the early Truman program, still persuasive for some groups, are largely incompatible with the patterns of cooperation essential in a multilateral program. A multinational program of assistance is likely to find few friends and fewer sponsors. It may be easier to win political sup-

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[138] U.S. President (Richard Nixon.) "Foreign Assistance for the Seventies: The President's Message to the Congress Proposing Reform of the United States Foreign Assistance Program." September 15, 1970. Weekly Compilation of Presidential Documents, (September 21, 1970), pages 1220–21.

[139] Ibid, page 1224.

port for foreign assistance, no matter how strongly supported by theoretical or policy considerations, if the U.S. electorate can identify directly the relationship with the recipient.

And finally, the problem remains unsolved of how to assess the impacts of present and future technology at all these different levels, in relation to the various sets of national and international objectives. The United States is only beginning to appreciate the difficulty of assessing technology domestically. The task is recognized as one of transcendent difficulty. The power of technology to alter the human condition, so evident in the United States, can be equally potent on the world scene. Effects of technology can be favorable or adverse. Combinations of technological effects can operate synergistically toward good or bad results. The many nations of the world differ widely in their sophistication, their grasp of these considerations. How far the United States should go in exercising leadership, globally, in the international transfer of technology, and in the effort to separate good from bad technology, in view of all the other elements of this great catscradle must remain an open question.

V. The Emerging Policy Issues of International Technology

Preceding sections of this chapter explored the evolution of technology as the dominant factor of change that has shaped the modern world. Its effects have been shown to be both beneficial and injurious. The point has been made that technology is the most obvious avenue to national strength and international influence. Technology has also been shown to be a potent force, linking the world together by many threads. Technology itself has an evident propensity to "go global."

The United States, by virtue of tremendous vigor and public expenditure for the past two decades, currently enjoys a commanding technological lead among the nations of the world. As Herman Pollack has said:

> Our preeminence in science and technology is now one of the pillars of U.S. strength and image abroad. The attraction generated by this preeminence among the nations of the world, especially those in the process of development, is perhaps one of the lesser understood but more pervasively powerful forces at work in international relationships today.[140]

He added that "If we are wise and imaginative and vigorous, these forces can be turned to our advantage in support of our foreign policy objectives and our hopes for a stable and peaceful world."

The emerging question posed by the onrush of technology, and its effect on the relations among the countries of the world, is whether this potent factor of change and national power is to operate in a random way, or whether it is possible, and desirable, to devise a national strategy to guide and direct it, to stimulate innovation in some directions, and possibly to slow and inhibit innovation in others.

The Issue of National Strategy in Technological Innovation

In a recent article in *Science*, Professor Robert Gilpin, of the Center of International Studies, Princeton University, identifies three major

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[140] U.S. Congress. House. Committee on Science and Astronautics. "1970 National Science Foundation Authorization." Hearings before the Subcommittee on Science, Research, and Development of the . . . on H.R. 4283. March 17, 18, 20, 24, 25, 26, 27, 28; April 1, 1969. 91st Congress, first session. (Washington, U.S. Government Printing Office, 1969), page 488.

interrelated economic consequences of modern technology. The first is the "increased interdependence among national economies and the consequent greater sensitivity of foreign trade to changes in economic conditions." The second is the "enhanced role of technological innovation in economic growth and competition." The third is the rapid spread of multinational corporations, primarily dominated by American capital. He suggests that a "new international economy" is developing, under the stimulus of technology.

There are, Gilpin's argument continues, three alternative national strategies in response to this development: (1) "to support scientific and technological development across the broadest front possible;" (2) scientific and technological specialization; and (3) the importation of foreign technology. The United States and the Soviet Union have followed the first strategy; Sweden, Great Britain, and a number of other countries have followed the second; while Japan and West Germany have in general followed the third. Although the U.S. strategy has been relatively successful, particularly in fields of high technology like space and the computer, it has begun to show defects, and, in Gilpin's opinion, "the direction of America's technological strategy will become an increasingly important political issue."

> In the first place, even America does not have the economic and technical resources to support all projects of importance; it too must choose. Second, a high proportion of the limited resources has gone into military and military-related projects, while pressing social and economic needs of the society have been neglected. Third, the devastating consequence of technological advance for the environment has suddenly emerged as a major national concern. . . .

Accordingly, thought might be given ". . . to the formulation of a more explicit technological strategy designed to increase the social return of its immense investment in science and technology and to minimize its negative environmental effects." Gilpin concludes with a prediction that:

> . . . To a degree perhaps unparalleled in the past, economic and technological considerations will shape the ways in which political interests and conflicts seek their expression and work themselves out. In a world where nuclear weaponry has inhibited the use of military power and where social and economic demands play an inordinate role in political life, the choice, success, or failure of a nation's technological strategy will influence in large measure its place in the international pecking order and its capacity to solve its domestic problems.[141]

In Riesman's book, "The Lonely Crowd," he develops a theory of a society divided into persons characterized as "Inner-Directed" and "Other-Directed." If nations were so categorized, in aspects of their behavior, it might be said that in the field of technology the United States to a considerable degree is "Other-Directed." The great efforts of the United States in science and technology—since 1940, at least—were inspired by external events. The Manhattan Project was initiated from fear that Nazi Germany might achieve nuclear power first. Work on the H-bomb was impelled by the conviction that it was necessary to beat the Russians to it. The Polaris ballistic missile submarine was a response to the Soviet missile threat. The whole first decade of the space race was an effort to catch and pass the Soviets in an area in which they had assumed a lead. The great technological programs

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[141] Robert Gilpin. "Technological Strategies and National Purpose." Science, (July 31, 1970, volume 169), pp. 441–2.

supported by the United States are still in military, atomic, and space developments, and all are motivated by events outside the United States or else support for them wanes.

Professor Harvey Brooks of Harvard declares that national defense is too often used as justification for doing what is needed to be done for the good of American society. It was a "convenient route for doing the things that needed to be done without the necessity of engineering the large scale democratic consensus that would have been necessary had the same things been done under civilian auspices." For example,

> We backed into federal support of higher education while stoutly insisting that we were only buying necessary military research results. We entered upon school curriculum reform, long overdue, on the grounds that it was needed to make our engineers and scientists better than their Soviet counterparts. We launched a gigantic interstate highway program on the grounds that it was needed for national defense. We fostered the study of international affairs and the development of foreign area research on the grounds that a great power needed this knowledge to maintain its power position.[142]

It seems paradoxical that the United States, best equipped to apply science and technology to the solution of man's global problems, and credited with the highest development of managerial skills, has been reluctant to devise and implement a positive technological strategy of its own. There would seem to be no lack of opportunities: earth resources satellites, ocean and ocean floor development, urban improvement, recovery of resources from all forms of waste, the Oak Ridge proposal for large agricultural-industrial-nuclear complexes, and many more.

One of the consequences of this "Other-Directed" syndrome in national technological strategy is that the United States has concentrated its efforts on technologies characteristically remote from everyday experience. It has supported the laser but not the science of processing garbage. There are lags in the technological levels of a number of industries in the United States; such lags may in time impair the credibility of the U.S. posture of world technological leadership. On this point, one issue of U.S. technological strategy would seem to be a conscious set of decisions as to the domestic technological gaps to be closed or ignored. What older technologies might be revitalized by an infusion of fresh technological effort, such as the railroads, glass and ceramics, coal, lumber, and textiles? What would be the diplomatic consequences of a vigorous technological effort in one, several, or all of these fields?

And more generally, how strong or superior should the United States aspire to be in technology? It has been shown repeatedly in the recent past that enormous outlays of public funds by the United States to support a new field of research brought only a short-lived technological advantage that quickly disappeared. Other nations came into the act and duplicated the U.S. successes, while avoiding the failures and blind alleys that are an inescapable part of pioneering. Clearly, there are added costs as well as benefits in the hard-earned role of technological leader. The various fields of science and technology may offer their own version of national "comparative advantage" such

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[142] Harvey Brooks. "Appendix E. Impact of the Defense Establishment on Science and Education, October 1970." *In* U.S. Congress. House. Committee on Science and Astronautics. "National Science Policy, H. Con. Res. 666." Hearings before the Subcommittee on Science, Research, and Development of the . . . 91st Cong. 2d sess. July, August, September, 1970. (Washington, U.S. Government Printing Office, 1970), page 962.

that specialization may be of mutual benefit within the community of nations. But to exploit in the field of technology this long-established economic principle would require a conscious decision to abjure leadership in favor of an international partnership in technological progress.

Finally, what are the policy resources the United States can bring to bear on these issues of national strategy in technology? U.S. efforts have been concentrated in fields of high technology in a reaction against external threats; the result has been to assemble large organizations in the fields of military, space, and atomic technologies. That these fields continue to be important is not questioned. But in the design of a total national strategy of technology, the effect of their being already on the scene in great numbers is to provide pressures for the United States to keep on doing what it has been doing. Where can objective analysis and innovative policy be found that can examine alternatives or additions to the national program?

The Issues of Global Strategy in Technological Innovation

Examination of the history of a number of fields of technology has demonstrated the tendency for technology to cross national boundaries, to generate problems involving many nations, to offer opportunities for general global benefit, and to effect profound changes in the world scene for better or worse. Perhaps the most significant fact about technology is this force for interdependence among nations.

The philosopher, Kant, proposed the "Categorical Imperative," an ethical principle to govern human behavior. It postulated that man should "Act as if the maxim from which you act were to become through your will a universal law." In other words, one should inquire of his actions as to what the effect would be if everybody did them. Perhaps the same principle warrants examination as applied to nations. Are there some general principles governing the development, application, and sharing of technology that should be incorporated in a Technology Treaty?

Reference has been made to the growing cost and scope of some fields or projects of technology: exploration of space, weather modification, global resource surveys, and the like are examples. When projects of this sort are not only costly but also inherently affect many nations, would it be feasible to mobilize all interested nations in a joint endeavor? For example, throughout all the literature on foreign assistance runs the theme of the population explosion and what to do about it. Examination of this problem would be a major function of the U.S. International Development Institute the Peterson Report recommended and the President has proposed to the Congress. The food/population balance and the threat of widespread starvation are predicted to become a major crisis of the late 1970s. A global strategy mobilizing the technological resources of many nations, with general funding support, and a central coordinating administration might serve beyond the capabilities of any single nation to achieve a goal or avert a catrastrophe. Can the United Nations be used as an institution to devise a global strategy in the application of technology for the betterment of all mankind? The President has suggested the use

of the resources of the seabed to finance U.N. programs of technological aid. Should this concept be expanded?

Many criticisms have been directed at the multiplicity of loosely affiliated agencies under the umbrella of the United Nations. An obvious issue is whether management principles applied in such tightly and effectively organized agencies as AEC and NASA could be transferred to international application. It is axiomatic, for example, that an institution with a diffused structure requires tight policy control at the top, supported by an abundant and accurate flow of information from all its elements. Policy decisions require information about the organization itself, its personnel, projects and results; and about the status, needs, and future prospects of the areas it serves. At the same time, the access of the public to this same information enables a closer understanding of the problems and opportunities of the organization and a means for improving its performance through general review and criticism. How well has the congeries of U.N. agencies performed in this respect?

If the United States is indeed technologically "Other-Directed", the same can probably also be said of the Soviet Union. To the extent that this is true of both countries, there are repeated pressures on both to "catch up" in some field of technology in which the other has scored an advance. Under these conditions, the more joint programs of technology in which both countries can participate, the less of this pressure is generated and the more progress with less effort toward shared goals. Some evidence of this technological teamwork already exists with respect to the exchange of meteorological information, and there have been discussions as to the possibility of a joint program of cancer research. However, it is not evident that there is any particular merit in maintaining such teamwork efforts on a bilateral basis. The possibility is open for the United States and the Soviet Union to provide joint leadership within the United Nations system to mount global projects in some directions. Who in the Federal Government is currently responsible for thinking up innovative possibilities for further cooperation along these lines?

It is a truism that the nation coming last to exploitation of a technology achieves the highest level of efficiency and the highest sophistication of design. What use is made of this principle in the extending of technical assistance to developing countries? Moreover, is there opportunity for a general feedback of technological information from countries with advanced technologies to those with lagging technologies? Lags occur when a technology involves heavy initial outlay and commits an industry to a pattern of capital equipment that is superseded elsewhere. This happened in the steel industry in the United States when L–D oxygen converters went into use abroad. It happened in the glass industry with the development of float glass. When a large industry is confronted with this situation, it has the alternatives of seeing its markets dwindle as it fails in competition, or of gathering resources to replace its outmoded equipment. Looked at from a global perspective, this is an inefficient and costly arrangement. Before World War II, it was widely resolved by the emergence of international cartels that allocated markets and fixed prices. The emergence of the multinational corporation suggests that a similar accommoda-

tion may be in prospect for the future. What alternative solutions are there, and is this an appropriate subject for study within the United Nations?

The Ultimate Issue: Reconciling National and Global Technological Advance

Technology emerges as a powerful force—perhaps the most powerful of all forces—for change in the modern world. Excellence in technology serves to establish a new measure of a nation's leadership within the community of nations. At the same time, it affords a means by which all nations can progress toward their own internal goals of reducing human hardship and enlarging human opportunity. How are these two effects of technology to be reconciled? What policies and what compromises are suggested for the United States, to optimize the benefits and minimize the adverse effects of technology within the United States and globally?

There is no mistaking the potency of nationalism as a spur to action. It ranks with personal gain, religious devotion, and ideological commitment, as human motivations compelling man to achieve and surpass. No comparable sentiment exists to unite or mobilize to action the nations of the world and their peoples. Participation in international technological efforts and programs may be, as the President and others have said, a necessary course for the achievement of peace and progress. Moreover, as the President has also said, "Peace and progress are impossible without a major American role." The appropriate motivation has also been suggested by the President: "If our policy is to embody a coherent vision of the world and a rational conception of America's interests, our specific actions must be the products of rational and deliberate choice."

Chapter 10—The Politics of Global Health

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CHAPTER 10—THE POLITICS OF GLOBAL HEALTH

I. Introduction

The purpose of this study on the politics of global health is to open up the subject of international health to greater visibility. The degree of freedom from epidemic disease enjoyed by Americans is the result of many steps taken by physicians and statesmen over many decades, toward improving global health conditions.

The American people contribute to a large variety of vitally essential but unglamorous programs with health benefits in small tropical villages and thriving modern cities all over the world. The unpublicized programs of worldwide disease surveillance and health assistance are supported by the commitments of the U.S. Government to the World Health Organization and the Pan American Health Organization. There is little awareness as to why or how these organizations came into existence, what they have achieved, or what they are supposed to accomplish. The closest voluntary involvement of the public is with UNICEF, the United Nations Children's Fund, many of whose activities are worked out with the advice and assistance of the World Health Organization which, like UNICEF, is a specialized agency of the United Nations.

Benefits from these programs accrue not only to the less developed countries of the world but also to the highly urbanized industrial nations. The benefits are likely to be greatly in excess of the costs, but little evidence has been offered to show this.

Scope and Limitations of the Study

The study describes the origin of early international agreements for control of epidemic disease, up to the broader and more comprehensive constitutional machinery under which international health experts now operate. Questions are raised about how purposeful the world's governments were, over the years, in establishing conventions to control the spread of disease; the extent to which national sovereignty yielded to international health imperatives; the use of health agreements in foreign policy objectives; and whether health technology remains an appropriate area of exploitation for national interests.

In formulating the elements of diplomatic policy having to do with world medicine and improved conditions of public health, national leaders have historically been strongly influenced by such other considerations as trade advantage, national prestige, and the quest for profits abroad. Although commanding high respect and priority as a political and economic force within most nations, public health and medicine have yet to become an attractive base to glamorize institutional reform of the relations among nation states. The question persists: Why a concern so important to all mankind—personal and public health—has not become a more effective, comprehensive, and dynamic focus of international cooperation.

Note: This chapter was prepared in 1971 by Freeman H. Quimby.

Other questions emerge about present perspectives on the implications of global health: About the practical necessity of a healthy world in order to safeguard health in the United States, and about the possibility that health programs for the "world village" may be grossly undercapitalized as compared with growing demands for individual health care in the United States. Indeed, there are striking differences between the emphasis of international health agencies on highly cost-effective, preventive medical care and the curative emphasis of U.S. medicine, which only an affluent society can afford—if even such a society can.

Another interpretation available from the data and trends presented in the study is that public health and preventive medicine may have already played their major role in history, and that the future solution to health problems lies in the character of the curative-oriented American medical enterprise and its emulation by other countries around the world. It may be that the international health machinery for which there were such high hopes twenty-five years ago has run its course, that a technology with predictable but unexciting results has failed to enlist world support, and that the apathy surrounding international health activities in both political and medical circles will reduce further the lonely concern with which only a relatively few competent American scientists and statesmen are now engaged.

The study deals with an immensely complex subject. It is a piecemeal attempt to provide an adequate picture of the situations and changes in U.S. involvement in global health institutions. The approach is to select and deal in some depth with several elements crucial to understanding and policy, rather than to provide a cursory overall treatment of the subject. The elements selected include:

—The historical perspective of international health conventions;
—The objective and functions of international health organizations;
—The ability of international health institutions to function effectively under cold war conditions;
—The cost of U.S. participation in international health organizations;
—The activities and trends of U.S. Federal agencies in overseas biomedical work; and
—The links and barriers between congressional committees and the Federal agencies responsible for the administration of U.S. commitments to international health organizations.

In the effort to concentrate research effort on activities of the highest current concern, in which the decisions of the U.S. Congress could be most decisive, many fields of global medicine were glossed over or virtually ignored. The global network of industrial corporations and international corporations dealing in drugs and medical supplies was not considered. Little space was given to the health activities of the Communist World, or to bilateral arrangements of the Soviet Union with aided countries. The various programs of imperial countries to extend health services to their colonies, or former colonies, and the various World War II health programs by the United States over much of the world were not researched, although in particular areas they may well have been of decisive importance. In short, the study is largely future-oriented: being concerned with those kinds of international health activity judged of high cost/effectiveness, and with

an appropriate claim to the attention of congressional decisionmakers at the present time.

The Evolution of Preventive Medicine

Nothing is more international than disease. It recognizes no political boundaries and few natural ones. It moves freely across national frontiers and spreads as conditions permit from one area to another. The picture usually drawn is that of great pestilences moving from backward regions to the more modern countries. But disease can also go the other way, as shown in numerous accounts of aboriginal populations' becoming infected by the customary diseases of the missionary, trader, explorer, and traveler. If one extends the problem to include the diseases of plants and animals, there is little doubt today that pathogenic organisms themselves are either already globally distributed or can rather rapidly become so. However, large numbers of these organisms, and the diseases which they cause, remain largely sequestered in regions where unsanitary conditions and certain insect vectors prevail. These conditions are the reasons for the generally endemic nature of such diseases as cholera, malaria, and plague in the less developed countries.

Preventive medicine, like disease. is inherently international. Had there not been the problem of preventing the entrance of disease from one country to another and of controlling the spread of disease within countries. preventive medicine would not have developed as early as it did. Public outcry demanded that corrective measures be taken against recurring epidemics based upon the observed association between polluted water and disease. Thus was born the first phase of preventive medicine—sanitary engineering and public hygiene.

Historically, the origin of this phase is marked by legislative Acts in England like the Great Reform Bill of 1832, the Metropolis Water Act of 1852, and the Public Health Act of 1875. In England, at least, the origin of preventive medicine and its early institutionalization as a public health service was essentially a layman's movement.

The scientific or experimental phase of preventive medicine, which both overlapped and followed the sanitation movement, provided the factual foundation upon which sanitary water and sewage disposal remain in their present practice. It also provided a foundation for more intelligent decisions regarding the limitations of sanitation, and on whether or not to quarantine and for how long. A vast array of vaccines and other measures for the prevention and control of communicable disease evolved. This experimental phase of preventive medicine can be called the era of bacteriology. Although as a discipline it goes well beyond bacteriology, the early classical discoveries which revolutionized the understanding of epidemic diseases were in that field. The developments include the identification of the causative organism of cholera by Robert Koch in 1883, the identification of the plague bacillus by Kitasato and Yersin in 1894, the discovery of the gonococcus by Neisser in 1879, and of the typhoid bacillus in 1880. Henle had seen anthrax bacilli in sheep in 1850, Lister had killed infectious bacteria in wound dressings in 1865, and Pasteur created a wave of enthusiasm in 1880 following years of fascinating experiments on behalf of the French silk and wine industries. The microbe causing yellow fever was not identified until 1927, but as noted elsewhere in this study, Walter Reed and associates in the U.S. Army dis-

covered in 1900 that the disease was transmitted by a certain species of mosquito. Along the way other mosquitoes and rats, lice, fleas, flies, and hundreds of invertebrate parasites were identified and their complicated life cycles were described.

Historical Overview of World Health Cooperation

There were times in the past when the world was more or less sharply divided between diseased and non-diseased parts. Some nations were continually afflicted with epidemics of famine and with insect- and water-borne diseases while others were comparatively free of these afflictions. As a result, early international policing of diseases was restricted to efforts against their spread from the underdeveloped countries to the developed ones. While this is still true, the lines can no longer be so clearly drawn between the poor and rich nations. Today the problems of world health are beginning to develop a broader base. As Dubos points out:

> The worldwide urban sprawl is creating a disease pattern of its own even in prosperous settlements. * * * One consequence of the explosive growth of large cities and the urban sprawl is that the old problems of air, water, and food pollution are re-appearing everywhere with new and intensified manifestation.[1]

But it is the story of epidemic disease which is of the greater interest, for it is here that formal international action in public health began. It is also a contemporary story, because as noted above, prosperous and poor countries alike are producing conditions which may permit the return of old problems.

To provide the problem with a kind of headline flavor one does not have to go back to the great pandemics that devastated the nations in the Middle Ages. In fact it was only a mere 112 years ago on September 1 and 2, 1858, that the Staten Island Quarantine Station was attacked and destroyed by angry citizens who attributed frequent epidemics of yellow fever to laxity of the quarantine administration. According to Russell, the local courts sustained the riot as an "act of salutary and well intentioned violence."[2]

However, in what has been an inconspicuous endeavor, the outlook which has guided international health workers and government leaders for many recent years is that described by Raymond B. Fosdick in 1945:

> In a world that is haunted by fear and torn by hate, public health can be one of the rallying points of unity. It can be one more bridge across the political and ideological gulfs that divide mankind. Health is something that all nations desire, and no nation by the process of gaining it takes it away from another. There is not a limited supply of health for which nations must compete. Rather, every nation by promoting its own health adds to the better health of other nations, just as by assisting in the public health efforts of other nations it protects itself.[3]

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[1] Rene Dubos, "Man Adapting," (New Haven, Yale University Press, 1965), pages 237–8.
[2] Paul F. Russell, "International Preventive Medicine," The Scientific Monthly (December 6, 1950), pages 393–4.
[3] Austin J. Kerr, ed. "Building the Health Bridge: Selection from the Works of Fred L. Soper, M.D." (Bloomington, Indiana University Press, 1970), faceplate.

And as Ruth Masters stated two years later:

> Today there are few spheres of governmental activity in which states so readily agree to pool experience, to render each other assistance, to harmonize their administrative practices, and to share their knowledge freely, as in that of public health.[4]

But even in public health, today's level of international cooperation was not easily achieved nor is it easily sustained. Historically, the cycles of pestilence were accepted as a fact of life. There was a series of disease invasions beginning with the Christian era, running on through the fall of Rome, and climaxing in the Black Death of the fourteenth century. Most of this was probably plague, but typhus came into the early picture too and it is now known that "more crusaders were slaughtered by typhus and plague at the gates of Antioch and Jerusalem than by the infidel." Much later it was thought in the developed countries that the scourges of plague and cholera could be kept away by sanitary practices at home. The fact is, however, that many infectious diseases can threaten advanced countries. It was not cholera or plague which took the lives of twenty million people in 1918–1919, but rather a particularly virulent strain of influenza in pandemic—twice the number of casualties produced by World War I itself. These casualties occurred in the developed world where death records were kept; uncounted additional deaths occurred elsewhere.[5]

In the early deliberations (1850–1900) of nations on public health there occurred the now well-known phenomenon of scientific dispute. The paucity and uncertainty of scientific knowledge about health and medicine left much room for debate, and the doctors could more easily align themselves with views held vital to the national interest of their countries. The quarrel between French and British doctors about how to control the spread of international disease was intensified and embittered by traditional Anglo-French political rivalry. The German members of the International Sanitary Council of Constantinople made decisions of little consequence to disease but calculated to expand the political dominance of Germany in one instance and to weaken British commercial dominance in the other.[6] According to Masters, Turkey rarely observed sanitary rules, holding that the whole system was a tool of imperialist power politics rather than a system for the protection of Europe against epidemic invasions.[7] British physicians, even with French scientists ridiculing their logic, had little difficulty in supporting British foreign shipping interests by downgrading the importance of quarantine restrictions.

The "medical plank" which most of the British doctors were supporting is described in the 1849 British Report on Quarantine, which concluded "that the only real security against epidemic disease is an abundant and constant supply of pure air * * * and that ventilation

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[4] Ruth D. Masters. "International Organization in the Field of Public Health," (Washington, D.C., 1947). page 2.

[5] Ibid., p. 31. Only recently, as the instruments of war have reached the capacity of high kill, have their toll in casualties exceeded that of disease. Not until World War II did more soldiers die from bullets than from disease. As for the great World War I influenza pandemic, it must be stated in all fairness that the deaths were low compared with the 700,000,000 people who came down with the disease. There were hardly that many soldiers or civilians exposed to bullets, gas, or any other deliberate weaponry. So, while the deaths were relatively low, the casualties were enormous. Then as now the primary enemies of man were disease and disease-producing organisms.

[6] Ibid., page 38.

[7] Ibid., pages 7–8.

and dispersion can dissipate any contagion."[8] This notion continued for at least another 30 years, as can be seen in the Governor of Bermuda's 1878 report on "Climate and Public Health":

> It is singular that with such a summer atmosphere, and with a considerable portion of its surface occupied by undrained marshes, the exhalations from which must necessarily be more or less prejudicial, Bermuda should have no local summer fevers, such as prevail at Malta and at Gibraltar. This immunity from local disease may probably be due to the small extent of land surface, and its distribution in long narrow bands separated by arms of the sea and raised but slightly above its surface, so that the whole area of each island is frequently swept by the sea breeze which carries away with it every unwholesome emanation.[9]

And in the same year from the report from Penang:

> The gaol was at the moment of outbreak overcrowded, and the probable cause of the outbreak [cholera] was the admission of an incipient case of the disease into an atmosphere rendered, through overcrowding, suitable for its generation and rapid dissemination.[10]

An even more disturbing note of the times was that the medical men were seemingly trying to get out of the argument altogether:

> In England the conviction that quarantines are ineffective against epidemics has advanced with greater decision and rapidity among non-professional persons engaged in commercial and public life than among medical men. It is not a technical question, but one of evidence, on which a person capable of observation is as competent a judge as any physician.[11]

This state of ignorance and fear, of political and economic dominance, of unilateral 40-day quarantine periods based upon arbitrary grounds, of resentment by the Moslem States that their countries were regarded as less than clean, of medical argument instead of experimentation, and of an extraordinary pursuit of national interests at the risk of national and global health, dominated the picture of international discussion of communicable disease during the entire second half of the nineteenth century.

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[8] Ibid., page 37.

[9] "Papers Relating to Her Majesty's Colonial Possessions, Reports for 1876 and 1877. Presented to both Houses of Parliament by Command of Her Majesty" (London, George E. Eyre and William Spotteswoode, Printers, August 1878), page 25.

[10] Ibid., page 327. The treatment for this disease was worse than ideas on its transmission: "Thirty-three cases, of which 27 were fatal, were treated by hypodermic injections of chloral hydrate; 6, of which 4 were fatal, with camphor; and 36, of which 5 were fatal, by inhalation of sulphur fumes * * * this treatment was supplemented by half drachm doses of dilute sulphuric acid, and a plentiful supply of iced water to drink" (pages 327–328) The treatment did not have to be this way. In a brilliant monograph published by Dr. William Brooke O'Shaughnessy in The Lancet in May 1832, an effective fluid therapy for sufferers of cholera was described. It was similar to that used today. The thesis was lost for over a century. However, Dr. O'Shaughnessy could not even apply it at the time to London where cholera was devastating the city. He had been educated in Edinburgh and moved to London. He was not permitted to practice medicine within seven miles of the city because he did not have a license from the Royal College of Physicians". (See Abel Wolman, "The Unreasonable Man", Second WHO/PAHO Lecture of Biomedical Sciences, Pan American Health Organization, 1967, page 14.)

[11] Masters, op. cit., page 37.

Early Efforts Toward International Collaboration

It is to the credit of diplomacy in international action under these circumstances that the nations sought a constructive plan to control the spread of disease. It was a long step forward, for example, when in 1851 the French government convened the first international quarantine congress. The 12 nations which sent delegations to the congress in Paris were fully aware of the "* * * pressures of the non-maritime powers to bar the entrance of disease, at any cost [and of] the great shipper, the United Kingdom * * * at any cost, to keep commerce and traffic moving."[12] Knowledge of the origin and transmission of infectious disease was not well enough advanced to impose a purely technological decision. Nevertheless, the participants from time to time seemed willing to do just that and to do it as a basis for international action. The scientific community, such as it was at the time, was divided between the sanitarians and the quarantinists. It is interesting to point out that their views were both wrong as single solutions to the problem, but both correct as combined approaches to it. Today, sanitary control and quarantine are significant components of the management of international epidemics.

When the delegates to Paris in 1851 got down to work it was with considerably more skill in negotiation than knowledge of epidemiology. In an atmosphere of ignorance concerning the origin and transmission of diseases like cholera and plague, diplomacy was faced with a unique challenge. Since the medical men were unable or unwilling to agree on whether or not certain diseases were contagious, the diplomats were forced to use a political strategy regarding the retention or abolition of international ship quarantine practices. Meanwhile, delegates from the same nation were free to exercise different motives and even to vote against each other. Thus—

Each nation was represented by a doctor and a diplomatist, and it was decided at the outset that they should vote individually. This set up tensions between medical men and the administrators, making the voting at times useless, since they tended to cancel each other out.[13]

Accordingly, it was possible for the diplomat from France to express the concern of the central government with the effect of prevailing regulations on trade, while the French expert familiar with epidemics introduced by travellers at the port of Marseilles advocated strict application of the regulations. This pattern of one diplomat and one doctor from each country continued during ten international sanitary conferences which followed between 1851 and the end of that century.

Although this first conference ended on a predictably inconclusive scientific note, the diplomats and doctors finally were able to put together 137 articles on international sanitary regulations. There is evidence of a considerable amount of patience behind this achievement; it required six months of work involving 48 plenary sessions.

In perspective it seems to have mattered little that the Convention was not ratified by all the governments, or indeed that it lapsed completely in 1865. The fact remains that a number of important international rules were established to promote uniformity in quarantine

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[12] H. van Zile Hyde. "The International Health Program," an address before the Army Medical Service Graduate School, Walter Reed Army Medical Center (Washington, D.C. March 9, 1954), page 4.

[13] John Taylor, "First Steps." World Health (World Health Organization, March 1968), page 5.

procedure and many of the main rules continued in practice for the remainder of the century. What is more important is that for the first time doctors and diplomats from the then European powers had met in earnest to discuss common global disease problems. And as a practical matter, diplomacy rather than science "saved the day" for this first congress. Although arguments over rival scientific theories occupied most of the time, the French diplomatic representative who was president of the conference continued to seek workable solutions. In addition, the diplomats appeared to have had definite instructions not to vote for either of the extreme scientific positions. Subsequent events and discoveries suggest that this compromise was all to the good.[14]

International quarantine congresses continued to be called. In succession they occurred in Constantinople in 1866, in Vienna in 1874, in Washington in 1881, in Rome in 1885, and in Venice in 1892. Three other agreements which followed in 1893, 1894, and 1897, and which like many of the others dealt with protection against cholera at specific places, were later combined in a single International Sanitary Convention in 1903.

Establishment of a Permanent Quarantine Office

Finally, as knowledge advanced and statesmen agreed on the need for continued international cooperation, a permanent International Office of Public Hygiene was created. The Office was set up in Paris in 1909 as a result of a 1907 meeting in Rome of twelve major nations, including the United States. According to Russell the advantage of the 1909 convention over its many predecessors was that the intergovernmental correspondence regarding the codes and regulations did not go "* * * through departments of state and foreign affairs * * *. It provided an operating agency outside lay diplomatic channels."[15]

The disadvantage of the International Office of Public Hygiene in Paris was its functional limitation to only those aspects of public health having to do with quarantine and the notification of cases of communicable disease. Its work was confined to its secretariat and its influence was limited even in the control of epidemics. It was expressly forbidden to "meddle in the administration of the several states" supporting it.[16] With national sovereignty, ports, and boundaries protected at every point there was still nonmedical resistance to the idea of the International Office of Public Hygiene. The resistance came from Germany, Austria-Hungary, and Great Britain. Great Britain, however, later changed its views and supported the "Paris Office", doing so under the considerable pressure of spokesmen for its doctors, who were apparently beginning to give more professional content to their thoughts and recommendations regarding international health. According to Goodman, the British medical journal, the Lancet, had severely castigated the parochial attitude of the British delegation.[17]

In this way the "Paris Office" of 1909 became the first international quarantine organization involving the major European powers and

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[14] N. M. Goodman. "International Health Organizations." (Philadelphia and New York, The Blakiston Co., 1952), pages 40–41.
[15] Russell, op. cit., page 394.
[16] Masters, op. cit., page 49.
[17] Goodman, op. cit., pages 81–82.

the United States. As in 1851 the French had taken the initiative, this time under the leadership of diplomatist Camille Barrère, French Ambassador to Rome. Although later resisting the absorption of his "Paris Office" by the Health Office of the League of Nations, it was diplomat Barrère who brought order out of chaos in international quarantine during the 1907–1909 period.[18] The "Paris Office" continued to function through both World War I and World War II, and was not dissolved until the World Health Organization came into existence.

The First International Health Organization

The first truly international health organization was not born in Europe, Rome, or Paris, but in the New World. This was the Pan American Sanitary Bureau, established in Mexico City in 1902, at the Second Inter-American Conference of the Pan American Union. Russell suggests that this organization was the first which "could cross frontiers of member nations." [19] Although the Pan American scheme of cooperation in public health matters did not become powerful and comprehensive until the Pan American Sanitary Code was ratified by 24 nations of the Americas in 1924, the system was from the beginning more like that of an international sanitary policing action. It also provided for regional cooperation in public health beyond that of mere notification and quarantine of communicable disease, and tended to go somewhat further than the European conventions in requiring compulsory notification of a larger number of diseases.[20]

The Pan American Sanitary Bureau, in the evolution of international health organizations, is important on several counts:

1. It brought an extensive body of hemispheric knowledge and experience in the control of disease before the post-World War II health experts who were in the process of designing the new World Health Organization.

2. It still exists as an autonomous international health organization for the Americas as well as the regional office for the Americas of the World Health Organization.

3. The executory powers bestowed upon the Pan American Sanitary Bureau by the signatory states appear to have been adopted and expanded when the World Health Organization was formed.

4. The PASB organization, particularly two of its eminent American directors, played powerful roles in the decentralized regional structure of WHO. This type of organization is unique among the Specialized Agencies of the U.N.[21]

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[18] Ibid., pages 81–82.

[19] Russell, op. cit., page 394.

[20] Masters, op. cit., pages 10–43.

[21] According to Calderwood: "The governments represented at the International Health Conference in 1946 at which the Constitution of the World Health Organization was written, were almost unanimous in the opinion that existing international health organizations should be replaced by a single organization. It was agreed, however, that the disparity of health conditions in different parts of the world was one of several reasons requiring a decentralized organization. The form that decentralization took in the World Health Organization was the establishment of regional organizations rather than administrative decentralization. This form was dictated by circumstances at the time, particularly by the insistence of the Latin American States on preserving the autonomy of the Pan American Sanitary Organization." (Howard B. Calderwood, "The World Health Organization and Its Regional Organizations." Temple Law Quarterly (Vol. 37, Fall 1963), page 16.)

The League of Nations Health Organization

The next primary cooperative venture in international health followed World War I. The League of Nations in 1920 set up an international Epidemic Commission and in 1923 the Health Organization of the League. With seemingly little prospect of support, financially or politically, the Health Organization was a surprising and welcome success. It soon outstripped the "Paris Office" in both importance and influence. Ultimately there was "hardly a medical field or corner of the world unaffected by its activities." [22] Although an integral section of a political body—the League of Nations, the Health Organization seems to have succeeded in part because member delegates were preoccupied with the political problems of the League itself rather than with controlling the activities of the League's Health Organization.

The United States generally favored measures to advance international health, but it was not a member of the League and therefore supported the French who wanted the "Paris Office" to be independent of the League. The net result was the coexistence of two different international health organizations in competition with each other. The situation was a constant irritant, perhaps ameliorated somewhat in 1936 by a Health Committee composed of members elected by both the Paris Office and the League. It hardly seems possible, however, that the secret of the success of the League's health activities could reside in this development or in the fact that the members of the directing committee "sat as members in their personal capacities," [23] rather than as delegates of their Governments. The Governments were not adequately supporting the Health Organization of the League anyway, and had it not been for some important financial assistance from the Rockefeller Foundation the situation would have been even more difficult. The U.S.S.R., incidentally, left the League and everything connected with it in 1937.

It is an interesting observation, then, that an international health organization in such apparent neglect could command the favorable appraisal of Russell. According to this authority:

> The Health Organization was commonly said to be the most successful League of Nations agency.[24]

Moreover—

> Time and war tend to fog memories, and today it is doubtful that many realize how great was the achievement of the Epidemic Commission and its successor, the Health Organization of the League * * * quarantine reform was stimulated, and numerous epidemics were effectively quelled. [There was] an attempt to standardize sera and vaccines * * * Epidemiological centers were set up in Geneva, Singapore, and Melbourne * * * International study tours and lectureships * * * were established [and] sanitary safeguards [were provided] for religious pilgrimages. [It] started a library of laws, decrees, reports and other documents relating to public health * * * it continued to promote international cooperation throughout the field of preventive

[22] Goodman, op. cit., page 308.
[23] Ibid., page 106.
[24] Russell, op. cit., page 397.

medicine. * * * The League of Nations Health Organization made substantial progress in a relatively short time.[25]

In her 1947 study, Ruth Masters was similarly complimentary of the Health Organization of the League:

> It was an outstanding achievement of the Health Organization that it succeeded in bringing together public health officials from almost all countries for the purpose of coordinating their efforts, and that it thus brought about a lowering of the artificial barriers dividing people engaged in work of a similar character.[26]
>
> [It made] a large amount of knowledge and experience available to national health administrations (a series of monographs on the *Organization of Public Health Services*, the *International Health Yearbook* and the *Bulletin of the Health Organization*). The *Statistical Handbooks* described vital statistics in different countries, and numerous other reports and surveys dealt with such varied questions as malaria, leprosy, rural hygiene, nutrition, etc. Never before had so much information on every aspect of health been assembled and freely made available to all interested persons.[27]
>
> [In addition to this] the Organization rendered direct assistance to governments. On request it placed its experts at the disposal of governments desiring advice and help with specific problems, and in a number of cases it assisted governments in the reorganization of their health services. Thus, advice was asked and given to * * * Albania * * * Bulgaria * * * Greece * * * Ireland * * * Chile * * * Bolivia * * * China * * * Czechoslovakia * * * and Rumania * * *. In appraising its achievements it has been said: "the steady work of nearly twenty years has gone to create a strong network of effort to assist humanity in improving the conditions of nearly every phase of its daily life. The fight against disease, the development of knowledge of the factors which make for physical and mental fitness, have welded a strong body of scientific and lay opinion in a real collaborative and enthusiastic comradeship. The call is not merely to expose and remedy the defects arising from primitive modes of life, but also to provide advanced modernity with the means to guard itself against the new perils of its conquest in the air, on land, and overseas." [28]

World War II brought an end to the 1923 Health Organization of the League and created the need for a new international health agency—a separate one, affiliated with the United Nations but operating under its own constitution. It was thus that the new World Health Organization was born—not as a revolutionary experiment in public health—but as a logical evolutionary development from its predecessor conventions, international offices, and agreements. [29]

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[25] Ibid., pages 395–396.
[26] Masters, op. cit., page 19.
[27] Ibid., pages 57–58.
[28] Ibid., pages 22–23.
[29] Russell, op. cit., page 397.

II. The World Health Organization

Constitutional Foundations of the World Health Organization

The World Health Organization (WHO) was established by the so-called "Arrangement of July 22, 1946" as a specialized agency within the terms of Article 57 of the Charter of the United Nations. The United States became a member of WHO on June 21, 1948. The international policies upon which the United States and the other contracting parties agreed when they became members of WHO are presented in the WHO Constitution under "principles," "objective," and "functions."

Among the accepted *principles* for the promotion and protection of the health of all peoples is the often-quoted WHO definition of health as being "* * * a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".[30]

International or globally-oriented *principles* of WHO declare that:

> The health of all peoples is fundamental to the attainment of peace and security and is dependent upon the fullest co-operation of individuals and States.
>
> The achievement of any State in the promotion and protection of health is of value to all.
>
> Unequal development in different countries in the promotion of health and control of disease, especially communicable disease, is a common danger.[31]

WHO has a single *objective* which is: "The attainment by all peoples of the highest possible level of health." [32]

The 22 Constitutional *functions* of WHO, regarded as essential to the achievement of the above objective, are broad and inclusive; indeed they have been called the Magna Charta for international health: [33]

> (a) to act as the directing and co-ordinating authority on international health work;
>
> (b) to establish and maintain effective collaboration with the United Nations, specialized agencies, governmental health administrations, professional groups and such other organizations as may be deemed appropriate;
>
> (c) to assist governments, upon request, in strengthening health services;
>
> (d) to furnish appropriate technical assistance and, in emergencies, necessary aid upon the request or acceptance of governments;
>
> (e) to provide or assist in providing, upon the request of the United Nations, health services and facilities to special groups, such as the peoples of trust territories;
>
> (f) to establish and maintain such administrative and technical services as may be required, including epidemiological and statistical services;

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[30] World Health Organization. "Constitution Adopted by the United States of America and Other Governments," Department of State Publication 3318, (1949), page 3.
[31] Idem. Principles quoted in part.
[32] Ibid., Chapter I, Article 1, page 4.
[33] Remarks of Dr. Parran, Surgeon General of the United States, at the concluding meeting of the WHO Constitutional session. (U. N. Document E/H/VP18), page 2.

(g) to stimulate and advance work to eradicate epidemic, endemic and other diseases;

(h) to promote, in co-operation with other specialized agencies where necessary, the prevention of accidental injuries;

(i) to promote, in co-operation with other specialized agencies where necessary, the improvement of nutrition, housing, sanitation, recreation, economic or working conditions and other aspects of environmental hygiene;

(j) to promote co-operation among scientific and professional groups which contribute to the advancement of health;

(k) to propose conventions, agreements and regulations, and make recommendations with respect to international health matters and to perform such duties as may be assigned thereby to the Organization and are consistent with its objective;

(l) to promote maternal and child health and welfare and to foster the ability to live harmoniously in a changing total environment;

(m) to foster activities in the field of mental health, especially those affecting the harmony of human relations;

(n) to promote and conduct research in the field of health;

(o) to promote improved standards of teaching and training in the health, medical and related professions;

(p) to study and report on, in co-operation with other specialized agencies where necessary, administrative and social techniques affecting public health and medical care from preventive and curative points of view, including hospital services and social security;

(q) to provide information, counsel and assistance in the field of health;

(r) to assist in developing an informed public opinion among all peoples on matters of health;

(s) to establish and revise as necessary international nomenclatures of diseases, of causes of death and of public health practices;

(t) to standardize diagnostic procedures as necessary;

(u) to develop, establish and promote international standards with respect to food, biological, pharmaceutical and similar products;

(v) generally to take all necessary action to attain the objective of the Organization.[34]

It is obvious that hopes were running high in 1946 when principles, objectives, and functions like these were incorporated in the Constitution for the World Health Organization. The sights of the public health experts from all parts of the world were aimed high with a view to the future as well as the immediate postwar period. The attitude at the time seemed to be that much was expected of new tools such as antibiotics and DDT developed during the war and that the necessary resources would be available without interruption because finally there would be no more war. Subsequent difficulties with respect

[34] WHO Constitution, op. cit., Chapter II Article 2, 4–5.

to the new technologies and the quick emergence of the cold war gave cause for re-appraisal of the early aspirations; nevertheless, there was immediate work to be done by this new international machinery to resume the work interrupted by the war and to deal with conditions produced by it.

Organization and Structure of WHO

The drafters of the WHO Constitution produced a unique structure for international health work and one with authority and power over functions which governments normally reserved to themselves. However, the authority and powers of WHO have never been fully exercised by its administrators. Prudent men have used both common sense and caution in the application of the constitutional provisions. If for no other reason, the available resources, personnel, funds, and technical knowledge available to the Organization have made it impossible for WHO to attempt to carry out all of the functions assigned to it.[35]

Nevertheless, under these constitutional directives WHO has grown into an international operation of considerable size and significance. Its regular budget, funded by assessed contributions from Member governments, has risen from $5 million in 1945 to $73 million for 1971,[36] plus $50 million or more from other sources which the Organization will administer in 1971.

Today WHO:

—Has 131 Member States and Associate Members.

—Continues its six regional offices and committees in Copenhagen, Alexandria, Brazzaville, Manila, New Delhi, and Washington, with headquarters in Geneva. (See Fig. 1)

—Maintains hundreds of reference centers or laboratories all over the world.

—Has formal working interfaces with some 82 major health-relevant international governmental and non-governmental organizations.

—Has a total staff in the order of 4500. Approximately a fourth of these are at headquarters with the remainder in regional and zone offices and in the countries.

—Is supported technically by some 45 Advisory Panels and Expert Committees in virtually every health or health-related subject area, including air pollution, food additives, cancer, drug dependence, human genetics, insecticides, nutrition, occupational health, medical research, international quarantine, venereal disease, mental health, and environmental health programs.

—Initiates per year about 200 collaborative research contracts, 100 training and exchange grants, and 3500 fellowships.

—Manages an extensive world-wide malaria eradication and control program.

—Administers the 107 Article, International Health Regulations, adopted by the World Health Assembly in 1969.

—Operates as a part of the above regulations a global intelligence network on the principal epidemic diseases of the world. (See Fig. 2)

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[35] Personal communication with Howard B. Calderwood. (November 25, 1970).

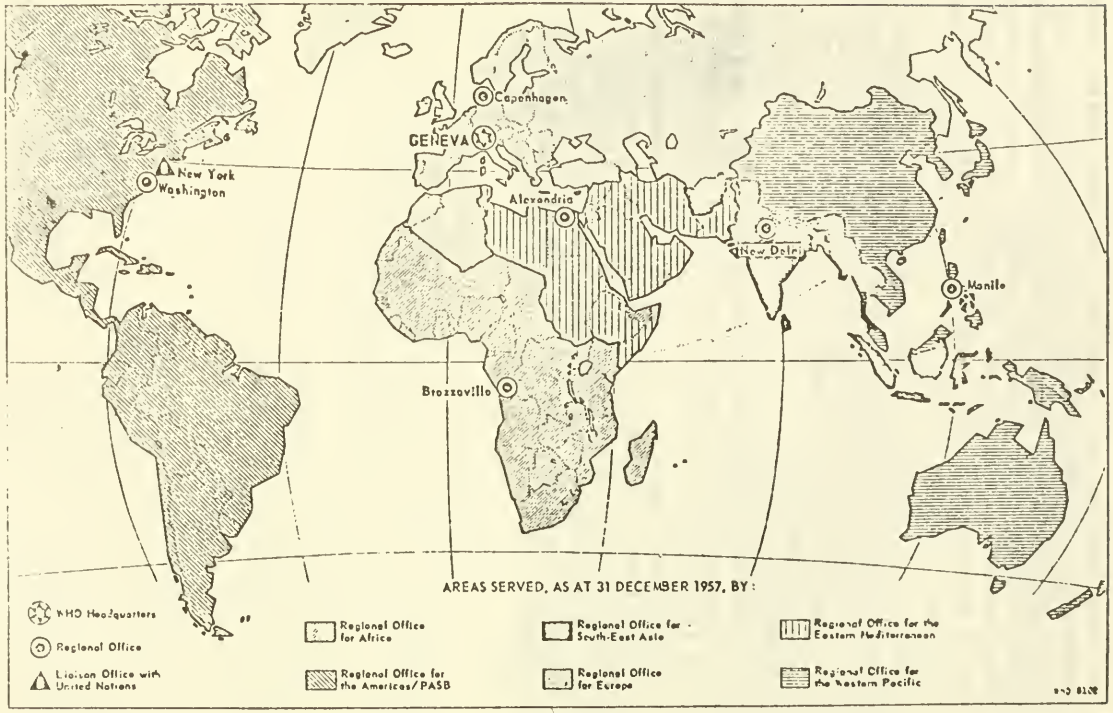
[36] As adopted by the 23rd World Health Assembly. WHO Chronicle (Geneva, World Health Organization, July 1970), page 293.

—Is a major publisher of biomedical literature. WHO publishes numerous monographs, technical reports, directories and guides, special scientific papers, and six periodicals. The monographs and technical reports often represent, in effect, a world scientific or medical consensus. Perhaps more frequently they are the collective views of international experts which do not necessarily represent the decision or policy of WHO.

The international reference centers are usually pre-existing institutions designated to function as a part of the WHO network of competent and specialized units. The technical excellence required here may tend to skew the centers towards the developed nations. There are for example, 40 institutions in the United States participating in support of WHO programs.

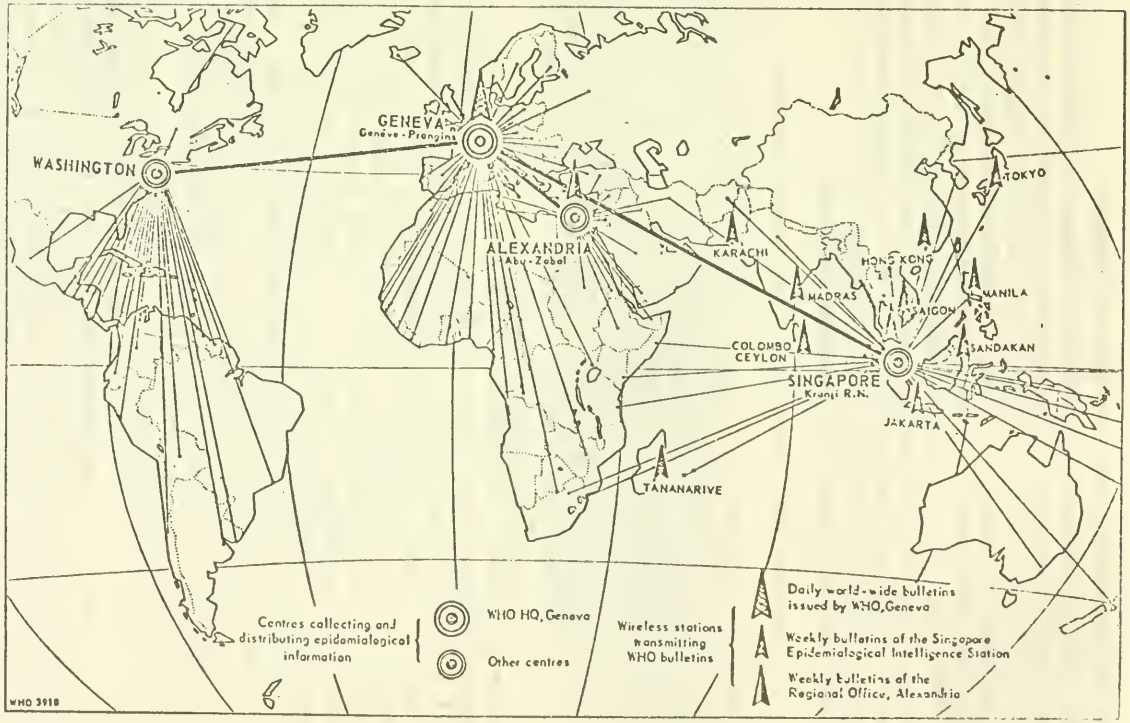
The forty-five or so WHO advisory panels and expert committees are also well represented by the technically advanced nations including, of course, the United States. The effect of this arrangement is that this network of reference centers and the advisory committees—who contribute to WHO on a cooperative (i.e., reimbursable) basis, rather than as beneficiaries under its budget—makes for a considerable expansion in the total WHO apparatus. As advanced technological expertise is being channeled into this apparatus by this arrangement, WHO is able to coordinate and tap a large, global resource of talent and information.

Fig. 1. WHO REGIONAL OFFICES AND THE AREAS THEY SERVE 37/



37/ "The First Ten Years of the World Health Organization," (Geneva, World Health Organization, 1958), page 85.

Fig. 2. NETWORK OF EPIDEMIOLOGICAL RADIO-TELEGRAPHIC COMMUNICATIONS 38 /



38/ " The First Ten Years," Ibid ., page 263.

WHO's Epidemiological Intelligence Network

The service performed by WHO in regard to international epidemiological intelligence deserves special emphasis for three reasons: (1) Disease surveillance and quarantine were the original bases for international collaboration in public health matters and they remain among the more difficult and dramatic aspects of such collaboration; (2) WHO has a unique semi-legislative authority over international epidemiological and quarantine procedures; and (3) the network may serve as a model of international authority with respect to the control of global diseases of as yet unknown etiology, as well as the management of emerging global environmental problems.

THE NETWORK ORGANIZATION AND ITS ACTIVITIES

The WHO Epidemiological Intelligence Network is an international system of surveillance and quarantine designed to receive and provide rapid information in order to prevent the outbreak and to control the spread of communicable disease anywhere in the world. As in the past, but under new "International Health Regulations", the health administrators of governments are obliged to inform WHO of the first cases or suspect cases of cholera, plague, smallpox, and yellow fever.[39]

The information must be supplied within 24 hours of disease identification, by means of telegram or telex directly to the intelligence headquarters in Geneva. The information is then given in a daily radio bulletin broadcast from Geneva and retransmitted throughout the world. Over 3,000 such disease case intelligence notifications come into Geneva every year. (Governments can obtain WHO assistance in investigating and controlling outbreaks of these reportable diseases.)

This rapid information service is essential in view of the risk of high-speed international spread of potentially epidemic diseases through the ever increasing volume and range of air traffic. The speed of dissemination of pathogenic micro-organisms (either the organisms themselves in infectious materials, or in vectors like mosquitoes and rats, or in carriers like human beings with or without obvious symptoms), may be even greater than at present with the advent and extensive use of large transcontinental aircraft.

The new regulations impose stricter requirements at ports and airports to ensure greater protection for and from the international traveler. Vaccination certificates are required for such diseases as cholera, yellow fever, and smallpox. Ships and aircraft arriving from ports outside a given territory are required to submit a declaration of health concerning all persons on board. Cargo, goods, and containers are subject to regulations and requirements to assure within practicable limits that they are free of infectious material, vectors, or rodents.[40] Ships, aircraft, trains, and road vehicles, depending on circumstances and the disease in question, are subject to quarantine or isolation. Persons on an international voyage not showing evidence of protection from a disease (like smallpox) may be placed under surveillance by

[39] Louse-borne typhus, relapsing fever, viral influenza, paralytic poliomyelitis, any one of a series of "hot" viruses, may also be reported, but are not subject to quarantine. There is a single special provision for malaria. Regardless of specific disease a health authority may act to control the discharge from any ship of sewage and refuse which might contaminate the waters of a port, river, or canal. Also, no matter capable of causing any epidemic disease shall be thrown or allowed to fall from an aircraft when it is in flight.

[40] "International Health Regulations," Chapter V. (Geneva, World Health Organization), page 15.

a national health administrator. If a person requires vaccination in the interest of public health and refuses the vaccination, he may be isolated for a period up to fourteen days.[41] Ships, aircraft, trains, and road vehicles are also subject to disinsecting or disinfection, depending on circumstances at the port of arrival. Further health measures may be applied to any vehicle as determined by conditions on board during the voyage or which exist at the time of medical examination by the port health authority.

The United States' part of the WHO epidemiological intelligence network is operated by the Public Health Service Center for Disease Control in Atlanta, Georgia. The Center also serves as the International Influenza Center of the Americas and the Arborvirus Center for the Western Hemisphere; it is also the International Center for Shigellosis (a form of dysentery).

To implement the International Health Regulations and to protect the United States from the importation of disease from abroad, the Public Health Service spends about $10 million annually and checks about 140 million international travelers arriving at some 400 different points of entry. The Public Health Service also maintains physicians on duty in more than 30 nations in order to examine an average of 250,000 applicants per year for visas to the United States.

CURRENT PROBLEMS OF EPIDEMIC CONTROL

Perhaps the main problem in implementing the International Health Regulations is a tendency on the part of some governments not to report diseases for fear of restrictive action that would affect trade and travel.[42] This problem came to the fore recently when WHO reported the presence of cholera in Guinea without awaiting notification of the serious outbreak there from the Guinea Health Ministry. WHO's notification of 2,000 cases and 60 deaths from cholera in Guinea came as it was completing its preparations for an emergency anticholera training program for African countries. The present epidemic (which began nearly a decade ago) has penetrated south of the Sahara where cholera had not been seen for more than a century.[43] WHO had earlier provided technical assistance for use in Conakry, the capitol of Guinea, when the government reported 230 cases of an unidentified illness which had already caused 27 deaths.[44]

The outcome of WHO's report of the nature and extent of cholera in Guinea were (1) a threat from the Guinea Government to withdraw from WHO in protest to the report [45] and (2) "no further news" from Guinea as of September 8, 1970, when the first WHO notification occurred concerning 2,000 cases of cholera there.[46] Notifications have been received from Dubai [one of the Trucial States], Israel, Lebanon, Libya, and the U.S.S.R.; however, Iran and the United Arab Republic have repeatedly denied the presence of cholera.[47] As the *Medical Tribune* states, "it seems clear that the haziness surrounding the exact locations outside the officially notified areas where cholera has appeared

[41] Ibid., Chapter IV, page 24.
[42] WHO Chronicle (World Health Organization, June 1970), page 262.
[43] Medical Tribune (September 21, 1970), page 3.
[44] Medical Tribune (September 7, 1970), page 1.
[45] Medical Tribune (September 21, 1970), page 3.
[46] The Lancet (September 12, 1970), page 578.
[47] Ibid.

is a gesture of self-protection [not against the disease itself but] against possible reprisals by other countries." [48] This situation is a reminder of exactly how far the world has—or has not—progressed since the quarantine regulations of over a century ago were reluctantly adopted despite ignorance, fear, and vested interests.

U.S. INVOLVEMENT IN EPIDEMIOLOGICAL PROBLEMS

Cholera may not be of immediate geographic concern to the Americas, but poliomyelitis is a growing problem in several countries in Central and South America [49] and viral influenza is an annual seasonal hazard in the United States. If the American political and diplomatic community is somewhat indifferent to tropical disease in the tropics, perhaps it should be more interested in Asian disease in the United States. For example, the new strains of influenza virus A2 in the Hong Kong epidemic of 1968 later spread and reached the temperate areas of the northern hemisphere, causing numerous epidemics in the 1968–1969 influenza season. In the United States the outbreak was extensive, covering nearly all of the States and "was associated with a large number of deaths from acute respiratory disease." [50] In testimony before the House Subcommittee on National Security Policy and Scientific Developments in December, 1969, Dr. Joshua Lederberg warned that the American public health authorities were not "sufficiently sensitive to the possibility of a devastating worldwide epidemic." He used the example of the Hong Kong flu as a foretaste of what could have happened and of what could happen in the future:

> I think there is a considerable amount of self-delusion that the antibiotics will take care of any bacterial infection; we need never worry about the plague again; the plague has been conquered by medicine; that virus infections will somehow be taken care of, although when you see a pandemic like the Hong Kong flu, you have a foretaste of what really can happen.
>
> That was a world-wide epidemic. The attack rate was something like 20 to 30 percent of the world's population that was infected by this virus. It was not a particularly lethal one, but it is only a minor accident that it is not a lethal virus.
>
> Such events are undoubtedly going to occur in the future that will be very much nastier, and we have simply not been oriented to take a sufficiently aggressive and sensitive view about this matter.[51]

Throughout his testimony, Dr. Lederberg saw public health defense as a global parallel to defense against biological warfare; he considered pathogenic micro-organisms to be the natural enemies of man, and recommended two measures of worldwide self-protection:

> (1) The establishment of central, international laboratories to monitor the occurrence of threatening organisms and

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[48] Medical Tribune (September 7, 1970), page 1.
[49] "The World's Poliomyelites." The Lancet (September 26, 1970), page 646.
[50] WHO Chronicle (June 1970), pages 263–4.
[51] U.S. Congress. House. Committee on Foreign Affairs. "Chemical-Biological Warfare: U.S. Policies and International Effects." Hearings before the Subcommittee on National Security Policy and Scientific Developments of the . . . November and December 1969. 91st Congress, first session. (Washington, U.S. Government Printing Office, 1969), page 128.

to help develop generally available means of protection against them; [and]

* * *

(2) A general acceleration of research and health services to minimize the incidence of infectious disease, particularly in underdeveloped countries. No situation could be better designed for the evolution of serious new viruses than the existence of crowded, underfed human populations in which foci could spread with a minimum of medical control.[52]

During 1969, WHO extended the scope and activities of its reference centers and collaborating laboratories on the viruses in general and established a new regional center for the enteroviruses at the Enterovirology Unit, Center for Disease Control, Atlanta, Georgia. The Center, Emory University, and WHO jointly conducted a conference on Hong Kong influenza and published the results.[53]

The WHO Director-General's report of 1969 expressed the belief that the cooperation of national centers had resulted in a degree of control of influenza:

> To cope with [influenza], a world network consisting of two international centres and 85 national centres in 55 countries has been established. WHO plays the role of centralizing agent, receiving and passing on to all Member States, as rapidly as possible, the significant information that reaches it through the international network. Perhaps it is not by mere chance that the many foci of influenza reported during the past year in the southern as well as the northern hemisphere remained limited in extent.[54]

Whether or not the United States contributes to WHO for the global monitoring, control, and eradication of communicable diseases, or to some other organization over which it might have more direct power, the fact remains that the United States is subject to worsening hazards domestically in the infectious disease area. In the developed countries, including the United States, the natural decline in the incidence of tuberculosis is slowing down; malaria and yellow fever are within the national boundaries; and there is an observed upward trend in the incidence of gonorrhea. Resistant forms of some of these diseases (malaria and gonorrhea) acquired by troops in Viet-Nam are not likely to become less resistant when troops with residual organisms return home. Plague may not be importable by American troops from Viet-Nam; nevertheless the disease is there. In 1969 "the highest incidence of plague was again in the Republic of Viet-Nam, where the number of cases was greater than the combined total for all other countries." [55]

As the Director-General of the World Health Organization stated a few years ago, "* * * the quarantineable diseases, which many people think of as scourges of the past, are still daily realities."

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[52] Ibid., page 90.
[53] Bulletin of the World Health Organization (Vol. 41, Nos. 3, 4, and 5, 1969).
[54] WHO Chronicle (July 1970), page 292.
[55] WHO Chronicle (June 1970), page 269.

G. E. W. Wolstenholme of the Ciba Foundation in London has praised the achievements of WHO and deplores the lack of news coverage concerning its constructive work. Of all the special United Nations agencies, he says, none "* * * contributes more to current improvements in our daily lives and gives more hope of a better future for all mankind than the WHO." Many people in positions of responsibility were totally ignorant of the work of this agency. In a recent symposium giving emphasis on our "stressful, diseased, crowded, ill-educated and uncooperative world," he said: [56]

> WHO is a world intelligence agency for communicable diseases, on which all quarantine measures are based. It sponsors international reference laboratories for diseases which scorn national frontiers. It is the ultimate authority on the health standards of foods, on vaccines, drugs, systems of disease classification and diagnostic procedures, and it runs the counter-spy system against the traffic in illicit and dangerous drugs of addiction. As the recorder of rare reactions to drugs, it may forestall another thalidomide-like tragedy. It awards some 2,500 fellowships a year for postgraduate training in medicine, nursing and environmental health. It organizes each year about 40 short instruction courses and around 80 technical conferences. It contributes at any one time, in manpower and in money, to 1,000 health projects in 150 countries.
>
> WHO is an organization which between 1948 and 1963 treated, for example, 43 million people in 45 countries for the syphilis-like disease of yaws, and set 190,000 trained workers to the task of essentially eliminating malaria, to which half the world's peoples were exposed—and almost one-third of the world's population has by now been given protection from malaria, though 360 million remain at risk. It is WHO which lends hundreds of experts and teaches thousands of health workers to attack a host of disorders and diseases: for example, smallpox (a campaign to vaccinate 220 million in one year has just begun, to continue over ten years); tuberculosis (still some two to three million preventable deaths each year); leprosy (about 15 million people in 50 or 60 countries blighted by its mutilation); maternal and infant mortality (a tenfold difference between the most fortunate and the unhappiest countries); cancer, heart disease, rheumatism (the big killers and cripplers with widely varying incidence in different areas); water, soil and air pollution (in the world as a whole it is said that one in four hospital patients is ill because of infected water); blindness (10 to 12 million sightless); deafness (millions still uncounted); infestations by parasites (many hundreds of millions of people chronically weakened and defeated by three or four such diseases together); mental illness; senility; accidents; malnutrition; and animal diseases.

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[56] G. E. W. Wolstenholme, *In* "Health of Mankind." A Ciba Foundation Symposium. (Boston, Little Brown and Company, 1967), pages 254–6.

The last details in this hasty, impressionistic sketch of WHO refer to its work on the co-ordination and stimulation of medical research, such as that on human genetics, heart diseases, cancer, dental health, bacterial resistance of insecticides—wherever a comparison from different areas may be revealing, or where a condition, a reaction to a drug for instance, may be too rare to excite attention in any one country.

It is an impressive record—yet this is only preliminary work in bringing to most people in the world a modest chance to enjoy the health which until recently has been the blessing of a privileged few. And already we have such an increased expectancy of life and so many more children survive that the problem of population growth makes almost every other problem trivial.

Impressive—but WHO can only act on request from governments. Its expert advisers operate only within national limits. And because of lack of money or skilled manpower not all requests can be met. Where it is able to help, WHO does its best to encourage the mobilization and creation of the local infrastructure which will maintain, or at least not wholly throw away, the value of WHO's efforts in disease control.

A year later (1968), in the *British Medical Journal*, Sir John Charles took a similar measure of WHO for the 1960 to 1965 time period:

In 1960 the UN and WHO were faced with a serious emergency in the newly independent Republic of the Congo (Leopoldville). Owing to the political crisis the health situation had gravely deteriorated. WHO demonstrated its co-ordinating and advisory functions in a variety of ways. [It placed] 37 Red Cross medical teams where they were most needed. By recruiting a few key health personnel it helped to avert the breakdown of environmental services and strengthened the control of disease. Finally, looking beyond the immediate present to the future staffing of the health services, it worked out a long-term programme of education and training of doctors and other personnel which is now bearing fruit. Altogether it was a highly successful reply to a challenge.

Another factor in increasing WHO's African responsibilities was the rapid accession of many states to independence, followed by their admission to the Organization as full members. At the end of 1960 only seven governments in the Africa Region were members of WHO. Five years later there were 27.

WHO's serious interest in national health planning can be traced to Latin American activities which began in 1959. It extended to the African Region in 1963, when the Organization became associated with the governments of five African countries in the preparation of health plans which were to be integral part of the national plans for social and economic development. It is now an advisory activity of major importance.

Population problems in many parts of the world have been a major concern of the United Nations for several years, and their repercussions have affected WHO. They arise not only from population increase but are associated with urbanization, industrialization, and changes in the age structure of the population, and involve questions of family planning and human reproduction. This complex of difficult problems resulted in WHO's establishing a Human Reproduction Unit in 1965. About the same time the Assembly authorized the provision of technical advice on the subject to such member states as requested it.

This is only one example of the continuing extension of WHO's interests. Sometimes the activity is an entirely new venture, as with human reproduction and the even more recently created Division for Research in Epidemiology and the Communication Sciences. At other times it is a more vigorous and comprehensive attack on an old-standing health problem. Typical of this approach are the community water supply programme and the world-wide smallpox eradication campaign, both of which were launched in 1965.

It is, as yet, difficult to measure that achievement in quantitative terms. Improved health statistics in many parts of the world are some indications of success, but the mere existence of a service or laboratory can also be evidence of an advance.

Nevertheless it is possible to recognize certain positive achievements. First among them is the universality of WHO. This is shown by its membership of 129 states. It is manifest in the system of regional offices serving as foci of advice and action. It is seen again in the network of reference laboratories and services for the collection of epidemiological data.

Next there are the results of the great campaigns against such diseases as malaria, yaws, and tuberculosis, which have saved innumerable lives, and been of immeasurable benefit to the economy of many developing countries.

There is the major contribution which has been made to educational activities of member governments in helping them to raise the total of medical schools in their territories from 553 about 1950 to 717 in 1966. Another facet of this activity is the granting of fellowships to individuals, who now total some 3,500 each year.

The strengthening of health services, always one of WHO's primary functions, has extended into the planning of national health services as a concurrent and integral part of economic and social development. And at the local level the development of the basic health services idea is an equally great achievement.

Then there is the international co-ordination of medical research in certain fields, and the communication and sharing of the results.

Finally, though the list could be continued, there is the accomplished fact of getting the nations to work together.[57]

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[57] Sir John Charles, "Origins, History and Achievements of the World Health Organization," British Medical Journal (May 4, 1968), pages 295–6.

WHO'S INTENT TO BE NON-POLITICAL

The World Health Organization has long regarded itself as a technical and non-political organization. Opponents of various proposals and amendments, whether they won or lost on issues before the Assembly, have based their opposition on this cherished assumption. For example, in dealing with applications for membership, the "Assembly has been more interested in the capacity of the applicant to fulfill the obligations of a Member than in the question of the applicant's possessing the attributes of sovereignty." [58]

While the International Health Conference agreed to consider membership in the United Nations as a basis upon which the WHO should enter into force (when 26 members of the United Nations had accepted the WHO Constitution), it rejected the criterion of membership in the United Nations as a standard requirement for membership in WHO. Before the First Assembly met, it was decided that those nonmembers of the UN that had been invited to send observers to the planning conference could become members of WHO merely by accepting the WHO Constitution. Questions concerning the competence of the Health Assembly to determine statehood before exercising its authority to admit a member were deferred to agreements between the UN and WHO.[59] Although it would be a mistake to assume that questions of WHO membership have not been influenced by actions of the United Nations, the fact remains that both the Assembly and the Director-General have asserted the autonomy of WHO in the determination of membership questions.[60] Spain was dissuaded from applying for membership in WHO as a result of the recommendation of the UN General Assembly of 1946 that that country not be admitted to any international organization in the UN family. When this barrier to admission was rescinded by the UN, Spain applied for membership in WHO in 1951 and was admitted in that year.

U.S. MEMBERSHIP: THE FIRST BIG TEST

Before WHO entered into force (Sept. 1, 1948) the question of United States membership came before WHO's Interim Commission. Once again, the Health Assembly asserted its competence to interpret or apply the Constitution concerning membership, and powerful nations who were already members took functional and realistic stances rather than legal ones in dealing with the unusual United States case.

The situation was that the U.S. instrument of acceptance, submitted in June 1948, stated that U.S. acceptance of the WHO Constitution was subject to certain reservations. Not only was the United States the first nation to pose reservations in its application, but there was no provision in the WHO Constitution for reservations to acceptance. The U.S. reservations, of course, were statutory:

> The President is hereby authorized to accept membership for the United States in the World Health Organization * * *.

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[58] Howard B. Calderwood, "Membership in the World Health Organization" (unpublished draft), page 3.
[59] Ibid., page 3.
[60] Ibid., page 5.

> The Congress does so with the understanding that, in the absence of any provision for withdrawal from the Organization, the United States reserves its right to withdraw from the Organization on a one-year notice: Provided, however, that the financial obligations of the United States to the Organization shall be met in full for the Organization's current fiscal year. [Also] the Congress does so with the understanding that nothing in the Constitution of the World Health Organization in any manner commits the United States to enact any specific legislative program regarding any matters referred to in said Constitution.[61]

The Credentials Committee was undisturbed by the reservation and the Health Assembly at its second plenary session seated the United States delegation with full rights, on the understanding that the problem of U.S. reservations would be discussed at a later date.[62]

When the problem did come up for discussion on July 2, 1948, India, the United Kingdom, and the USSR placed emphasis on evidence of participation of the United States in international health activities and on assurances given by its chief delegate that the U.S. would fulfill its responsibilities under the WHO Constitution. The representatives of the USSR, speaking before the Assembly proposed that the United States "* * * be accepted for membership." [63] The representative of India stated that an "* * * unwilling Member might withdraw in one of many ways [and the U.S.] provision for termination on a year's notice be considered a more straightforward method than other possibilities." [64] The Assembly accepted the proposal of its President that the United States should be admitted as a full member of WHO.[65]

Obviously striving for universality of membership and global function, the Assembly not only accepted the United States as an important technical and financial contributor to WHO, but at the same time refused to permit termination of membership to become an issue for the future or for the U.S. method of termination to become acceptable for other members. The representative of India proposed that the Assembly "* * * lay down a proposition of general application that any Member State may terminate its membership on a year's notice." [66] However, no observations were made with respect to his proposal at that time, and when subsequent withdrawals did occur the Assemblies made no reference to the U.S. technique of formalizing them.

THE TEST OF SOVIET BLOC WITHDRAWALS

Withdrawals did occur, however, and the manner in which they were handled by the Assembly was undoubtedly more important than the terminations themselves or the alleged reasons underlying them. In 1949, three Soviet States, the USSR, the Ukrainian SSR and Byelorussia, notified the Director-General of WHO that they no longer considered themselves as Members. As might be expected, there fol-

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[61] United States Code, title 22, pages 4477–4478.
[62] Calderwood, op. cit., page 10.
[63] "Official Records of WHO" (13), pages 77–79.
[64] Ibid., page 78.
[65] Ibid., page 80. Of course, as a practical matter the right of unilateral withdrawal from such a commitment inheres in national sovereignty even without explicit statutory provision.
[66] Ibid., page 48.

lowed withdrawals by Bulgaria, Rumania, Albania, Czechoslovakia, Hungary, and Poland. Poland's withdrawal, which brought the terminations to a total of nine countries, occurred on Aug. 15, 1950.[67] The criticisms offered by the USSR had to do with WHO's failure to abide by the activities proposed for it in 1946, its failure to accomplish the prevention and control of disease at the international level, and the high cost of WHO's administrative machinery.[68] The six Eastern States provided similar reasons for withdrawing and added a new one that the Organization was under U.S. domination.[69]

The eastern members of the Soviet Bloc argued for medical supplies for the war-devastated countries—insecticides, vaccines, antibiotics, drugs, and materials for research and education; their charge of "subordination" may have meant that the United States was not supplying such materials through WHO in the amounts requested. The theme of the USSR from the beginning was that WHO should direct its efforts and organize its activities for the consolidation and development of national health services. Once again, this attitude emphasizes the view at that time of the USSR and other Members of the Soviet Bloc that WHO should provide national health administrators with supplies, medical literature, and the results of research.[70]

Political or otherwise, the official WHO reaction to all this was essentially non-reactive: (1) The Director-General requested an invitation from the USSR to visit Moscow, (2) A draft resolution for the Assembly took account of the prevailing sentiment that the Members concerned reconsider their decisions and resume active participation in WHO, and (3) A resolution was passed by the Assembly (44–0–6) stating that the objectives of WHO required the cooperation of all countries; expressing regret over the absence of these States from WHO; pointing to their loss to the work of the Organization; hoping that in the near future they might wish to reconsider their position; and inviting them to join, if possible, the present and following session of the Health Assembly.[71] These and certain "non-developments" indicated that the Members of the Assembly were primarily motivated by the desire to have the withdrawn States return to the Organization. The non-developments were the almost complete silence of the Assembly on the withdrawal actions and on the implications of such withdrawals on the financial condition of the Organization.[72]

Subsequent resolutions reiterated the desire of the Assembly for the non-participating States to resume full cooperation in WHO. In the meantime, expenditure levels were adjusted, but the Assembly assumed that the contribution of what they called "inactive Members" would eventually be paid. The Second Assembly refused to recognize the withdrawal of the Soviet States, and Members were generally opposed to taking positive steps to suspend services to these States. Assembly after Assembly labored with assessment and budget problems but continued to assess the "inactive Members" for contributions which in all likelihood would not be paid. It was difficult to get any

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[67] "Official Records of WHO" (17), pages 52–53; "Official Records of WHO" (28), pages 553–554.
[68] "Official Records of WHO" (17), page 52.
[69] "Official Records of WHO" (28), pages 553–554, "Official Records of WHO" (35), pages 380–381.
[70] "Official Records of WHO" (13), pages 39–72, and 120–147.
[71] "Official Records of WHO" (21).
[72] Calderwood, "Membership in the WHO", op. cit., page 17.

proposal through the Assembly which assumed that the "inactive Members" would not eventually renew their participation in WHO.[73]

RETURN OF THE USSR AND EASTERN EUROPEAN STATES

Thus by a "fictitious position" that Member States who had terminated their membership in WHO were nevertheless Members ("inactive"); by continuing to assess them as if they were active Members; by refusing to resort to any type of punitive acts or by "lecturing" against them in the Assemblies; by continuing to invite them back into the fold; and by preparing the way for settlement of payments in arrears, the resumption of active participation of Russia and the Soviet Bloc States in WHO became a reality. Albania, Bulgaria, Poland and the USSR were represented at the tenth Health Assembly of WHO in May 1957. Czechoslovakia and Rumania resumed active participation in 1958, and Hungary became an active member in 1963.

For what it is worth as a lesson in diplomacy, the patient expressions and actions of the Members and the Assembly were specifically designed to facilitate the return of the separated States of WHO back to active participation. "Little attention was given to the legal and other relevant aspects, although they were not completely ignored." [74] Although all of the States concerned had originally notified the Organization that they no longer considered themselves Members of WHO, none objected to the Assembly's persistent thesis that they were merely resuming active participation.[75]

THE CHINA QUESTION CONSIDERED POLITICAL

The political question of the Republic of China versus Red China came up early in the history of WHO. The third Health Assembly was notified that the Republic of China wished to withdraw from WHO, presumably prompted by financial considerations. The notification was by telegram, dated 5 May 1950. Another telegram from the Central People's Government of the People's Republic of China, dated 13 May 1950, advised that the Republic of China should not be seated at the Assembly anyway, since it was not the legal government representing the Chinese people.[76] Finally, the Assembly (in plenary) accepted a resolution, without discussion or vote, which substituted "China" for "Republic of China" and which stated that "the resumption of China of full participation in the work of the Organization will be welcomed." [77] However, as Calderwood states:

> By treating the communication from Formosa as a communication from a Member of the Assembly, in effect, [the action] recognized the Government in Formosa as the Government of China [all China]. The Assembly's subsequent decision * * * in regard to the settlement of China's financial obligations to the Organization when China resumed active participation, had the same effect.[78]

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[73] Ibid., pages 21-22.
[74] Ibid., page 26.
[75] Ibid., page 26.
[76] "Official Records of WHO," (28), pages 555-556.
[77] Calderwood, op. cit., "Membership in the WHO", page 28.
[78] Ibid., page 27.

The final solution to the question of China's financial obligation to WHO was not worked out until the meeting of the Sixth Assembly (1954). Calderwood says:

> The practice followed at the Sixth Assembly in regard to the question of China's financial obligations is illustrative of the Assembly's attitude in dealing with almost every controversial issue, particularly one having a political aspect. The resolution which was finally accepted was the product of many informal conversations and meetings. Representatives of the Republic of China were consulted at various stages of these conversations, largely arranged on its behalf by representatives of States friendly to the Government in Formosa. The Secretariat was consulted as to the feasibility of suggested courses of action under consideration. These were also discussed with representatives of the Members that had recognized the People's Republic of China, with a view to finding a solution acceptable to a substantial majority of the Assembly.[79]

Calderwood does not note that by the time of the Sixth Assembly the number of Members present that had recognized the People's Republic of China was somewhat limited because of the prior withdrawal of the Eastern European States. The politics of the situation was kept in hand because of their temporary absence.

On the whole, WHO has dealt successfully with politically motivated proposals or proposals with distinct political connotations. Although some of these have been resolved for the time being they are likely to reappear. Some of these will have to do with the credentials of the Chinese Delegation, the Arab-Israeli dispute, suspension of certain rights of South Africa and Portugal, radiation, nuclear testing, and disarmament. At the Twentieth World Health Assembly the United States and 39 other Members abstained on a vote in plenary session urging Members of the UN to implement a resolution of the General Assembly with respect to the use of poisonous and other gases. The United States had argued in Committee that the World Health Assembly was not the proper forum for resolution of this issue.[80]

CONSENSUS VERSUS REGULATION ON PHARMACEUTICAL QUESTIONS

The questions of drug safety, well within the domain of consideration by WHO, though non-political are controversial. Resolutions to warn countries about the use of "wonder drugs,"[81] and narcotic and psychotropic drugs[82] have met with little resistance. However, as in the United States, resolutions which have become controversial involved the establishment of an international system for monitoring the adverse side effects of drugs, drug efficacy,[83] quality of drugs,[84] and pharmaceutical advertising.[85]

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[79] Ibid., page 30.

[80] Twentieth World Health Assembly, Resolution No. 54. *In* "Handbook of Resolutions," (Eighth Edition, 1948–1967.)

[81] Fifth World Health Assembly, Resolution No. 76, *In* Ibid.

[82] Eighteenth World Health Assembly, Resolution 47 and Twentieth World Health Assembly Resolution 43. *In* Ibid.

[83] Fifteenth World Health Assembly, Resolution 41; Sixteenth World Health Assembly, Resolution 36, Twentieth World Health Assembly, Resolution 51, and Twenty-third World Health Assembly, Resolution 13., *In* Ibid.

[84] Twenty-first World Health Assembly, Resolution 41, *In* Ibid.

[85] Twelfth World Health Assembly, Resolution 38, Twentieth World Health Assembly, Resolution 34, Twentieth World Health Assembly, Resolution 51, and Twenty-third World Health Assembly, Resolution 13. *In* Ibid.

On one of these issues, it was the absence of a systematic international warning system, among other things, which precipitated the thalidomide tragedy;[86] and WHO has only recently initiated steps toward a fully operational system for international drug monitoring. But the delay has been more of a technical problem than a political one.[87]

In recent years pressure has increased within WHO to adopt health regulations concerning pharmaceutical products. Under Article 22 of the Constitution, the Health Assembly has the authority to bring such regulations into force (if it were to pass them) "for all members after due notice has been given of their adaption by the Health Assembly except for such members as may notify the Director-General of rejection or reservations within the period stated in the notice."[88]

Also Article 21 points directly to "standards with respect to the safety, purity and potency of biological, pharmaceutical and similar products moving in international commerce; advertising and labeling of biological, pharmaceutical and similar products moving in international commerce."[89] As a general practice, however, in this area as well as others, the Assembly has preferred to make recommendations in order to obtain uniform practices rather than adopting conventions or regulations under constitutional provisions.[90] With few exceptions, ever since the First Assembly the attitude of WHO has been to rely on the discretion of Members as to the methods to be employed to attain the objectives of Assembly resolutions.[91] In some instances the Assembly has sought to achieve the objectives of WHO by simply declaring itself against certain practices rather than regulating against those practices. For example: The Assembly "* * * considers that any withholding of scientific or technical information on essential therapeutic and prophylactic drugs, in selling or otherwise supplying nations with the means for their production, or withholding the free exchange of medical scientists, is not compatible with the ideals of the World Health Organization and is against the interests of humanity."[92]

Across a wide variety of international health topics the World Health Organization has regarded it a prudent tactic to rely less on regulations and more on the authority of international biomedical consensus. Thus, the Sixth Assembly recommended the discontinuance of the medical use of diacetylmorphine (heroin) because of its addiction-producing qualities and of the availability of other less harmful drugs for the purposes for which heroin was being prescribed.[93] The Ninth Assembly recommended that the planning and implementation of projects concerned with the peaceful uses of atomic energy should be made in close contact with responsible health authorities.[94]

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[86] "Chapter 14: Thalidomide: The complex problem of drug control in free market." *In* U.S. Congress. House. Committee on Science and Astronautics. "Technical Information for Congress." Report to the Subcommittee on Science, Research, and Development of the. . . . 91st Congress, first session. Prepared by the Science Policy Research Division, Legislative Reference Service, Library of Congress. April 25, 1969. House Document No. 91–137. (Washington, U.S. Government Printing Office, 1969), page 380.

[87] "The Work of WHO. 1969 Annual Report of the Director-General." (Geneva, World Health Organization, March 1970), page 52.

[88] WHO Constitution, Article 22.

[89] Ibid., Article 21.

[90] Howard B. Calderwood, "Functions of the Assembly" (unpublished draft), page 55.

[91] "Official Records of WHO" (13), pages 121–6.

[92] Second World Health Assembly, Resolution No. 2. *In* "Handbook of Resolutions," op. cit.

[93] Sixteenth World Health Assembly, Resolution No. 14. *In* Ibid.

[94] Ninth World Health Assembly, Resolution No. 54. *In* Ibid.

The World Health Organization also relies on its Executive Board to implement its recommendations, particularly the findings of its expert committees. Under regulations governing expert panels, the Fourth Assembly instructed the Board "to consider and take appropriate action in regard to recommendations of expert committees and within its discretion to authorize publication of their reports, hence recommendations of expert committees endorsed by the Board become recommendations to governments." [95]

The recommendation-information-consensus-persuasion approach to conformity and improvement of global health practices may not in all instances be as effective as a formal international health regulation. At the present time, however, it seems politically wise as well as a more compelling overall strategy to let it be known that health experts of the world have reached a conclusion and to leave the adoption and implementation of that conclusion in the hands of member governments.

Political Problems Outside of the World Health Organization

Two distinctly political developments, one relatively recent and the other with a persistent 20-year history, lie outside of WHO's internal organization altogether.

THE DEVELOPMENT OF POLITICAL BLOCS OUTSIDE *WHO*

The recent development is a result of the growth of membership in WHO in such a way that political blocs have emerged. One of these blocs consists of numerous newly-constituted countries, in a section of the African region with common health problems. Depending on the issue before the Health Assembly, this group of countries can produce as many as 30 to 35 votes as compared with one vote for the United States or even some 20 votes for the major, developed nations which supply most of the funds for WHO. Whether or not the question before the Assembly involves WHO's budget, the African group of small developing countries becomes a political force when it votes as a bloc. This would be especially true should it contrive to consolidate on a proposition in its own self-interest without going through the established WHO channels.

Conversely, a number of the major nations, including the United States, because of their relative lack of voting power in the Health Assembly, have organized themselves outside of the WHO administrative structure into a so-called "Geneva group." This group appears to have been established to work out prior agreements on budgetary and program policies in order to exert leadership on the Secretary-General to promote greater economy and efficiency. It is also believed that the Geneva group is striving for a determination of priorities of WHO activities in the interest of the membership generally. A justification for the existence of such a group of developed nations outside of WHO's formal organizational structure is that the technical and management skills of those nations become lost in the overwhelming 131-Member World Health Assembly.

Even if the African bloc and the Geneva group are not as cohesive as the term "bloc" suggests, a principal argument against this arrange-

[95] Fourth World Health Assembly, Resolution No. 14. *In* Ibid.

ment is the absence of public record of their proceedings. Under these circumstances, a non-political organization can very rapidly become a political one. The outspoken Dr. Evang of Norway, an international health expert, made explicit his criticism of this development, before the Ciba Foundation Symposium on the Health of Mankind in 1967:

> Generally speaking, formation of political blocs of countries operating as such within WHO is not conductive to international health work, regardless of whether such a bloc is composed of developing African countries or of highly developed western countries. A number of the richest countries in the world have set a bad example by forming in Geneva a permanent committee which discusses the problems of international health at a non-technical and political level before the same problems reach the proper bodies of WHO.[96]

Nevertheless, the "Geneva group" arrangement would appear to be a realistic way of accommodating to the One-Member, One-Vote situation in the World Health Assembly; if not the only alternative, it is at least an available expedient in current use.

The political aspects of this situation, so far as the United States is concerned, pervade the entire UN system. The World Health Organization simply shares this defect because it is a part of that system. In an interim report of a Special Presidential Commission, Chairman Henry Cabot Lodge described this elementary and fundamental situation as: "The disparity between voting power and financial responsibility." [97]

Although financial responsibility was built into the UN and WHO from the beginning, the loss of relative voting power was not. The investigation of the UN and its agencies by the U.S. Comptroller General, the disillusionment with the UN and Foreign Aid in the Congress and pressure there for reducing the budgets of international organizations, the traditional preference in the Congress for bilateral assistance over multilateral organizations, all flow in part from this lack of control or power over the organization while paying the largest share of the organization's bills.[98] One committee of the Congress has expressed concern that the United States has not effectively "utilized economic assistance in the bilateral aid programs for leverage purposes." [99]

To overcome congressional and public disappointment with the UN, action is called for to strengthen the organization and its affiliates, and to effect a better understanding of its intrinsic limitations. One step is to identify clearly the principal points of disillusionment in an organization as large and complex as the United Nations. For example, when Mr. Lodge pointed to "a dramatic drop in public support for the UN in the United States * * * a five-year decline—from 84 percent to 51 percent—in the number of Americans who feel that the

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[96] "Health of Mankind," op. cit., page 208.

[97] "UN Weak, Nixon told by Lodge," Detroit Free Press, (September 14, 1970), page 2–B.

[98] See U.S. Congress. Senate, and U.S. Congress. House Committee on Appropriations. "State, Justice, Commerce, and the Judiciary, and Related Agencies Appropriations, Fiscal Year 1971. Hearings. 91st Congress, second session. (Washington, U.S. Government Printing Office, 1970), pages 431–494 and 349–414, respectively.

[99] U.S. Congress. House. Committee on Government Operations. "Economy and Efficiency of U.S. Participation in International Organizations." Hearing before a Subcommittee of the . . .. September 18, 1970, 91st Congress, second session (Washington, U.S. Government Printing Office, 1970), pages 45–55.

UN is 'the last best hope for peace,'"[100] the public opinion poll was registering public disenchantment concerning the peacekeeping machinery of the UN, not the success or lack thereof of the World Health Organization. The WHO and other UN specialized agencies *are* extensions of national government on an international scale, but they *are not* charged with keeping the peace. As Mary Ellen Caldwell states, their goal and their performance is in an entirely different sphere:

> * * * It is essential to recall that protection and preservation of human life and welfare was, and continues to be, their ultimate goal. During the past twenty-five years, most of these organizations have been concerned with using the benefits of science and technology in the global public interest, and protecting the world community against detrimental effects from that same science and technology.[101]

One of the Lodge Commission's solutions to the disparity between voting power and financial responsibility at the UN (and the solution could apply to WHO) is:

> * * * weighted voting in the UN system that will more adequately reflect power and responsibility in the world and seek arrangements for more reliable and equitable methods of financing the organization.[102]

With respect to weighted voting and financial responsibility, it is interesting to note that the International Office of Public Health (the Paris *Office* 1907 to 1946) had adopted such a provision. Participating states could be placed in any one of six categories (representing 1 to 6 votes) depending on the amount of annual contribution which they proposed to pay. In spite of the adjustment of voting power to the amount of annual subscription—in spite of important decisions taken at every session of the *Office*, no vote was ever taken during the entire course of the organization's forty-year history. According to Goodman this is—

> * * * a unique record and one to be remembered in these days of ingenious devices to overcome the transparent anomaly that the voice of Ruritendras or Mato should be equal that of the USA, the USSR, Great Britain or France.[103]

POLITICAL PROBLEMS IN THE EASTERN MEDITERRANEAN REGION

The most durable political quarrel within WHO, the roots of which lie well outside the central organization, concerns the Regional Committee for the Eastern Mediterranean. Arising out of the fact that WHO is organized into semi-autonomous decentralized regions, it has been the main problem to emerge from the regional concept, virtually paralyzing the operation of WHO's Eastern Mediterranean Committee. The problem, strictly political, is that of Israel versus the Arab

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[100] "UN Weak, Nixon Told by Lodge," op. cit.
[101] Mary Ellen Caldwell, "The UN and Science: Past and Future Implications for World Health," American Journal of International Law (Vol. 64, September 1970), page 172.
[102] "UN Weak, Nixon Told by Lodge," op. cit.
[103] Goodman, "International Health Organizations and Their Work," op. cit., page 94.

League. Beginning in 1951 and continuing to the present, the controversy is almost as old as WHO itself. The contestants do not bring their differences into the meetings of the World Health Assembly, and there is no contest in the Regional Committee because it is in effect and in practice non-existent. The Arab State representatives simply refuse to meet with Israel in sessions of the Regional Committee; there are no sessions, except as an Arab subcommittee, which excludes Israel, may regard itself as *the* Committee for the Region. A delegate from Lebanon frankly expressed such a view as early as 1955.[104]

According to Berkov, the problem arose in the following manner:

> When the First World Health Assembly delineated the area of the Eastern Mediterranean, it included in that area the territory known as Palestine, then under British mandate. When Israel emerged as a state and was duly admitted to membership in the United Nations, she also sought admission to WHO and was accepted without debate. Even when she requested assignment to the Eastern Mediterranean region, no objection was raised in the Health Assembly, and the action was completed by Assembly action on June 21, 1949. Israel representatives attended the meeting of the Regional Committee for the Eastern Mediterranean at Geneva in October of 1949, and again at Istanbul in 1950, and the record gives no indication of any controversy in regard to such attendance.
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> In 1951, however, the Arab League states decided not to cooperate with Israel in any manner, and the Arab state representatives in the WHO region for the Eastern Mediterranean declined to meet with Israel representatives in sessions of the Regional Committee. The Committee held no session in 1951, and there have been no sessions since.[105]

It goes without saying that this situation remains unresolved, that blame for the condition among member states of the regions is assigned in accordance with their political sympathies, and that the Executive Board and Assembly have been forced to experiment with solutions to the problem. Obviously the time and money could be spent better on the health problems of the region, which have been and still are considerable.

The Arab States had proposed that Israel be transferred to WHO's European Region, but this idea was unacceptable to Israel, perhaps on the grounds that the motive was political rather than a substantive health administration matter. The Health Assembly *is* constitutionally empowered to redefine the member composition of WHO's regional areas, but apparently has not been disposed to remove Israel from the Eastern Mediterranean region for political convenience or expedience. Once again, therefore, while the World Health Assembly has exercised diplomacy in handling political problems related to health, it continues to reject political solutions to political problems. In the meantime, health services as requested of WHO have been provided to all of the countries involved, and the United States continues to cooperate with both Israel and the Arab States on health matters through various bilateral instruments.

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[104] "Official Records of WHO," pages 426–427.

[105] Robert Berkov, "The World Health Organization: A Study in Decentralized International Administration" (Geneva, Librarie E. Droz, 1957), pages 133–4.

But the continuation of function of WHO in this most difficult situation is not limited to services rendered to the countries involved. One of the resolutions of the World Health Assembly in attempting to deal with this problem was to take the regional contestants out of the same arena. To accomplish this it established two subcommittees, Subcommittee B essentially for Israel, and Subcommittee A for the other States in the Eastern Mediterranean group. Both the Secretary General of WHO and the Regional Director have made every effort to convene both subcommittees but the Regional Director was unable to convene a meeting of the "Israel" (B) subcommittee in either 1969 or 1970.

Under these circumstances, and according to the 33rd Resolution of the Seventh World Health Assembly, Subcommittee (A) submitted its "opinion" (report) to the Director-General. It had met in Lebanon during September 1970, with regrets being expressed that Ethiopia and Jordan did not attend. France sent a delegate who chanced to be located in an Eastern Mediterranean French territory; and, of course, Israel was not supposed to attend. It had been a "Subcommittee B" country for several years. But the meeting came off well just the same, with 19 members and associate members attending, as well as representatives of the UN, the UNDP, UNICEF, FAO, and some 14 international non-governmental and intergovernmental organizations. The 35-page report to the Director-General dealt with environmental deterioration, chronic and communicable disease, the Pearson and Jackson Reports, the integration of family planning health services into maternal and child care, the shortage of health manpower, and medical education.[106]

In fact, an impressive agenda was competently handled by this rather makeshaft rump session. Its accomplishment reveals both the ability of WHO's participants to overcome adversity and the prospect of still larger benefits that could result if the dissident factions could find a viable course to more general cooperation. On this basis, it is worthwhile to examine in detail the achievements of Subcommittee A at its 1970 meeting.

The Director's report stated that the "brain drain" was being overcome with the assistance of WHO, that there were new efforts to eradicate smallpox in Ethiopia, and that a poliomyelitis outbreak in Lebanon had been controlled with WHO assistance. A WHO scientist had surveyed X-ray equipment and safety measures in 15 countries.

A number of recommendations were made with respect to the control of cholera and tuberculosis and to the strengthening of national health services through a network of health centers. The Subcommittee gave high priority to the training of national manpower; the control and eradication of communicable diseases; and improvement in environmental health, community water supplies, laboratory services, nutrition, medical research, and radiation protection.

The report spoke of improved working and housing conditions and of special attention to vulnerable populations. The responsibility of national authorities concerning the health manpower problem was repeatedly emphasized. It was estimated that 5000 new teachers would

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[106] "Report of the 1970 Session of Sub-Committee A of the Regional Committee for the Eastern Mediterranean" (November 30, 1970).

be required in the Region in the next five or ten years, and there was an extraordinary emphasis that such medical teachers know how to teach as well as to possess an adequate knowledge of the subject matter.

There was a discussion on how to reduce the present pressure on hospital beds by means of preventive measures, less specialized hospitals, and the removal of disabled patients for rehabilitation and ambulatory care elsewhere. The medical schools in the region had increased to 46 with six more planned to start next year. WHO had supplied teachers, consultants, fellowships and means for exchange visits of medical faculty members within the Region.

The 1972 budget for the Eastern Mediterranean Region, including UNDP and Funds-in-Trust, was approximately $12,000,000. The Regular budget showed a 9 percent increase over the 1971 figure. (This regular budget increase was about the same as that for WHO as a whole, and is an example of one of the primary sources of WHO budgetary increases over the years—the regional requirements.)

Some Difficulties in Achieving and Sustaining International Cooperation In Health Through WHO

In the Introduction to this study, the statement was made that international cooperation in public health was not easily achieved nor is it easily sustained. This statement refers to the World Health Organization, but it applies to any of WHO's predecessor organizations involving more than two governments. The birth of such multinational organizations as the Office of International Hygiene, the Health Organization of the League of Nations, and the World Health Organization was difficult despite the evident need for such international health treaties. It is tempting at first to ascribe blame for such difficulties to the natural political orientation of governments *per se*. Indeed, there is no doubt that scientists, engineers, and physicians have less friction at international congresses and that public health workers get work done more expeditiously when they do not have to worry about the position of their governments or when long-term national commitments on behalf of their governments are not involved. But when either personal or governmental interests are at stake in permanent international agreements, professional medical people are often as political as their professional diplomatic counterparts are expected to be.

For example, there is every reason to believe that the inordinate two-year delay of the United States in ratifying the constitution of WHO was motivated by both medical-political and national-political considerations. According to Allen [107] and Goodman [108] there were fears that WHO would become involved in such questions as health insurance and socialized medicine.

Agreements concerning the Pan American Health Organization (PAHO) and the World Health Organization were delayed even longer. It was not until 1950 that an agreement between PAHO and the Organization of American States (OAS) authorized the former to act as a regional organization of the World Health Organization in the Western Hemisphere. In this capacity, PAHO was to remain

[107] C. E. Allen, "World Health and World Politics," International Organization (Vol. 4, 1950), page 27.
[108] Goodman, "International Health Organizations," op. cit., page 20.

an Inter-American specialized organization, to continue to enjoy the fullest autonomy and to respond to the recommendations of the OAS Council.[109] This action by the OAS left hanging an earlier (1949) "first step" integration agreement between PAHO and WHO and the issue has not been revived.[110].

A few months after the International Health Conference of 1946 had made provision for integration of PAHO with WHO (Article 54), the Directing Council of PAHO adopted a resolution deliberately designed to prevent such integration from:

> * * * affecting the identity of the Bureau, lessening its administrative autonomy, limiting its economic independence, disturbing its essential development and detracting from its character as a continental, coordinated health organization of the people of the Americas.[111]

The Directing Council of PAHO went even further and "* * * advised the American States in ratifying the World Health Organization Constitution, to make a reservation that would recognize the supremacy of the Pan American Health Organization over the Constitution of the World Health Organization." [112]

The obstacle to full integration was made essentially insurmountable in a charter adapted by OAS in June, 1948. Article 100 of that charter was apparently aimed directly at the 1946 WHO Constitution. That article states:

> The specialized organizations shall establish cooperative relations with world agencies of the same character in order to coordinate their activities. In concluding agreements with international agencies of a worldwide character, the Inter-American specialized organizations shall preserve their identity and their status as integral parts of the Organization of American States, even when they perform regional functions of international agencies.[113]

Whatever it was that PAHO or OAS had in 1946 that it wished to protect from full integration with WHO is not evident. The situation and the outcome are not altogether unlike those of the final developments concerning the "Paris Office" and the Health Organization of the League—the coexistence of two international organizations, one regional and the other universal, with the regional organization fulfilling obligations to two different international agreements and with overlapping regional interests.

This latter specific problem in PAHO was solved by providing that all meetings of the Directing Council or of the Pan American Sanitary Conference would be at the same time meetings of the Regional Committee of the World Health Organization, except when constitutional or juridical matters were under consideration. Accordingly, representatives of the European States with territorial interests in the Americas have attended PAHO meetings with full voting rights since 1951.[114]

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[109] Calderwood. "The World Health Organization and Its Regional Organizations," op cit., page 24.
[110] Ibid., page 25.
[111] Ibid., page 23.
[112] Ibid., page 23.
[113] Ibid., page 23.
[114] Ibid., pages 24 5.

The WHO concept of a single international health organization remains technically unfulfilled. Meanwhile, in accordance with prior agreements, the Pan American Sanitary Bureau functions much as do the other Regional Offices of WHO.[115] The Pan American Health Organization remains legally an Inter-American specialized organization of OAS. But the arrangement is working and the technicalities are being ignored.

Persistent Tendency to Neglect Health as an International Goal

Apart from the scientific and political difficulties of establishing multinational machinery for cooperation in health, it is disconcerting to note that on at least two major occasions formal diplomacy came close to overlooking global health altogether. Both the Health Organization of the League of Nations and the World Health Organization were last-minute additions to the Covenant of the League and the U.N. Charter. Dr. K. Evang of the Health Services of Norway recalls:

> One interesting historic example is that health was "forgotten" when the Covenant of the League of Nations was drafted after the first World War. Only at the last moment was world health brought in, producing the Health Section of the League of Nations, one of the forerunners of the present FAO, as well as of WHO. Although international participation in the League of Nations was limited, the Health Section of the League developed into one of the most successful and non-controversial parts of the organization, making itself indispensable through its statutory functions.
>
> Who would have thought, therefore, that health would again be "forgotten" when the Charter of the United Nations was drafted at the end of the Second World War? However, this was exactly what happened, and the matter of world health again had to be introduced more or less ad hoc at the United Nations conference at San Francisco in the spring of 1945.[116]

It was only the vigorous intervention of the national delegations from Brazil, China, and Norway that held a place for an international health organization under the United Nations.[117]

Three advisers in health matters, Dr. De Paula Souza, Dr. Szeming Sze, and Dr. K. Evang—hardly diplomats or politicians in the usual sense—took the initiative which ultimately resulted in the World Health Organization.

Evang is quick to note that the reluctantly-launched WHO was not to be in for smooth sailing:

> The World Health Organization came into being just at the time (1948) when the political honeymoon which the United Nations had enjoyed for a short period after the Second World War had definitely come to an end, and the "cold war" had started. It was of course a most unfortunate political climate for a newcomer which was supposed to act non-politi-

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[115] Ibid., page 24.
[116] "Health of Mankind," op. cit., pages 202-3.
[117] Ibid., page 203. See also: Charles, "Origins, history, and achievements of the World Health Organization," op. cit., page 294.

cally in the field of international health, but which was built and run by member governments. The withdrawal for a short period into "inactive membership" of the group of Eastern European countries was a blow to the organization, from which, however, it recovered. The lack of success in bringing the People's Republic of China in as a member, was—and still is—much worse. It means that a whole wall is missing in the building. The Arab-Israel conflict also created some trouble. As if this was not enough, influential political forces of a more general character made themselves felt through the UN itself, threatening the independence and technical integrity of WHO and other specialized agencies. The very principle established at San Francisco in 1945, namely to give scientists, technicians and administrators a chance, in the specialized agencies and independently of political considerations, to build international co-operation on a broad scale, was in the process of being betrayed.

The most dangerous attack came through the proposal in the UN for a "consolidated budget". In principle this meant that all the member states of the UN would have had to pay only one contribution, namely directly to the United Nations. Like the individual ministries in a national government, the various specialized agencies would have to produce their separate programmes. A clear-cut political body, namely the UN itself, would then have discussed, accepted or rejected these programmes, decided priorities and finally allotted to each specialized agency one part of the total consolidated budget.

If I am not wrongly informed, high credit goes to the Directors-General of the most important specialized agencies at that time—Morse, Hoxley, Boyd Orr and Chisholm—for stopping this frontal attack to get political control over the specialized agencies.

A weaker and more indirect attempt was made later when the UN programme of technical assistance was introduced, but this also worked out in a satisfactory way on the whole. Again great credit for political wisdom goes to the non-political heads of these organizations, including Dr. Candau (WHO).[118]

Cost of U.S. Participation in the World Health Organization

Few problems have come before the governing bodies of WHO so regularly and have remained so stubbornly controversial as the question of how much money it should spend on its work. In the early period of the Organization's history C. E. A. Winslow tried to lay out the general guidelines:

The task is a vast and difficult one. It is particularly challenging to the World Health Organization, because it seems clear that a public health program adapted to the individual needs of each area offers the most economical method of breaking the chains of disease and poverty and initiating an upward cycle of social evolution. To accomplish the end in view

[118] "Health of Mankind," op. cit., pages 205–206.

> two things are necessary. The first essential is an analysis by each country—at whatever stage of health evolution it may be—of the most vital health problems which may be attacked with maximum results at minimum cost. The second essential is the development of cooperative programs of technical assistance, in which the more fortunate areas may cooperate with those of less advanced development for the common goal of a healthful, prosperous, and peaceful world.[119]

Nevertheless, disagreement has persisted. On the one hand, and speaking for a number of countries, Dr. Evang told the third World Health Assembly:

> If half, or one-third, or even one-tenth of the present scientific knowledge of medicine had been spelt out in terms of public health administrations, hospitals, sick insurance schemes, doctors, nurses and auxiliary personnel, in a proper production and distribution of drugs and insecticides, medical literature and equipment, the picture of the whole world would have been very different indeed from that which meets the eye today * * *.
>
> "The vast majority of the peoples of the world still live in bondage to disease and misery. Science knows the means to rapid improvement, and we know how to administer the proper health measures. We are not dreamers, but practical men. Nevertheless, a majority of the member countries themselves voted a budget for WHO which is disastrously inadequate. Why has this situation arisen and why do we uphold it? I am not offering an explanation, because I know of none which would satisfy you and me.[120]

Representatives of other nations at the same Assembly dissented and expressed other concerns:

> * * * Lest the Organization attempt to cover too much ground superficially, and pointed out that it was essential to limit its activities to work that could only be done through international machinery or particularly lent itself to international action. That international funds should be spent sparingly, and primarily to help countries face problems for which their own resources are inadequate, has been repeatedly emphasized by representatives of all governments and is one of the fundamental principles on which international work rests.[121]

SOME ASPECTS OF U.S. SUPPORT OF THE *WHO* BUDGET

As the activities of WHO began to appear rewarding, and as the number of member nations increased, the Organization received more requests for aid and assistance. The Director-General's budgets reflected this growing need for funds and the World Health Assembly with few exceptions voted approval of the increased budgets each year. The budgetary approvals often resulted from the large vote

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[119] C. E. A. Winslow. "The cost of sickness and the price of health." WHO Monograph Series, No. 7 (Geneva, 1951), pages 9–10.
[120] Third World Health Assembly, 1950.
[121] WHO Chronicle, (July 1960).

from the new and needy countries. The United States rarely voted for approval of the budget, and has recently worked with the other major contributing States ("the Geneva Group") to try to reduce it. One of the few times that the United States did vote for the Director-General's working budget as proposed was in 1958. On this occasion the budget was approved by acclamation.

TABLE 1.—RECENT EVOLUTION OF THE WHO BUDGET AND U.S. ASSESSMENTS [1] (CALENDAR YEAR)

Year	WHO regular budget	Percent increase over previous year	U.S. assessment	Percent U.S. assessment to regular budget
1971 [2]	$73, 230, 000	8. 2	$23, 648, 660	30. 87
1970	67, 650, 000	8. 9	21, 680, 810	30. 87
1969	62, 121, 700	10. 7	19, 533, 130	31, 20
1968	56, 123, 000	7. 8	18, 075, 620	31. 20
1967	52, 075, 600	11. 7	16, 627, 320	31. 20
1966	44, 481, 800	12. 6	13, 578, 420	31. 20
1965	39, 507, 000	14. 4	12, 327, 120	31. 29
1964	34, 542, 750	13. 6	10, 852, 040	31. 29
1963	30, 394, 100	22. 2	9, 611, 280	31. 12
1962	24, 863, 800	25. 7	7, 657, 430	31. 71
1961	19, 780, 448	16. 9	5, 999, 700	31. 70

[1] Figures obtained from Office of International Health, Public Health Service. In 1958 a statutory limitation was placed upon the U.S. payment which required that for any fiscal year it could not exceed 33⅓ percent of the total assessments of the active members of WHO for that year.
[2] Proposed.

Beginning in about 1960 the WHO regular budget increased each year in increments varying between $3 and $6 million (see table 1). The budget for 1971 was roughly 3½ times larger than that for 1961. The percent of increase per year over this same period, however, showed a generally downward trend from 16.9 percent in 1961 to 8.2 percent in 1971. The average increase 1966–1971 was 9.5 percent. The table reflects the continued growth of the United States' assessed contribution. The recent preoccupation of the United States, and of some other major contributors,[123] is to stabilize the WHO budget and reduce the rate of increase.

Although U.S. participation in WHO has been influenced by necessary budgetary restraint in recent years, there is reason to believe that other restraining factors of one sort or another have been operating from the very beginning. Some of these factors seem well established in spite of the good performance of the United States in voluntary contributions to international health activities in general and its faithful payment of assessments to WHO in particular. For example, early congressional actions with respect to WHO were not enthusiastic, as has been documented by Russell in a paper on "International Preventive Medicine" published in 1950:

> Although American leaders in preventive medicine had a prominent part in laying the groundwork for WHO, the United States Congress has thus far given it reluctant and limited support.[124]
>
> Slow to ratify the [WHO] constitution, Congress arbitrarily fixed our annual participation in the budget of WHO

[123] In 1962: U.S. share, 31.7 percent; U.S.S.R., 12.48; United Kingdom, 7.13; France, 5.86; Federal Republic of Germany, 4.88; China (Taiwan), 4.59; Canada, 2.85; India, 2.25; Italy, 2.06; Japan, 2.01; Australia, 1.64; Sweden, 1.27; Poland, 1.25; Belgium, 1.19; Argentina, 1.02. Most of the member nations contributed less than 1 percent.
[124] Russell, "International Preventive Medicine," op. cit., page 397.

> at 1.9 million dollars[125] (meanwhile appropriating tens of millions for short-term bilateral health aid * * *.)[126]
>
> A measure recently passed by Congress permits our annual appropriation for WHO to be increased up to 3 million dollars[127] * * * this new bill met stiff opposition.[128]
>
> Such hesitant cooperation is regrettable, for Congress, has repeatedly demonstrated great interest in public health. Doubtless this opposition is simply the reflection of a lack of active and informed concern on the part of laymen and most physicians about the subject of international preventive medicine.[129]

Perhaps two hypotheses can be derived from Russell's points concerning the prominent role of American leaders in laying the groundwork for WHO and the lack of active and informed concern on the part of most American physicians in international preventive medicine: (1) The American leaders involved in the planning of WHO were more likely to have been mostly diplomats and specialists in *preventive medicine or public health*, rather than experts in *curative medicine with individual patient orientation*, the latter dominating the power structure of American medical practice at the time. (2) The concern of American physicians during the planning and Congressional ratification of WHO may have involved the implications of health insurance and socialized medicine in an international context rather than the problems of preventive medicine on an international scale.[130]

THE IMPACT OF DEVELOPMENT STUDIES ON *WHO*

Little in the recent studies available to the Congress concerning international development focuses attention adequately on the extent to which poor health impedes social and economic progress of mankind. The Pearson Report,[131] for example, dismisses international health problems in two pages (of some 400), yet conveys the impression of sweeping advances in the control of infectious diseases and the sweeping spread of therapeutic health services worldwide. It credits to WHO achievements which that agency would not itself claim; as a practical matter, the unsolved health problems confronting WHO and other international health institutions are extensive and difficult. Of the report the New England Journal of Medicine states:

> The cursory and grossly inaccurate treatment afforded health is representative of current economic thought.[132]

The Jackson Report[133] appears to deemphasize the World Health

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[125] This action in effect fixed the size of WHO's regular budget, because of the assessment formula.

[126] Russell, "International Preventive Medicine," op. cit., page 397.

[127] This action, too, in effect fixed the size of WHO's regular budget.

[128] Russell, "International Preventive Medicine," op. cit., page 397.

[129] Idem.

[130] Allen, "World Health and World Politics," op. cit., page 27, and Goodman, "International Health Organization," op. cit., page 20. See also WHO Constitutional Function, "P," Part 11.

[131] Lester B. Pearson, "Partners in Development," Report of the Commission on International Development. (Set up at the request of Robert S. McNamara, President of the International Bank for Reconstruction and Development.) (New York, Praeger Publishers, September 15, 1966), pages 12, 40–41.

[132] "Medical Research as Measured Against the Needs of All," op. cit., page 537.

[133] "A Study of the Capacity of the United Nations Development System," Vol. 1, (Geneva, United Nations, September 30, 1969).

Organization in favor of a reorganized United Nations Development Program as the focal point of funds, coordination, review, and decision in technical assistance for country-centered health programs. It proposes that somehow the UNDP can simultaneously coordinate and decentralize. Using WHO as an example, this report tells the member governments that they can stabilize that Organization's budget at its present level. On the basis of the Jackson Capacity Study, one could hardly expect present and future appropriation committees to expand the budget of WHO, even though full implementation of the United Nations Development Cooperation Cycle (UNDCC) concept, which the report recommends, may be several years away.

The Peterson Task Force report [134] would rely on multilateral organizations like WHO in place of AID, but there is no specific recommendation that AID funds in health and sanitation be transferred to WHO. There is also little reason to believe that new breakthroughs in science and technology as anticipated through a proposed U.S. International Development Institute represent a primary need at this time for WHO or any other organization working in the field of international health. The report doesn't mention WHO and rarely mentions health, but its philosophical stance warrants elaboration in a later section..

The economists, international organization experts, bankers, and fiscal managers who prepared these three reports are distinguished scholars and businessmen whose conclusions deserve serious consideration in the long run. However, for the immediate future and possibly for the next few years appropriation committees of Congress might also examine the growing budgets of WHO and PAHO and the U.S. contributions thereto in the light of applying the technology already available to alleviate the mass misery of ill health abroad as well as at home. A report of this type, by Dr. John Bryant of the Rockefeller Foundation, is commended by *The New England Journal of Medicine*, citing especially the following paragraph from the preface of Dr. Bryant's book:

> Large numbers of the world's people, perhaps more than half, have no access to health care at all, and for many of the rest the care they receive does not answer the problems they have. The grim irony is that dazzling advances in biomedical sciences are scarcely felt in areas where need is greatest. Vast numbers of people are dying of preventable and curable diseases, or surviving with physical and intellectual impairment for lack of even the simplest measures of modern medicine.[135]

The Journal notes incidentally that "Bryant's excellent study benefited from an Advisory Committee, representing a broad experience in the international health field, and including senior staff members of the World Health Organization.[136]

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[134] "U.S. Foreign Assistance in the 1970's: A New Approach." Report to the President from the Task Force on International Development. March 4, 1970. (Washington, U.S. Government Printing Office, 1970), page 2.

[135] John Bryant. "Health and the Developing World." (Ithaca, Cornell University Press, 1969), preface, and page IX.

[136] "Medical Research as Measured Against the Needs of All," op. cit., page 538.

The cost of international collaboration in public health through multilateral organizations may be relatively less in the future than in the past. The "engineering" lessons have been learned and institutions can now devise more cost-effective designs. Much is known about how, where, and when to provide technical assistance in international health. As Bryant says, "to give effectively is an exacting task. To give without doing harm is, surprisingly, equally exacting." [137]

TOTAL COST OF *WHO* ACTIVITIES AND TOTAL U.S. CONTRIBUTION

Actually, the United States contributes larger funds to WHO than those indicated in Table 1 "The Recent Evolution of the WHO Budget and U.S. Assessments." WHO's regular budget on which assessments are based does not adequately reflect the total amount of funds available to the Organization and for which it is administratively responsible. Table 2 provides some estimated data for 1968 to enable comparison of sources of all funds administered directly or indirectly by WHO and the U. S. assessed and voluntary contributions to those sources as utilized by WHO.

Since one study (Jackson) suggests that the WHO regular budget might be fixed at its present level and that future voluntary funds for technical assistance be centralized under a "beefed up" and reorganized UNDP, it becomes possible to visualize stronger U.S. influence over any future expansion of international health activities.

TABLE 2.—SOURCE AND AMOUNT OF TOTAL FUNDS ADMINISTERED BY WHO, INCLUDING TOTAL U.S. CONTRIBUTIONS (1968)

Source of funds	1968 obligations for activities funded directly or indirectly by WHO	U.S. contributions to WHO activities—1968
Regular budget	$56, 123, 000	$17, 989, 000
UNDP: Expanded program of technical assistance U.N. Special Fund	7, 616, 526	3, 046, 810
Voluntary funds for health protection	6, 922, 419	1, 288, 930
International Center for Research on Cancer	1, 600, 000	150, 000
UNICEF	17, 000, 000	12, 000, 000
PAHO (regular and other)	14, 589, 460	8, 479, 825
Total	107, 073, 731	43, 249, 645
Funds-in-trust	2, 860, 499	

That is to say, unlike the WHO Executive Board and Health Assembly where the U.S. has one vote out of 24 and 131 respectively, in the UNDP the United States sits as a member of the Governing Council which is composed of equal numbers of representatives of developed and less developed States. In addition, the UNDP at the present time is under strong and competent management by an American administrator. The implications of these prospects become even greater, if a larger amount of U.S. funds for loans, foreign aid, and technical assistance are transferred from bilateral programs to such multilateral agencies as the UNDP and others.

It does not necessarily follow that increased United States technical and programatic influence over international health activities is the

[137] Bryant, op. cit., page 298.

clue to a substantially improved health picture for the world. A greater U.S. influence, however, would satisfy the demands of American policymakers that such influence exists. The Congress can also be expected to find merit in the equal representation of donor and recipient countries on the UNDP Governing Council as well as improved coordination of international health work through that Council.

For comparative purposes it is useful to show the relative amounts which the United States contributes to international health (WHO) through involuntary assessment and the amount which it spends on certain related activities. The U.S. assessed contribution to WHO for 1971 represents approximately:

—One dollar for every 800 dollars which the Federal Government appropriates in one way or another to its own total health budget;
—One dollar for every 2000 dollars which United States citizens spend for health care;
—Less than one half of one percent of the total outflow of funds for overall technical assistance to the lesser developed countries;
—About 15 percent of the total assessed contributions of the U.S. to all international organizations; and
—About 20 percent of the total U.S. assessed contributions to the UN and its Specialized Agencies.

III. U.S. Agencies Supporting International Health Programs

There are 20 U.S. Government units which in one way or another are involved in international health and related programs. The latest estimate for the amount of funds provided annually by the U.S. Government in support of this omnibus category is "$175 million, exclusive of the Food for Peace Program, foreign currencies generated by repayment of loans and the sale of agricultural surpluses under Public Law 480, and the funds made available through the international lending agencies." [138]

Apparently, overseas scientific activities, including biomedical research, peaked around 1965 and together with AID health activities have been gradually declining since then.

The major U.S. Government departments or agencies which support programs of research, technical assistance, or economic aid in health and related subjects overseas, are the Department of State, the Department of Health, Education, and Welfare, and the Department of Defense.

International Health Activities of the Department of State

The two principal organizations in the Department of State that have to do with international health matters are the Bureau of International Organization Affairs and the Agency for International Development (AID).

The Bureau of International Organization Affairs administers the U.S. contributions to international and Inter-American organizations and to certain special programs. These activities, especially as they relate to WHO and PAHO, are discussed in Section IV.

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[138] "International Cooperation in Health and Sanitation Programs," Draft prepared by the U.S. Department of Health, Education, and Welfare, and the Agency for International Development (November 8, 1965), page 185.

AID administers the bulk of United States bilateral technical and economic assistance, including health and sanitation projects, and makes voluntary contributions to multilateral organizations like the United Nations Development Program. Although the U.S. foreign aid program has undergone many changes, is re-organizing now and will doubtless reorganize again, the original objective remains essentially intact. The concept as it applies to the health of the less developed countries was described several years ago by David E. Bell, administrator of AID at that time:

—to help them act to meet their most immediate health problems—of which the most conspicuous are malaria and the water-borne diseases—and

—to help them create the trained personnel and the functioning institutions to enable them progressively to overcome their health problems. The most urgent of these institutional changes are generally taken to be those which are concerned with training health personnel, those concerned with the provision of public health services, and those concerned with the study of a nation's health problems and with planning how to meet them." [139]

In what may be considered a well-phrased political objective, the health programs supported by AID are:

> * * * Measures that bring better health to the whole population, or a large segment of it, lay a basis for a broader distribution of political power, for where only the elite are healthy and vigorous and most of the people are lethargic from sickness, power tends to remain concentrated and democratic institutions are not likely to develop.[140]

AID'S INTERNATIONAL HEALTH ACTIVITIES

It is difficult to determine from AID's diverse activities in health matters which ones should be regarded as clearly emergency or relief as against longer term public health programs, or indeed which programs are bilateral and which multilateral. The war on hunger, the green revolution, population and family planning, nutrition and child feeding, and food from the sea, as described in the Foreign Assistance Program report for 1969,[141] are crucial to the health of all populations and especially those where malnutrition and endemic disease work together in the production of high morbidity and mortality. Also what may appear to be a straightward engineering operation may have a most profound significance for public health. For example, one of the largest health programs, in financial terms, which AID has supported was that for community water supply development and sewerage and waste disposal. The financial assistance (from about 1961 to 1965) was nearly $400 million, but was largely in the form of loans from international lending agencies. These funds, together with local expenditures made by the developing countries involved, constituted an $800 million improvement in water supply and sewage disposal systems.[142] This type of cooperative venture does not require a physician

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[139] Ibid., page 69.
[140] Ibid., pages 75–76.
[141] "The Foreign Assistance Program, Annual Report to Congress for FY 1969" (Washington, U.S. Government Printing Office, 1970), pages 11–14.
[142] "International Cooperation in Health and Sanitation Programs," op. cit., page 76.

either from the United States or in the host country, but it is nevertheless "preventive medicine" and in this sense is a health program. It will be noted in a later paragraph that AID is still active in promotion of the management, operation, and maintenance of water and sewerage systems.

AID health work is bilateral, except for U.S. voluntary contributions from the AID appropriation to the United Nations Development Program ($71 million in 1969), a part of which is utilized by WHO; or contributions to UNICEF, much of which is administered by WHO.[143] AID also contributes to the Special Development Assistance Fund of the Organization of American States which supports multilateral activities.[144]

A general description of AID's health activities was presented in the 1969 AID report to Congress:

> AID health programs in fiscal 1969, amounting to $123 million [including $45.4 million for population programs], were coordinated with those of international organizations, such as the World Health Organization, Pan American Health Organization and the United Nations Children's Fund.
>
> Support for malaria eradication programs was provided in 18 countries under bilateral agreements. Of a population of 753 million in the malarious areas, 256 million now live in areas where the disease has been eradicated and 189 million where malaria transmission has been stopped. An active antimalaria campaign is protecting an additional 288 million people.
>
> Measles control and smallpox eradication programs covered 19 countries in Central and West Africa where more than 68.4 million people have been vaccinated against smallpox and 11 million children vaccinated against measles.
>
> In environmental health activities, the management, operation and maintenance of water and sewerage systems continued to be emphasized in efforts to lessen the danger of diseases caused by pollution.
>
> Research projects have developed new approaches to the control and eradication of epidemic and endemic diseases. Promising leads to possible immunization techniques for the prevention of malaria were established. The major causes of death in infancy and childhood were also studied.[145]

TRENDS IN THE LEVEL OF SUPPORT FOR *AID*'S HEALTH ACTIVITIES

Beginning in 1956, the overall trend in AID dollar contributions in support of health and sanitation programs and the use of counter-

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[143] "The Foreign Assistance Program," op. cit., page 42. There are two types of appropriations involved in the State Department from which funds may be utilized for health work in foreign countries. One appropriation is directly to State for the assessed contributions of the United States to international organizations. The others are pursuant to the Foreign Assistance Act (AID) in "Funds Appropriated to the President." (See: "The Budget of the United States Government, Appendix, Fiscal Year 1971." Washington, U.S. Government Printing Office, 1970), page 80. When funds from the later source are contributed to an international organization, AID's bilateral character becomes functionally multilateral. When a multilateral organization, such as WHO or PAHO sets up a project with a host country, the agreement is a bilateral one—between the international organization and the host country. The difference in the latter case is that the agreement is not country with country.

[144] "The Foreign Assistance Program," op. cit., page 32.

[145] "The Foreign Assistance Program," op. cit., page 15.

part funds for these programs is one of general increase up to 1963 and 1964. In 1965 these funds were sharply decreased to $48 million each. Table 3, below, shows the figures for the 1956–1965 time period.

TABLE 3.—AID DOLLAR CONTRIBUTION AND WITHDRAWALS FOR COUNTRY USE OF COUNTERPART FUNDS AND U.S. OWNED LOCAL CURRENCY, 1956–65

[Millions of dollars or dollar equivalent] [1]

Category	1956	1957	1958	1959	1960	1961	1962	1963	1964	Estimated 1965
Dollars	34.2	45.6	45	38.3	48.7	48.2	63.4	88.5	67.3	48.5
Dollar equivalent in local currency	5.7	3.7	5	15.6	36.0	1.9	78.9	67.4	118.8	48.1
Total	39.9	49.3	50	53.9	84.7	50.1	142.3	155.9	186.1	96.6

[1] Report on the health and sanitation activities of the Agency for International Development for fiscal year 1967. Prepared by the Office of International Health, Department of Health, Education, and Welfare (1968), p. 79.

This decreasing trend continues into recent years where it may be followed by observing the health and sanitation category in AID's tables on technical cooperation. For example the amount of project assistance in health and sanitation was $35.5 million in 1967 [146], $18.4 million in 1968,[147] and $13.2 million in 1969. Table 4, below, shows the level of AID health and sanitation projection assistance in 1969 of $13.2 million as compared with other fields of activity, totaling $250.3 million.

TABLE 4.—AID TECHNICAL COOPERATION PROJECTS IN FISCAL YEAR 1969 BY FIELD OF ACTIVITY [1]

[In millions of dollars]

Field of activity	Technical cooperation	Field of activity	Technical cooperation
Total project assistance	[2] 263.5	Regional and country programs—Continued	
		Public administration	14.0
Regional and country programs	209.5	Community development and social welfare	3.0
Food and agriculture	38.2	Housing	1.1
Industry and mining	6.0	Private enterprise promotion	2.5
Transportation	6.3	General and miscellaneous	28.2
Labor	9.1	Technical support	36.8
Health and sanitation	13.2	Nonregional projects	54.0
Education	44.5		
Public safety	6.7		

[1] Foreign assistance program, 1969, op. cit., p. 51.
[2] Project total only; excludes $7,400,000 in program (nonproject) assistance funded from the technical cooperation/development grant appropriation.

AID HEALTH TECHNICIANS

The number of U.S. technicians in health programs financed by AID declined much earlier than did the available funds. There were 366 AID technicians in health and sanitation in 1960, 328 in 1962, and 215 in 1965. The reduction in South America was particularly marked, declining from 93 to 25 during the years 1960 to 1965.[148]

Both AID and Public Health Officials expected this downward trend in the number of U.S. technicians and advisers to be reversed. And by June 1967 it was; there was at that time a total direct-hire and PHS

[146] Ibid., Attachment 5.
[147] "The Foreign Assistance Program, Annual Report to Congress for FY 1968," (Washington, U.S. Government Printing Office, 1969), page 45.
[148] "Report on Health and Sanitation Activities of AID for FY 1967," op. cit., pages 7–9.

AID-financed staff of 501 people (health, sanitation, and administration). One hundred nineteen of these were located in Washington at AID and PHS and 197 were in Vietnam. The remainder were distributed as follows:[149]

Africa	82
East Asia	39
Latin America	34
Near East and South Asia	30
Total	185

CONTINUING RESOURCES OF *AID*

In spite of continuing reduction in funds appropriated to AID it remains a sizeable organization. It had nearly 4,000 permanent positions in 1970 as compared with 23,266 for the entire Department of State.[150] By direct-hire or interagency agreement AID employs thousands of additional people.

Eighty-one U.S. voluntary agencies (most of them health-related) are registered with AID's Advisory Committee on Foreign Aid for the purpose of receiving overseas freight payments of supplies donated by numerous types of religious, regional, welfare, and national or ethnic interest groups. In 1969 this freight bill was about $5,000,000.[151] U.S. Government excess property may also be shipped out under this arrangement, as well as food and drug surpluses of industry; these last are transferred by donating the surplus to one of the registered voluntary agencies.

Some 500 nonprofit organizations, foundations, and missionary groups maintain overseas programs. In order to provide a central source of information concerning these various types of assistance projects, AID arranges under contract for the publishing of directories by the Technical Assistance Information Clearing House. This idea is not unlike that recommended by the Public Health Service evaluation group as a result of a study conducted in Latin America in 1952. If these directories are complete and are utilized it should be possible to prevent duplicate materials from piling up on shipping docks and air terminals as well as preventing technical assistance and missionaries from "stumbling over each other" in a country in need at any given time. What is required, of course, are country registers: records of who is giving short and long-term assistance to a country and what the amount and nature of that assistance is. Such registers do not exist, very likely because of the high cost of assembling the data.

RECAPITULATION OF *AID* ACTIVITIES

In summary, AID has established unique guidelines and machinery for operations in international health work. However, funds available for such operations have been decreasing, year by year. AID still contributes significant amounts of money to multilateral organizations such as the United Nations Development Program, the U.N. Special

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[149] Ibid., page 9.

[150] "The Budget of the United States Government, Fiscal Year 1972, Appendix," pages 77 and 684.

[151] "The Foreign Assistance Program, Annual Report to Congress for FY 1969," op. cit., page 75.

Population Fund, and UNICEF. Some of these funds are made available to WHO and PAHO.

The principal limitations of AID as an organization to serve the Nation's interests in health in all parts of the world are its lack of adequate staff in the medical field and its practice of concentrating assistance in relatively few countries. In the fiscal year 1969, 87 percent of AID's country assistance went to only 15 nations.

International Activities of the Department of Health, Education, and Welfare

The Public Health Service (PHS) in the Department of Health, Education, and Welfare (DHEW), is the primary U.S. Government resource in both national and international health. It is the official technical liaision of the U.S. Government with the World Health Organization and the Pan American Health Organization. (The liaison is in the Office of International Health, now under the Assistant Secretary for Health and Scientific Affairs.) Its Chief Medical Officer played a major role in the drafting of the WHO constitution and has usually served as the head of the U.S. delegation to the World Health Assembly.

In addition to its constitutional role in WHO, PHS prepares the U.S. technical position papers for the World Health Assembly, supplies or assists in providing experts for the WHO advisory committees, and is the technical point of contact between the World Health Organization and the U.S. Government.

Many of DHEW's laboratories and institutes participate as Reference Centers for the World Health Organization. There are 40 such WHO centers or laboratories in the United States. The National Center for Disease Control in Atlanta, Georgia, is the home of at least 8 of these Reference Centers for the World Health Organization at the present time.

The Department's prominent role in international health organizations does not make for an exclusively multilateral orientation on its part. It "* * * has actively participated in bilateral health and sanitation programs supported by the U.S. Government in many countries since World War II." [152] Under interagency agreements with AID, 200 or more PHS staff members work in cooperation with AID headquarters or are on field location with AID missions. Additional PHS medical officers and other officers are assigned to the Peace Corps.

OVERSEAS UNITS OF THE NATIONAL INSTITUTES OF HEALTH

The National Institutes of Health (NIH) maintains overseas offices in U.S. Embassies in Paris, Rio de Janeiro, Tokyo, and New Delhi. It also supports research laboratories in the Panama Canal Zone (the Middle America Research Unit), in Puerto Rico (Laboratory of Perinatal Diseases), in Guam (Epidemiology and Genetics Centers); and administers the Pakistan Cholera Research Laboratory for SEATO.[153]

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[152] "International Cooperation in Health and Sanitation Programs," (1965), op. cit., page 94.

[153] "NIH Almanac, 1970," (Washington U.S. Government Printing Office, 1970), pages 137–9; See also: U.S. Congress, House, Committee on Science and Astronautics. "The Participation of Federal Agencies in International Scientific Programs," Report of the Science Policy Research and Foreign Affairs Divisions, Legislative Reference Service, to the Subcommittee on Science, Research, and Development, 90th Congress, first session, (Washington, U.S. Government Printing Office, 1967), pages 137–9.

Other overseas laboratories supported by NIH are administered through grants to American universities. This is a five-laboratory program called the International Centers for Medical Research and Training.[154] The total cost of the supporting grants in 1969 was about $2.3 million. The five centers are located as follows:

1. The Institute for Medical Research, Kuala Lumpur, Malaysia
2. All-India Institute of Hygiene and Public Health, Calcutta, India
3. Center at the University of Costa Rica, San Jose, Costa Rica
4. Institute of Hygiene, Lahore, West Pakistan
5. Center at the Universidad del Valle, Cali, Colombia.

THE FOGARTY INTERNATIONAL CENTER

On July 1, 1968, the Congress and the President approved a bill offered by Rep. Melvin Laird of Wisconsin to establish the Fogarty International Center at NIH.[155] To date, the Center has established programs (1) for encouraging international communication among biomedical scientists through conferences, seminars, and workshops; (2) for Scholars-in-Residence, called "Fogarty Scholars," for the purpose of making advanced contributions to the health sciences, including philosophical, social, economic, and legal issues; and (3) for an International Visitors' Center as the focal point at NIH for the reception of international dignitaries and scientists.

In addition, the Fogarty International Center now administers the NIH International Postdoctoral Fellowship Program and the Special Foreign Currency Program. Under the Fellowship Program young scientists come to the United States for one or two years of advanced research training. The fellows come from about 40 countries. In Fiscal Year 1969, 173 fellowships were awarded (new and second-year) at a cost of $1,408,102.

The Special Foreign Currency Program, earlier called the "Special International Research Program" (SIRP), is a system of overseas health research projects utilizing P.L. 480 funds. These cooperative research agreements are usually set up for three- to five-year periods. Unless there has been a very recent change in the situation with respect to the availability of foreign currencies to NIH, it is correct to state that this program has been undergoing a rapid decline. As of June 30, 1966 current projects numbered 143 and the U.S. dollar equivalent involved was over $19 million;[156] the 1967 appropriation Congress reduced this program to $10 million;[157] and the program was further reduced in 1969, as seen in Table 5 below:

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[154] "NIH Almanac, 1970," op. cit., page 139.

[155] "NIH Annual Report of International Activities, FY 1969," Prepared by the Fogarty International Center, National Institutes of Health. (Washington, U.S. Government Printing Office, February 1, 1970), pages 1–5.

[156] "The Participation of Federal Agencies in International Scientific Programs," op. cit., page 138.

[157] Ibid., page 144.

TABLE 5.—NIH SPECIAL FOREIGN CURRENCY PROGRAM[1]

Name of country	Number of projects	Amount awarded fiscal year 1969
Poland	7	$1,254,309
Yugoslavia	6	492,830
United Arab Republic	4	478,701
Israel	1	1,000
India	23	2,017,525
Pakistan	3	3,068,057
Total	44	7,312,442

[1] "NIH Annual Report of International Activities, fiscal year 1969," op. cit., pp. 141–153.

THE RISE AND DECLINE OF PHS AND NIH GRANTS IN INTERNATIONAL HEALTH

PHS and NIH awarded a limited number of grants to institutions in foreign countries and to international organizations between 1944 and 1960. The basic Public Health Service Act of July 1, 1944, was interpreted as providing sufficient legislative authority to empower the Secretary and the Surgeon General to conduct and support research overseas during that period. However, on July 12, 1960, new statutory authority for international health activities was provided:

> July 12, 1960—Recognizing the importance of cooperation in international health research, Congress passed the International Health Research Act. Under the new law the Surgeon General was authorized to establish and make grants for fellowships in the United States and participating foreign countries; make grants or loans of equipment and other materials to participating foreign countries for use by public or nonprofit institutions and agencies; participate in international health meetings, conferences, and other activities; and facilitate the interchange of research scientists and experts between the United States and participating foreign countries. (Public Law 86–610, 74 Stat. L. 364.)[159]

For several years following the passage of this act, PHS and NIH international activities of all types were increased.

Two additional programs have to do with research and training performed overseas. The programs differ primarily in the nature of the performer. In the Research and Trainees Abroad Program, the performer is an American scientist who goes to an institution in a foreign country for additional research and training. The institution is selected by the applicant and is usually located in a developed nation where biomedical research is well established and where the institution has won recognition of excellence in research. In the other program, of Research and Training Grants Awarded to Foreign Institutions, the research is performed by foreign nationals in these institutions. Once again, although many nations are recipients of these awards, the bias is in favor of the developed countries and the work is heavily research-oriented. These programs have also been declining. For example, the research grants awarded by NIH and the Bureau of State Services to foreign institutions in FY 1963 were 1,001 in number at a total cost

[159] As summarized in the "NIH Almanac, 1970," op. cit., page 16.

of $15,477,000. In 1966 the corresponding figures were 757 and $10,710,000.[160] By FY 1969 the number of such projects had decreased to 360 and the level of support to $5,909,060. The country distribution of projects and funds for FY 1969 are shown in the Table 6, below:

TABLE 6.—BIOMEDICAL RESEARCH AND TRAINING GRANTS OR CONTRACTS AWARDED BY NIH TO INSTITUTIONS IN FOREIGN COUNTRIES AND TO INTERNATIONAL ORGANIZATIONS, FISCAL YEAR 1969 [1].

Name of country	Number of projects	Amount awarded
Argentina	15	$206,571
Australia	15	204,332
Austria	2	9,094
Belgium	7	79,952
Brazil	12	120,232
Canada	32	559,745
Chile	6	30,222
Colombia	7	120,130
Costa Rica	1	11,595
Denmark	9	184,176
El Salvador	1	12,440
Ethiopia	1	13,820
Finland	8	90,685
France	10	127,283
Germany, Federal Republic of	2	3,320
Greece	3	39,925
India	3	20,432
Iran	1	2,500
Ireland	2	9,795
Israel	21	449,531
Italy	24	346,807
Japan	56	478,979
Korea	2	18,894
Lebanon	4	68,375
Liberia	1	30,686
Mexico	5	52,076
Netherlands	6	114,290
New Zealand	5	28,223
Nigeria	1	45,900
Norway	3	75,680
Pakistan	1	2,500
Papua and New Guinea	1	3,050
Peru	6	85,321
Philippines	3	48,316
South Africa, Republic of	5	102,816
Spain	3	14,000
Sweden	26	680,490
Switzerland	4	38,555
Taiwan	3	18,066
Thailand	3	55,883
Uganda	2	136,950
United Kingdom	24	318,400
Uruguay	3	82,928
Venezuela	2	68,401
Yugoslavia	4	31,704
International Union Against Cancer (Geneva, Switzerland)	1	50,000
Pan American Health Organization (Washington, D.C.)	3	457,225
Pan American Health Organization, Institute of Nutrition of Central America and Panama (Guatemala City, Guatemala)	1	68,854
Total	360	5,909,060

[1] "NIH Annual Report of International Activities, fiscal year 1969," op. cit., pp. 141–153.

ROLE OF HEW IN MULTILATERAL PROJECT SUPPORT

It is interesting to note in Table 6 that NIH made individual project grants to the Pan American Health Organization (PAHO) and to the Institute of Nutrition of Central American and Panama (INCAP). An examination of past awards by HEW to international organizations, including WHO, shows that the Department has played a continuing role in the development of multilateral health organizations by direct research and training grants. (This is in addition to the early functions of the Public Health Service in the organization of WHO and the present administrative and technical responsibilities of the Office of International Health.) The history of PHS, NIH grant or contract support for training and research of three principal international health organizations is shown in Table 7, below:

[160] The Participation of Federal Agencies in International Scientific Programs," op. cit., pages 142–146.

TABLE 71.—PHS RESEARCH AND TRAINING GRANTS AND CONTRACT SUPPORT TO WORLD HEALTH ORGANIZATION, PAN AMERICAN HEALTH ORGANIZATION, AND INSTITUTE OF NUTRITION OF CENTRAL AMERICA AND PANAMA

Fiscal year	Total		WHO		PAHO		INCAP	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount
1947	2	$48,526			2	$48,526		
1948	1	40,000			1	40,000		
1949	2	42,696			2	42,696		
1950	2	65,886			2	65,886		
1951	1	47,150			1	47,150		
1952	1	58,283			1	58,283		
1953	1	42,700			1	42,700		
1954								
1955								
1956	1	20,378					1	$20,378
1957	3	72,837	1	$19,800			2	52,977
1958	2	60,709					2	60,709
1959	4	410,563	1	300,000			3	110,563
1960	7	234,433			2	56,209	5	178,134
1961	15	904,607	2	282,940	5	252,904	8	368,763
1962	20	1,346,359	5	603,000	8	365,110	7	378,249
1963	22	1,601,310	4	614,000	9	514,475	9	472,835
1964	17	1,341,894	3	549,000	6	400,837	8	392,057
1965	20	1,422,626	4	614,000	7	391,488	9	417,138
1966	13	957,042	5	520,200	3	210,231	5	226,611
1967	4	194,000	1	23,000			3	171,000
1968	3	131,000	1	19,000			2	112,000
1969	4	526,079			3	457,225	1	68,854
Total	145	7,569,078	27	3,345,000	53	2,993,810	65	3,030,268

[1] "NIH Annual Report of International Scientific Activities, fiscal year 1969," op. cit.; see also: "The Participation of Federal Agencies in International Scientific Programs," op. cit., p. 138.

FAILURE OF BILL TO SUPPORT INTERNATIONAL HEALTH TRAINING

In 1966 a bill (H.R. 12453), the International Health Act of 1966, was introduced in the Congress.[161] The purpose of the legislation was to authorize funds for the training of top-quality health workers in international careers, for the recruiting of young professionals for overseas assignments, for the training of mature professionals in leadership in international public health, and for the creation of a career service in international health. The bill was aimed at the manpower shortage in international health expertise and at the low percentage of Americans on the staff of the World Health Organization. It was supported by the Secretary of DHEW, the Surgeon General, the American Public Health Association, the Association of American Medical Colleges, and the American Medical Association. During hearings on this bill in February 1966, there was an excellent dialogue among the members of the Committee on Interstate and Foreign Commerce together with the expert witnesses. WHO and PAHO were mentioned repeatedly during the hearings as was the fact that international health problems require a different kind of instruction from that provided by the typical American medical school. It was pointed out at the time that there were only three medical schools in the United States which had schools of public health within the framework of the medical school itself. In spite of this support and the need to correct a defect in medical education, the legislation was not passed, failing to get out of the Rules Committee. Presumably this inaction is attributable to the low priority attached to the measure, as no opposition was recorded. No subsequent legislation has been introduced for the special training of international health specialists or health diplomats.

[161] U.S. Congress. House. Committee on Interstate and Foreign Commerce. "International Health Act of 1966." Hearings, February 15 and 16, 1966. 89th Congress, second session. (Washington, U.S. Government Printing Office, 1966).

RECAPITULATION OF HEW ACTIVITIES

The international health activities of the Department of Health, Education, and Welfare, like those of the Agency for International Development, have been in rapid decline over the past few years. There appear to be no plans at this time to reduce the rate of decline, to stabilize the level of support where it now is, or to increase it. On the other hand, activities and budgets of the World Health Organization and the Pan American Health Organization have continued to expand somewhat each year. Although there is U.S. resistance to these "assessed" expansions, the United States continues to meet its commitments by treaty to these international organizations and to facilitate certain of their needs and objectives by means of special voluntary contributions.

International Health Activities of the Department of Defense

Military medicine has long been the backbone of tropical and preventive medicine. The U.S. Army, Navy, and Air Force, in that order, have contributed substantially to knowledge of communicable disease and still do. Most of this contribution derives from military operations or anticipated operations in areas where the index of infectious and parasitic disease is high. The improvement in military medical organization beginning during the latter part of the Civil War, the ability of the services to attract competent researchers and practitioners, and the extraordinary mobility of the armed services, have made it possible for military medicine to contribute to the remarkable progress of American medicine as a whole and especially to global health problems. Military medicine has produced one of the best medical libraries in the world, and among the medical disciplines it ranks high in the fields of pathology and epidemiology.

One of the most brilliant and conclusive advances in the control of communicable disease was made by a U.S. Army Board, headed by Major Walter Reed, in 1900. It demonstrated that yellow fever is transmitted to man by a species of mosquito, *Aedes aegypti*. This discovery made it possible to begin the eradication of yellow fever in the United States, the West Indies, and in other parts of the world. It also made possible the building of the Panama Canal by controlling mosquitos and hence yellow fever which prior to such control had incapacitated the engineers and other workers on the project to such an extent that the work could not be performed.

Subsequent activities of import to international health, particularly those developed during World War I and II, have been numerous. Some of the progress and installations are well defined, but on the whole the international medical service and assistance work of the armed forces are "in support of operations" and are not carried in budgetary line items as such, so that no cost estimates can be made. The broad scope of overseas research and assistance as it relates to the health of populations in foreign areas is discussed in a ten-year-old set of United States Senate Hearings.[162] Although the account applies to specific activities as of ten years ago, the broad nature and extent

[162] U.S. Congress. Senate. Committee on Government Operations. "The U.S. Government and the Future of International Medical Research." Hearings before the Subcommittee on Reorganization and International Organizations of the . . . Part II. 86th Congress, second session. (Washington, U.S. Government Printing Office, 1961), pages 375–404.

of the programs are still essentially the same. These hearings cite arrangements for cooperation with the Public Health Service, the World Health Organization, and the Food and Agriculture Organization; and such cooperation still continues.

OVERSEAS OFFICES OF THE DEPARTMENT OF DEFENSE

The Department of Defense (DOD) maintains four overseas offices in developed nations, mainly for research and development liaison purposes. Three of these offices also support and coordinate a small number of grants and contracts which are awarded to scientific research institutions in Europe and the Far East. The Army has two small groups in Frankfurt and Tokyo; however, the Office of Naval Research in London and the European Office of Aerospace Research in Brussels each has a larger staff of approximately 60 persons.[163]

In 1966 the Department of Defense was supporting a substantial amount of research in foreign countries. Computer readouts at that time [164] revealed that the total level of support was approximately $18 million, and that nearly one-third ($5,412,000) of this was for research in the biological and medical sciences. There were 378 projects in this field. The most recent figures (1969)[165] indicate a drastic reduction in DOD-supported medical research in foreign nations. Army, Navy, and Air Force projects combine to make a total of $1,445,300, some of which include Special Foreign Currency Funds. Thus in a four-year period (1966 to 1969) the overseas biomedical research grants and contracts of DOD were reduced by a factor of between four and five. The 1969 country distribution of funds for medical research projects by the three services is shown in Table 8 below:

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[163] "The Participation of Federal Agencies in International Scientific Programs," op. cit., page 128.

[164] Ibid., page 130.

[165] Letter from A. E. Hayward, Acting Deputy Director for Research and Technology, Office of the Director of Defense Research and Engineering to Charles S. Sheldon II, Chief, Science Policy Research Division, Congressional Research Service, Library of Congress, January 20, 1971.

TABLE 8.—DOD CONTRACTS AND GRANTS FOR MEDICAL RESEARCH PERFORMED IN FOREIGN COUNTRIES,[1] (FISCAL YEAR 1969)

[In thousands of dollars]

Country	Army	Navy [2]	Air Force	DOD total
India		200.7	15.0	215.7
West Germany	6.0		15.2	21.2
United Kingdom	39.1	31.4	10.0	80.5
France	32.3		11.0	43.3
Pakistan		283.1		283.1
Australia	4.3	12.8		16.8
Egypt		303.0		303.0
Brazil	106.9			106.9
Canada	45.4			45.4
Republic of China	26.7			26.7
Israel	53.7			53.7
Italy	37.4			37.4
Japan	41.6			41.6
South Korea	32.7			32.7
Malaysia	27.9			27.9
Peru	22.7			22.7
Philippines	7.6			7.6
Thailand	18.8			18.8
Chile	27.0			27.0
Ceylon	1.0			1.0
Austria	15.0			15.0
Belgium	15.0			15.0
Holland	2.0			2.0
Total	563.1	831.0	51.2	1,445.3

[1] Letter, Hayward to Sheldon, January 20, 1971, op. cit.
[2] Includes Public Law 480 special foreign currency funds.

DOD MEDICAL RESEARCH LABORATORIES OVERSEAS

For a great many years the Army and Navy, have conducted medical research in overseas laboratories which they own and operate under agreement with the local government and in cooperation with the scientists of the country in which the laboratory is located. The laboratories are usually located where tropical diseases (parasitic and infectious) can be studied. A comprehensive summary of relevant information on these international health activities as they exist today is presented in Table 9, below:

TABLE 9.—DOD MEDICAL RESEARCH LABORATORIES OVERSEAS [1]

Unit	Major program area	Total DOD personnel	Total other U.S. personnel	Total foreign nationals	Area size ft.[2]	Fiscal year 1969 (thousand) [2]
U.S. Army Medical Component, SEATO Medical Research Laboratory, Bangkok, Thailand.	Infectious diseases	65		326	100,000	$1,374
U.S. Army WRAIR Medical Research Unit, Saigon, Vietnam.	do	41		15	10,000	251
U.S. Army Medical Research Unit, Middle America Research Unit, Canal Zone, Panama.	do	16	[3] 12	44	[4] 5,000	155
U.S. Army Medical Research Unit Institute for Medical Research, Kuala Lumpur, Malaysia.	do	6		60	10,000	176
U.S. Army Medical Research Unit, Landstuhl, Germany.	Nuclear medicine	7			5,100	15
U.S. Navy Medical Research Unit No. 2 Taipai, Taiwan.	Infectious diseases	36		342	89,000	1,168
U.S. Navy Medical Research Unit No. 3 Cairo, Egypt.[5]	do	38		220	217,800	1,372

[1] Letter, Hayward to Sheldon, January 20, 1971, op. cit.
[2] Does not include military salaries.
[3] National Institutes of Health.
[4] Total laboratory, 40,700 sq. ft.
[5] There is a small extension unit of this laboratory in Addis Ababa.

Unlike overseas health research grants from all agencies, which have declined precipitously during the past five years, and unlike the five overseas laboratories of the National Institutes of Health, which have held their own in size and level of support, the DOD Medical Research Units Overseas have doubled their operating budgets. The Navy installation at Cairo is nearly twice the size it was five years ago and the number of foreign nationals working in the Navy units at Taipei and Cairo has increased significantly. The combined total of foreign nationals on the staff and in the overall work force of these two laboratories is now 562. In view of the declines in almost every other aspect of international collaborative research in the health field, including military grants and contracts, this development must be regarded as an encouraging one to those interested and concerned with global preventive medicine.

In a recent paper, Dr. John C. Cutler, Professor of International Health and Director of the Population Division, University of Pittsburgh, points to the importance of military medical experience abroad as it benefits health work among U.S. nationals both abroad and at home. He sums up this picture of experienced medical manpower in connection with industry, bilateral and multilateral organizations, and private foundations as follows:

> With the passing of the colonial era it has been interesting to note that the military has taken on responsibility for filling the need for technical medical and health work abroad and bringing back to this country and to other countries the benefits of this experience for the protection of our own manpower here as well as abroad. American industry has drawn very heavily upon military experience in this respect and I think it is interesting to note the magnitude. In Wright's study of a few years ago 83 native American corporations were studied. 24 replied describing 49 programs in 27 countries. They had 58 hospitals totaling 5,000 beds with approximately 313 American physicians working in these installations, 33 dentists, and almost 1,000 nurses, at a total budget of $27,000,000. And the involvement of industry is increasing rapidly. The per capita expenditure on health services by American industry in every country in which work is carried on is much greater than that provided by the Governments of the countries themselves, although not usually available to the entire population * * *.
>
> With the decline in teaching of tropical medicine in United States medical schools about the only way a physician can prepare to deal with exotic diseases such as malaria is through the experience he had as a military medical person, or by working abroad in industry, or from experience in one of the international health programs either multilateral or bilateral. Unfortunately it is to the discredit of American medical education that we have with few exceptions discontinued completely the type of teaching required to prepare American medical professionals to deal intelligently with the health problems of the increasing international movement of American tourists today.

It is unfortunate from the political point of view that we have not made sufficient study of the yield from the group of American health professionals who have served abroad in the bilateral programs of the United States since the 2nd World War, nor of the large yield from returned military who have had this experience and who developed while abroad both increased adaptability and motivitation. The public is unfortunately also quite unaware of the returns to our country from service with the international multi-lateral organizations and with the many voluntary organizations. Yet we can put our fingers on large numbers of individuals in key positions and say, on the basis of individual case studies, that their experience abroad was crucial to them. It is essential that we document this very much more, and publicize it; because otherwise we shall continue to see further cuts in the U.S. budget for health work in the foreign aid programs.[166]

IV. International Health Organizations and the U.S. Congress

The U.S. share of funding support of the World Health Organization and the Pan American Health Organization is implemented through the Department of State, under "Contributions to International Organizations." The Department presents a budget justification each year before two committees of the Congress: In the House, before the Subcommittee on Department of State, Justice, Commerce, the Judiciary, and Related Agencies Appropriations of the Committee on Appropriations; [167] and in the Senate, before the Subcommittee of the Committee on Appropriations [168] (same agency units as in the House).

The Problem of U.S. Funding of World Health Programs

The State Department presents its request for funds in support of WHO as part of a total package that includes the United Nations and its nine specialized agencies (of which WHO is one). The package also includes six inter-American organizations (including the Pan American Health Organization); seven regional organizations (including NATO); and 15 miscellaneous bodies. So far as WHO and PAHO are concerned, the Committees see two tables, one on Contributions to International Organizations (see Table 10) and one on Voluntary Contributions to Multilateral Organizations and Programs (see Table 11). There are back-up tables on legislative authorization, a formal budgetary defense, and some discussion.

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[166] John C. Cutler. "Dividends to Americans from Experience Abroad." American Review of World Health. (Published by the American Association for World Health, Inc., Vol. 18, No. 1, 1970), pages 16–17. (Quoted in part. Dr. Cutler is Professor of International Health and Director of the Population Division, University of Pittsburgh.)

[167] U.S. Congress. House. Committee on Appropriations. "Departments of State, Justice, Commerce, the Judiciary, and Related Agencies Appropriations for 1971." Hearings before a Subcommittee of the . . . Part 2. 91st Congress, second session. (Washington, U.S. Government Printing Office, 1970), pages 349–414.

[168] U.S. Congress. Senate. Committee on Appropriations. "State, Justice, Commerce, the Judiciary and Related Agencies Appropriations, FY 1971 on H.R. 17575." 91st Congress, second session. (Washington, U.S. Government Printing Office, 1970), pages 436–478.

TABLE 10.—CONTRIBUTIONS TO INTERNATIONAL ORGANIZATIONS [1]

Program by activities	1971	Increase (+) or decrease (−)
A. United Nations and specialized agencies:		
1. United Nations	$46,450,986	+$5,181,137
2. United Nations Educational Scientific, and Cultural Organization	10,531,058	
3. International Civil Aviation Organization	3,769,464	+38,486
4. World Health Organization	21,680,810	+2,147,680
5. Food and Agriculture Organization	10,085,782	+1,749,700
6. International Labor Organization	7,458,875	+805,691
7. International Telecommunication Union	642,175	+26,447
8. World Meteorological Organization	774,565	+75,970
9. Intergovernmental Maritime Consultative Organization	121,659	+10,605
10. International Atomic Energy Agency	3,672,502	+298,267
Subtotal	105,187,876	+10,333,983
B. Inter-American organizations:		
1. Inter-American Indian Institute	61,561	
2. Inter-American Institute of Agricultural Sciences	2,758,800	+321,708
3. Pan American Institute of Geography and History	90,300	
4. Pan American Railway Congress Association	5,000	
5. Pan American Health Organization	9,263,557	+861,092
6. Organization of American States	16,155,404	+2,514,035
Subtotal	28,334,622	+3,696,835
Total, 1971 estimate	144,611,000	14,824,000

[1] House. "Departments of State, Justice, Commerce, the Judiciary, and Related Agencies Appropriations for 1971," hearings, op. cit., pp. 350–1.

TABLE 11.—VOLUNTARY CONTRIBUTIONS TO MULTILATERAL ORGANIZATIONS AND PROGRAMS [1]

	Fiscal year 1971 proposed
Technical assistance:	
U.N. Development Program	$100,000,000
U.N. Children's Fund	13,000,000
U.N. Technical and Operational Assistance to the Congo	0
U.N. Food and Agriculture Organization, World Food Program	1,500,000
U.N. Population Program	3,500,000
U.N. Institute for Training and Research	400,000
U.N. Programs for Southern Africans	
Special Contributions for Vietnam	950,000
International Atomic Energy Agency, Operational Program	1,500,000
World Health Organization-Medical Research	150,000
World Meteorological Organization/Voluntary Assistance Program	1,550,000
International Secretariat for Volunteer Service	70,000
Subtotal	122,620,000
Supporting assistance:	
U.N. Relief and Works Agency	[2] 13,300,000
U.N. Force in Cyprus	6,000,000
Subtotal	19,300,000
URWA-Arab Refugee Training, Subtotal	1,000,000
Total	142,920,000

[1] House. "Departments of State, Justice, Commerce, the Judiciary, and Related Agencies Appropriations for 1971," hearings, op. cit., pp. 413.
[2] Plus commodities available under Public Law 480, title, II valued at $8,900,000.

Most recently, Assistant Secretary of State, Samuel DePalma [169] justified this total package in such terms as: "in our national interest"; as work "where many important steps are being taken to build a better world order"; and as "some activities of direct benefit to the United States". The World Health Organization was one of three UN specialized agencies mentioned by Mr. De Palma as an example of benefit to the United States.

[169] Senate. "State, Justice, Commerce, the Judiciary and Related Agencies Appropriations, FY 1971," op. cit., p. 432.

These recent hearings records on budgetary justification for international organizations do not deal with the nature and merit of the substantive work of the specialized agencies, including WHO, or with the inter-American agencies, including PAHO. Attention is largely focused on increasing budgets and balance of payments; this concern applies to all of the international organizations, regardless of their somewhat different objectives, achievements, and potential. It would appear that the prevailing view holds the United States to be over-assessed in the first place, and overcommitteed to ever-increasing organizational budgets; assessments from multilateral enterprises are viewed as one more form of foreign aid.

International health has not been spared from the growing doubts about costs, about lack of control over the budgets, and about the desire to restrict the outflow of American dollars. Indeed, international health organizations were most often singled out for budgetary discussion in the Senate and House Appropriations Hearings. The general climate under which international health organizations are considered can be seen in the following items of testimony.

IN THE SENATE

> Convinced as we [in the Department of State] are of the benefits of U.S. participation in international organizations, we are nevertheless seriously concerned about the increases in their budgets. I can assure you that we have fully taken into account the views expressed by the Senate Appropriations Committee last year and that we have made every effort to keep the budget as low as possible.[170] * * *
>
> In the World Health Organization, which has the largest assessed budget of any of the specialized agencies, we [State] concerted throughout the budget process with other major contributors to keep down the budget. I would point out that for the first time the WHO Assembly, as a result of U.S. leadership, rejected the Director-General's proposed budget. However, we were unable to obtain support for an acceptable compromise figure and consequently we voted against the budget as adopted.[171] * * *
>
> We also, of course, sought to restrain budget increases in the organizations outside of the UN system. In the Pan American Health Organization, the strong approaches of the United States to other members last year resulted in a reduction in the original budget proposed by the Director. This was the first time in at least fifteen years that the Directing Council of that organization was prevailed upon to vote for a budget smaller than the Director's request.[172] * * *
>
> Senator McClellan: With respect to the agreements that are now in force, have you re-evaluated them and found where our participation could be modified or reduced?[173]
>
> Mr. De Palma. We have made a continuous check on them.[174]

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[170] Ibid., pp. 433–434.
[171] Ibid., pp. 435–436.
[172] Ibid., p. 436.
[173] Ibid., p. 445.
[174] Ibid., p. 445.

* * *

Senator McClellan. In our contribution to these agencies have we in some measure contributed to the imbalance of payments?

Mr. De Palma. Actually, sir, our estimate is—based on data provided by the organizations—that our overall balance of payments benefit by our participation in these international organizations. In fiscal year 1970 we estimate that they spent $25 million more in the United States than was contributed. It is because of substantial expenditures here by the U.N. and the OAS, for example.

Senator McClellan. We benefit?

Mr. De Palma. Actually we benefit. There is a net inflow. It is small, but it is actually a net inflow.

Senator McClellan. Then there is no way, as now constituted and operating, that it would contribute to the imbalance of payments, that is your statement?

Mr. De Palma. Yes, sir.[175]

* * *

Senator Ellender. Mr. Chairman, it indicates that the Pan-American Organization receives a contribution from us of 66 percent.

Senator McClellan. On what?

Senator Ellender. Pan American Health Organization, the Organization of American States. Our contribution is 66 percent. That organization was established in 1925.

Senator McClellan. If those countries down there don't care enough to try to improve the health of their people. I don't think we will improve it very much by just spending money.[176]

Mr. De Palma (continuing from prepared statement).

In fact, close to two-thirds of the increase we are requesting for the United Nations, for example, is attributable chiefly to rising prices and salaries.

By far the largest part of the increase requested for the fiscal year 1971 is for the United Nations and the specialized agencies, and is mainly due to increases in the budgets of the U.N., the World Health Organization, the Food and Agriculture Organization, and the International Labor Organization.

In each of these organizations we pressed hard for budgetary restraint. In my prepared statement, I explain specifically what we did in each case to control the rise in the budgets.

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[175] Ibid., p. 471.
[176] Ibid., p. 477.

I can assure you, Mr. Chairman, that we will continue to press for tight budget levels in the future. As in the past, we will continue to approach the executive heads of the major organizations to urge them to prepare reasonable budgets before they put pen to paper because we do not have the votes in the organizations on budget matters, and the best time to influence budget levels is before the estimates become frozen in a printed document.

We will also, of course, push for budgetary stringency in the governmental bodies of the organizations. Throughout the process we will continue to concert with other major contributors to try to maximize our impact on the programs and budgets. A dozen of the largest contributors have developed the practice of coordinating their positions on these matters in the major specialized agencies.

For example, I attended a 2-day meeting of these major contributors in Geneva last March. This meeting devoted a great deal of attention to the problem of rising budgets. There was wide agreement on the need to promote a policy of budgetary restraint, and plans were made to pursue this objective during this year. At the same time, I have to note that while other major contributors share our desire for efficiency and economy, not all of them think that the budgets of these organizations are excessive. In fact, we often find it very difficult to persuade them to join us in pushing for budget levels as low as we like. We are also working to establish better administrative and fiscal procedures to promote efficiency and economy in these organizations.

Again, in my statement, I have pointed out a few of the things that are being done. I will not go into them at this point.

In addition to these efforts to improve the operations of the international organizations, we are also trying to make our own participation in international organizations as effective as possible. On the 8th of January of this year the White House issued a memorandum which conveyed the President's wish that the Secretary of State direct, coordinate, and supervise the activities of the executive agencies relating to our participation in international organizations. To implement this memorandum, I held a meeting of an interdepartmental committee on international organizations, consisting of officials from 15 Government agencies, and I asked for their help in carrying out the President's directive. I particularly asked them for help in assessing the programs of the organizations in terms of current and future priorities.[177]

IN THE HOUSE OF REPRESENTATIVES

Mr. ROONEY. I feel this committee has been wasting the taxpayers' money with the Government Printing Office in printing each year an admonition in our report to cut down

[177] Ibid., page 443.

our contributions to these international organizations. We just don't get anywhere doing that, do we? [178]

Mr. DE PALMA. We have not succeeded in slowing the rate of increase; no sir * * * there have been two principal reasons for the increase [$14.8 million for total increased U.S. contributions to all international organizations=10%], Mr. Chairman. A substantial portion has to do with just maintaining the current level of activity in the face of rising prices and wages.[179]

Mr. DE PALMA. * * * We have managed in every case to work out certain savings in the budgets as proposed. We have not managed to prevent increases. We have not done that, sir, because in the first place we did not have the votes * * *. We have also been unable to do it, because in some cases even some of the major contributors have felt that the ceilings we were trying to impose were unjustified.[180]

RECAPITULATION OF U.S. LEGISLATIVE PROBLEM

There is no question but that the costs and benefits of external activities of the United States, after an impressive outpouring of wealth in World War II and large foreign assistance and military activities thereafter, are coming under increasing public scrutiny. Congressional control of policies and programs is historically exerted by means of the purse strings. Accordingly, funding levels of U.S. foreign programs are a proper subject for congressional examination. However, it seems also to be an important question as to precisely what the consequences are of such U.S. expenditures, in terms of benefits to the United States. It is suggested that these aspects are not sufficiently examined; and the reason seems to be the enormous range and complexity of the subject matter. Accordingly, the possibility might be entertained of enlisting the services of a qualified research institution to make a thorough investigation, in depth, of the relationship between actual costs and direct and indirect benefits of foreign assistance, with particular reference to international agencies concerned with health. Few fields of international activity present more difficult problems of fiscal accountability than do health and medicine.

Cost/Benefit Analysis as a Possible Solution

Few programs of major significance become or remain a fruitful effort which do not rest on a mutual understanding of objectives and costs on the part of the practitioners and the politicians. WHO and PAHO are major international health programs, and to present their costs in the absence of information concerning their qualitative and quantitative benefits makes the entire appropriation process an exercise in arithmetic. If the American taxpayers' investment in global health is not achieving the results expected from that investment, what institutional and policy reforms can be implemented to change the situation? And how does one determine that benefits are consistent with cost? A rational basis for the determination of priorities and in

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[178] House. "Departments of State, Justice, Commerce, the Judiciary, and Related Agencies Appropriations for 1971." Hearings, op. cit. page 401.
[179] Idem.
[180] Ibid., page 404.

promoting the efficient use of available resources faces obvious ethical and moral obstacles. Nevertheless the economics of health and disease is a legitimate way of evaluating certain kinds of international campaigns against disease and the techniques of cost/benefit analysis are proving of value in a number of other fields of medicine. In addition to international health activities which would have to be explained and justified to Congress along non-quantifiable lines, there remains the possibility of satisfying the Congress as to the nature of failures and successes with numbers or with concepts derived from a numerical approach of one kind or another. As Dr. John Bryant states:

> The major, analytical tool used to evaluate alternative health programs in the United States has been cost-benefit analysis * * *. Benefits are generally measured in terms of number of lives saved, amount of disability prevented, or amount of economic loss avoided * * *. There are special problems in extending [these] concepts * * * to the less developed countries * * *. Still, the concepts of cost-benefit analysis are very important, whether applied with carefully derived data or as an aid to common sense in making decisions on health programs.[181]

Some Examples of Approaches to Cost/Benefit Analysis in Health Programs

The difficulty of obtaining quantitative information about the results of health programs has been a historical obstacle to their orderly presentation in the budget and accounting process. Nevertheless, some sources of quantitative information are available, and these may not be adequately exploited for policy purposes. The following is a brief sampling from the literature of such sources.

1. A study of the control of poliomyelitis in the USSR showed that the cost of vaccinating 127 million people amounted to nearly 46 million roubles; benefits were evaluated by comparing actual incidence of the disease following vaccination with estimated incidence in the absence of the program:

> The benefits were evaluated by working out the number of cases that would have occurred in the period 1958–1965 (assuming a continuation of the 1958 morbidity figure), the cost of treating them, and the financial losses due to disablement and death. On this basis, the benefit was found to be over 3000 million roubles, or 66 roubles saved for every rouble spent. The assumption of a continuation of the 1958 morbidity level may well have given this estimate an upward bias, but a benefit so much greater than the cost allows ample scope for more stringent assumptions.[182]

2. In a Yugoslavian program to reduce infant mortality from its existing level of 44 per thousand live births to 20 or below, two alternate methods were used: (a) a child health dispensary and a 12-bed unit for normal deliveries, staffed by a pediatrician and two nurses; and (b) a clinic staffed by a midwife, supported by periodic visits (three times a week for six hours) of a general practitioner. "After

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[181] Bryant, "Health and the Developing World," op. cit., pages 106–7.
[182] "Economics of Health and Disease," WHO Chronicle (January 1970), page 22.

ten years, infant mortality in [the (a) area] had fallen to 17.1, while in [the (b) area] it had fallen to 18.1." It was concluded that these results were essentially the same, although the cost of the (b) method was much less, "* * * an experience which may be of value to developing countries where both financial resources and highly trained health personnel are in short supply." [183]

3. The productivity of labor was used in one U.S. study to illustrate a method of formally calculating the monetary value of health services. For example—

> * * * The health costs of producing a member of the United States labor force, aged eighteen, in 1960 were about $1,000; therefore, the 73 million persons in the labor force in 1960 represent a 73-billion-dollar investment. Other costs of upbringing would of course be added to this figure. The costs would then be compared with the return on investment in terms of labor productivity.

The study notes that in less developed countries a different pattern of costs and productivity would prevail, but that "one of the troubles in [such countries] is that there is too much unproductive investment." High rates of death and disability detract from the economic return from the investment in feeding and bringing up of a new generation for productive work.[184]

4. Three sets of calculations as to the differential productivity of the U.S. working population with and without health care show large value differences:

(a) In the years 1900–1960, with 1900 death rate assumed throughout, compared with actual reduced death rates, an additional 13 million population yielded in excess of $60 billion in additional national income;

(b) In the period 1938–1952, the use of antibiotics and chemotherapy in pneumonia and influenza saved 1.1 million lives, and as a consequence national income in 1952 was enlarged by more than a billion dollars;

(c) The asset value in 1960 of the labor product attributable to workers "added to the labor force by reduction in mortality rates since 1900" was estimated at $820 billion. That sum is to be weighed against investment in public health over this period, which is of course a much smaller figure.[185]

5. Absenteeism of labor due to malaria in one area of the Philippines was reduced by an antimalaria program from 35 percent to less than 4 percent; at the same time, labor productivity rose by 20 to 25 percent.[186]

6. A yaws eradication campaign in Haiti returned an estimated 100,000 incapacitated workers to their jobs.[187]

7. On a broader basis, an analysis conducted on 22 less developed countries, in 1970, showed a very high inverse relationship "between variations in infant mortality rates and variations in changes in subsequent agricultural output." In fact, in this study, it was found that

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[183] Ibid., page 21.
[184] Bryant, "Health and the Developing World," op. cit., page 105.
[185] Ibid., pages 105–106.
[186] Ibid., page 98.
[187] Ibid., page 99.

the relationship between health (plus education) and agricultural productivity was "more vigorous" than that of labor and fertilizer, the more usual indices of changed agricultural productivity.[188]

In summary:

> There does emerge clearly the evidence of an output response in the rural parts of poor lands when activity in the health field changes, and this in a society and economy where popular arguments notwithstanding—labor is a relatively under-utilized resource. The health influence may thus not operate simply through more man-hours * * *; it is rather, or also, a consequence of attitude shifts on the part of the laborer.[189]
>
> Output per person in Africa, Asia, and Latin America has increased in recent decades even as population growth reached record rates of expansion * * *. On the record, therefore, economic progress has begun even as population growth expanded.[190]

Malenbaum considers health benefits so obvious that there is little effort to quantify them. When that effort is made a whole spectrum of social and economic indicators (in 115 countries) showed that health variables tended to be the most highly correlated with all measures of progress.[191] He states further that the use of statistics which lump urban and rural data together tends to conceal rather than reveal the benefits of health service to poor people in poor nations. Cost/benefit statistics in such countries must be worked up below the national level because national statistics obscure too many important subnational or regional differences:

> Preliminary statistical analysis of changes in health and in health programs in poor areas, where labor is the dominant factor of production, suggests a positive effect of health inputs on subsequent output. There is an economic rationale for such a relationship in poor lands, through changes in the vigor and motivation of the self-employed workers who are predominant in the labor force. Such a positive role also fits new doctrines of growth, in which quality of factor inputs receives greater weight than quantity of labor or capital. There exists a need for such additional statistical analyses, and especially in small areas (villages, counties, districts), where outputs and production processes are more homogeneous than in nations as a whole.[192]

The Complex Issue of Health and Overpopulation

The most provocative dilemma of all faces those who would try to show by analysis that, on a short-term basis at least, the saving of lives which increases population also produces a net economic gain in today's low-income, non-developed lands. There *is* a gain in production, including food, but there is also reduction in morbidity rates which increases

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[188] Wilfred Malenbaum. "Progress in Health: What Index of Progress?" The Annals of the American Academy of Political and Social Science. (January 1971), pages 109–113.
[189] Ibid., page 114.
[190] Ibid., page 110.
[191] Ibid., page 110.
[192] Ibid., page 113.

birth rates and life expectancy—so that the number of consumers is equal to or greater than the gains in production. Malenbaum's claim is that all or most developed nations have gone through this transition of high population growth rates and that the dilemma is solved when the percentage gain in output exceeds that in population.[193] But this argument assumes a course of growth in the developing nations similar to that of the Industrial Revolution in the Western world. It also assumes an ultimate socioeconomic status like that of the United States where in 1960 middle and upper income families were averaging three and two children per family, respectively.[194]

The theory of the relationship of population growth to improvement in public health measures combined with rising standards of living is not well developed. In the nations of Western Europe, when living standards rose during a period of improved public health and sanitation, populations tended to rise more slowly. On the other hand, in the developing countries, population increases have responded to public health measures by proceeding at even steeper rates, while living standards have increased slightly if at all. Observation of this set of conditions has tended to cast doubt on the idea that declining rates of population in these countries go hand in hand with rising standards of living. Moreover, the implication is that because of the threat of population explosion, public health measures should be deferred until the populations of the less developed countries have been brought under control. This thesis is challenged by Dr. John Bryant, who contends that there is still some validity in the concept that relative stability of populations is coupled with economic and health factors. In particular, he warns that it is contrary to the values of the medical profession or of civilized society to solve the problem of the population explosion by relying on ill-health, under-nourishment, and the misery of poverty; on the contrary, he declares that population control is incompatible with such conditioning.

> As we think about the interrelationships of health, population, and economic development at a national level, we must not lose sight of the meaning of these terms for individual families and communities. Consider, for a moment, the findings of Aguirre and Wray in a small Colombian community.
>
> They found that 42 percent of children under six years of age were malnourished and 30 percent had diarrhea at any one time. In seeking cultural, social and economic reasons for the malnutrition, they found a dramatic correlation with factors that lead to a low per capita expenditure on food. With increasing age, incomes of fathers remained static because as untrained workers their value did not increase with age. But they had increasing numbers of children, and there was, therefore, a steady decrease in the amount of food money for each child. Just as steadily, there was a mounting proportion of malnourished children.
>
> Aguirre and Wray initiated a nutritional supplementation program simple enough and economical enough to be within the resources of the community, and this led to a drop in the

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[193] Ibid., page 110.
[194] Arthur R. Jensen. "IQ and Scholastic Achievement." Harvard Educational Review (Winter 1969), page 96.

incidence of both malnutrition and diarrhea. But there should be no underestimating the awesome difficulties of searching for the best answers among such tangled relationships. The number of children in a family may already be at insupportable levels, and another life saved would depress even more the amount of food-money per child. Indeed, the study revealed the desperate efforts of these people to limit the numbers of their children. But acting in ignorance, their efforts were often futile or tragic.

It is important to recognize that while health services have contributed to increased rates of population growth, they also have an essential role in limiting population growth. Walsh McDermott has described a fertility-mortality cycle in which high fertility leads to large numbers of children, often crowded into a setting of poverty and ignorance with a resulting high childhood mortality, which in turn sustains high fertility. He argues that reducing the death rate in small children is a necessary precondition for reducing fertility. McDermott's thesis has historical support. Fertility and infant mortality have always been highly correlated, and increasing evidence indicates that a lowered infant mortality must antedate lowered fertility. * * * *Improved health is a precondition to reduced fertility.*[195] [Emphasis supplied.]

Moreover, Bryant goes on to say—

The issue must remain unmistakably clear—it is morally unacceptable to the people of the countries involved to allow continued high mortality as a means of population control. Myrdal states this issue forcefully in the context of the problem of South Asia: "In facing up to their population problems and striving to formulate an appropriate policy, the South Asian countries are bound by one rigid value premise, which has important practical consequences: any attempt to depress population growth is restricted to work on the fertility factor. Complacency about or even tolerance of a high level of mortality because it slows population growth is simply not permissible. As a value premise, this is indisputably the basis for public policy in South Asia as it is elsewhere throughout the civilized world. All that can reasonably be done to combat disease and prevent premature death must be done, regardless of the effect on population growth * * *. As a moral imperative, this valuation is absolute. But as with all other categorical norms of ethics, it becomes a more relative precept when for its realization it must compete for scarce resources and then be placed in an order of priorities."[196]

In backward countries today, taken as a whole, [he continues] birth rates are rising, not falling; in those with population policies, there is no indication that the government is

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[195] Bryant, "Health and the Developing World," op. cit., pages 100, 102–3; Also described in: John H. Bryant, "The Gap between Modern Biomedical Technology and Health Needs in Developing Countries," *In* "Science and Technology in Developing Countries," (Cambridge University Press, 1969).

[196] Bryant, "Health and the Developing World," op. cit., pages 99–100.

controlling the rate of reproduction. The widely acclaimed family planning program of Taiwan may, at most, have somewhat speeded the later phase of fertility decline that would have occurred anyway because of modernization. Even so, the aim of the program is that women should have the numbers of children they want, a number that currently averages 4.5 children each. Even if social choices change and the Taiwanese women decrease their wishes for children to the United States level for 1966 of 3.4, this would yield a long-run rate of natural increase of 1.7 percent per year and a doubling of population in forty-one years.

Davis points out that the characteristics that make family planning acceptable are the very characteristics that make it ineffective for population control. By stressing the right of parents to have the number of children they want, it evades the basic question of population policy—how to give societies the number of children they need. By offering only the means for couples to control fertility, it neglects the means for societies to do so. *By sanctifying the doctrine that each woman should have the number of children she wants, and by assuming that if she has only that number this will automatically curb population growth to the necessary degree, the leaders of current policies escape having to ask why women desire so many children and how this desire can be influenced.*[197] [Emphasis supplied.]

Policy Issues of World Health—A Summary

In this section on what, in effect, is an approach to establishing a better dialogue between the international health profession and the people, Congress, and Government of the United States, an attempt is made to extract from the literature examples of how one might somehow close this very serious communications gap. The arguments from these examples is more convincing where the cost/benefit equation is obviously attractive, less convincing when questions of goals and management are raised, and difficult in connection with the population problems. But the international health literature shows that better cost/effective programs are being established as time goes on, that definitive goal setting and improved management practices are making headway in the less developed countries, and that there is some progress with the dilemma of health and population. On the latter problem it was pointed out (1) that developing nations can be expected to go through a transition of high population growth, (2) that in a Colombian community ignorance rather than indifference was the cause of failure to limit the size of families, (3) and that McDermott's thesis concerning improved health as a precondition to fertility control is biologically and historically sound.

While it is true that governments of poor countries which have population policies do not have very effective ones, it might be noted that any government of a rich or poor country which utilized coercion today to control the birth rate would very soon be out of power.

At any rate, until the countries understand and agree on the number of human beings which can be supported by the earth and its resources,

[197] Ibid., pages 101–102.

there seems little point in withholding medical assistance and advice to lesser developed countries on the grounds that the more lives we save the more lives there are. Obviously, one should expect some long overdue philosophical and educational assistance along these lines from non-medical sources. It is not the business of doctors to make social decisions simply because they know how to implement them.

U.S. Benefits From Increased Investment in World Health

It is difficult to present an explicit statement of the return to the United States taxpayer of a vigorously supported and expanding program of global preventive medicine under the aegis of the World Health Organization. The scope of the canvass is too large, and the options for improvement are too varied and detailed. However, a general statement of the proposition may be in order. Several lines of opportunity are given as illustrations:

1. Pockets of infectious and communicable disease exist all over the world—not only in the less developed countries but in the advanced countries as well. Under conditions of social disruption, floods, hurricanes, and other natural disasters, these pockets can become sources of world epidemics. Conversely, by a relatively modest investment in each case, they can be eradicated or controlled.

2. Heavy U.S. investment in capital equipment has for two decades gone to the less developed countries to advance their productivity. However, measured in terms of labor productivity alone, the dollar investment in the capital of public health has yielded higher returns.

3. Arrangements for global medical surveillance and early warning of the dangerous spread of disease have hardly scratched the surface. The benefits of a more thorough system of early warning, especially in influenza and the more lethal viruses, and of an ability to take prompt remedial measures of global control, seem obvious. More controls mean international surveillance, rapid identification, rapid vaccine development, and rapid application to susceptible populations.

4. Smallpox eradication, already a global campaign of WHO, could be brought to a much earlier and effective conclusion with additional funds and effort among the cooperating countries. This would be particularly valuable to the United States, which must now contend with the cost of protecting its people against this infrequent but dangerous, incurable, and highly infectious disease.

5. With the growing problem of medical education and increasing demands for health care in the developed nations there is need in the World Health Organization for a greater sharing of country experiences and experiments in the delivery of health service. It would appear that the United States could benefit greatly by evaluating some of the various systems of health care now in operation around the world.

6. The United States might benefit from a set of international standards and guidelines accepted by WHO on:

a. electronic medical diagnostic equipment
b. water and air pollution
c. methods of choice in the treatment of alcoholics and heroin addicts
d. safety and efficacy of drugs.

7. The United States would also benefit by a set of international standards agreed upon by WHO and the FAO (Food and Agriculture Organization) with respect to the amount of heavy metals to be permitted in edible foods.

8. Severe protein-calorie malnutrition does not exist with sufficient identifiable frequency in the United States to permit in-depth study of malnutrition on development, especially the effect of prenatal and postnatal protein malnutrition on early development and subsequent learning ability. WHO, FAO, INCAP have both the methodology and the observable populations at their disposal. Such studies are already underway, but the importance of the results on possibly impaired future physical and mental health justifies a greater international research effort. The economic considerations are important to developed and developing countries alike.

9. Populations for the study of groups and conditions resistant to certain types of cancer and heart disease are not available in sufficient numbers in the United States. The WHO International Agency for Research and Cancer at Lyons, France, is an example of a WHO effort which could be expanded on behalf of the developed nations. Cardiovascular diseases may deserve a similar international approach for the same reasons and for the same developed countries where degenerative diseases are among the leading causes of death.

V. Summary, Conclusions, and Comments

During the early history of man, famine, disease, and pestilence in combination were essentially global for the then known world. Pandemics raged on through the middle ages, at one time destroying up to a quarter of the population. With only a slight change in the prevailing biological conditions, the entire human race in Europe might have been eliminated.

Later, the provision of clean water and sanitary waste disposal, together with geographic climatic conditions unfavorable and favorable to the prevalence of disease vectors, divided the world into lesser and greater diseased parts. When this division was recognized, unorganized efforts were taken to isolate and quarantine people and materials against the introduction of disease from one area to another. By 1851, Nation-States began formal cooperative efforts to control the spread of communicable disease, but labored under the lack of knowledge and under the distorting influence of the special interests of commerce.

After some 50 years of continuing diplomatic efforts and gains in the understanding of the cause of disease, modest, non-intrusive international agreements were reached and a permanent organization was set up to manage the control of communicable disease on the part of the signatory nations. Two such organizations appeared on the international scene almost simultaneously, shortly after the turn of the 20th century. These were the Office of International Hygiene in Europe and the Pan American Sanitary Bureau in the New World.

The world in 1900 A.D. was a relatively small one, commercially, and so was its total human population. It was, however, relatively large in reference to the barrier protection offered by the oceans and the atmosphere, the limited amount of goods and people moving to and

fro, the slow speed of such movement, and the general agrarian dispersal of the population. Today the world is small in these latter respects, is rapidly becoming a unit, epidemiologically speaking, and urban sprawl threatens to renew the dangers which were inherent in the unsanitary conditions of the past.

International health institutions, the public health profession, individual nations in bilateral agreements, and the private foundations have attempted to keep pace with these explosive developments. The nature of the problems was such that most of these efforts have focused on large sections of a country, on large geographic regions, or on virtually the entire globe. All of the efforts have been temporarily interrupted by the great wars; conditions against which such efforts were aimed have been worsened by these wars.

Public health on a worldwide scale has yet to command the attention of governments which a global perspective of health would appear to require. The nature of the work is undramatic; the subject offers little in the way of political capital as do so many other medical topics. Disciplinary development and professional status for public health and preventive medicine are low compared with those of modern diagnostic and curative medicine in the United States and other developed countries. The public and its elected representatives may not be aware of the miracles which have been achieved in the field of preventive medicine; it was these, rather than the glamorous surgical and pharmaceutical inventions of recent vintage, which so dramatically changed the life expectancy of man. The world was made a relatively safe place in which to live and travel many years ago by the application of what now appear to be rather simple biological, medical, and engineering facts. Indeed, the techniques of preventive medicine have been so successful in developed lands that neither crisis nor controversy worthy of intensive political attention has emerged in recent years.

In the less developed lands, the power to improve human health at least cost still lies in the application of proven technology in the public health and sanitation field. Curative medicine in the poor countries has as much appeal as it does in advanced countries with large populations of people with various forms of degenerative disease, but there are lacking the medicines, the doctors, and the places in which to apply the cures. In many of these developing areas, the services of sanitary engineer, hydrologist, or geologist are more essential to permanent health gains than is the increased availability of doctors and clinics. Plant geneticists and agrarian reform, together with culturally adapted population policies, will contribute more at this time to a revolution in the health of some of the economically depressed countries than will the importation of modern medical technology.

The skills to prevent or control the spread of a new virulent "germ" lie in the now vast and potent technology embracing physical and chemical detection, microbiology, biochemistry, molecular biology, water treatment and rapid vaccine development. These are perhaps the more modern elements of preventive medicine. Some students believe that a resurgence of the preventive medicine and public health point of view will also prove to be the most incisive channels of exploiting modern biological knowledge on behalf of the degenerative diseases. Lederberg, for example, has noted the high cost of a cure of cancer after the fact, versus the application of existing knowledge

and of knowledge yet to be gained for preventing some forms of the disease in the first place.[198] Other experts have made similar arguments with respect to cardiovascular diseases.

The magic of health as a rallying point for international unity does exist to a degree but it is not as persuasive as some well-turned phrases would imply. Transnational medical work, of course, is performed with greater ease by private organizations (such as, for example, the hookworm eradication program of the Rockefeller Foundation), but multilateral institutions are necessary and might function almost as well if fewer reservations and restraints were imposed upon them. Thus the hypothesis is advanced that it may be the attitudes of member governments of international health institutions which are in need of change, as well as the priorities and management practices of the institutions themselves. The nations have experimented for 70 years with organized intergovernmental cooperation in the control of disease and more recently in the direct promotion of health. From agreement to agreement, it is generally held among health authorities that the member states have been overcautious and have either structured the organizations to protect their sovereign interests or have avoided full commitment to the regional or global health objectives which were formalized in the charter of those organizations.

When special circumstances kept member governments occupied with other important matters, so that the health institutions were left to their own devices, a great deal somehow was accomplished, even with very modest resources. The Health Organization of the League of Nations is an example of this. However, when relative bigness and increased authority prevail, as in WHO and PAHO, there is some anxiety about new international health regulations, concern over the high and growing costs of operations, and suspicion and fear that global health philosophies might challenge traditional health care systems of any given country. The pharmaceutical industry may be especially wary of resolutions and regulations affecting their products and their profits.

The WHO/PAHO arrangement grew slowly at first, adapted to many kinds of anticipated resistance and to some difficulties which were not anticipated—the cold war, the Korean conflict, the Vietnam war, and even to the situation in WHO's Eastern Mediterranean region. But the system of international health institutions flourished anyway and it continues to grow in worldwide influence. There are several reasons for this relative success:

1. There was work to be done; it was needed, as statesmen and doctors had agreed when they established prior conventions, offices, and organizations over a period of many years.

2. WHO has utilized diplomatic assistance both during the structuring of its constitution and in subsequent problem solving, but WHO is a professional, scientifically based, international complex. While all of its halls may not be decked with eminent scientists and physicians it still has them at its disposal. It appears to have followed at least two of the axioms of successful international technical enterprise:

a. *If scientists or engineers can render technical assistance to a developing country it can succeed best with good science at the helm.*

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[198] Joshua Lederberg, "Cancer 'Cure' Has Limitations," The Washington Post (February 14, 1971), page C–2. It is well known among dermatologists, for example, that an important reduction in the incidence of skin cancers of the most prevalent type could be effected by the simple expedient of shielding the body from the sun more carefully, especially in subtropical latitudes and in open-air occupations.

b. *If scientists of many nations find it necessary to pool their resources and talents on a global problem that transcends national boundaries, they will do well to be in control of the enterprise as a whole.*

3. WHO worked out solutions to some political and controversial issues, or refused to deal with others because they were political. It continues to function effectively even in the presence of unresolved political problems.

4. Its members are bound by treaty to support it at a budgetary level determined by the organization itself.

5. The member states honor their commitments to international health organizations today more than they did in the past. "On time" collections over the period 1958 to 1967 were over 96 percent.

The United States is the chief contributor to WHO and is also one of the chief sources of complaint—principally with its heavy share of the financial burden as matched against its lack of direct control over the WHO programs. A Report of the Comptroller General of the United States [199] was critical of WHO and many agencies connected with it. As a result the UN, the Department of State, and Health, Education, and Welfare have sought to improve WHO's fiscal and administrative practices. WHO itself recently set up a Headquarters Program Review Committee (HPRC).[200] But the climate in the Congress is cool, with the Federal agencies unable to change the apathy, the outlook, or the nature and extent of the dialogue. In addition, the Nation's health practitioners, researchers, and medical educators are very much preoccupied with their own problems. Indeed the entire tripod of support (government-industry-education)[201] essential to the success of any technically based enterprise is missing. Yet the United States abides by its treaty obligations to WHO. Through other channels, the United States provides additional support to both WHO and PAHO by means of voluntary contributions which more than double the amount it is obliged to provide under the United Nations scale of assessment. There is no doubt about it: For some reason the moral support for international health institutions as seen in the public record is extremely low-keyed, yet the overall level of financial support provided by the United States to the multilateral health organizations is actually quite substantial.

It is important that this multilateral support continue and that the level of it increase somewhat each year, because other forms of U.S. supported direct or related activities in international health have been extensively curtailed in recent years. With the exception of a few overseas laboratories operated by NIH and DOD, the activities of a number of Federal agencies relevant to health, and especially the health and sanitation work of AID, have been reduced to very small percentages of their earlier peak levels.

Recent trends reflect the deliberate movement of international health activities from bilateral programs to multilateral ones such as the United Nations Development Program and the World Health

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[199] "U.S. Participation in the World Health Organization." Report to the Congress by the Comptroller General of the United States. (Washington, 1968), page 1.

[200] Airgram from U.S. Mission Geneva, to the Secretary of State re: Information, Office of International Health, Department of Health, Education, and Welfare. December 24, 1970.

[201] Caryl P. Haskins. "Science and Policy for a New Decade." Foreign Affairs (January 1971), page 251.

Organization. Various studies have recommended this approach. In particular, President Nixon's initiatives along these lines appear to be based on the report of the Peterson task force,[202] the study group which was appointed by the President to advise him on the appropriate role of the United States in foreign assistance. The report repeatedly urged that bilateral assistance be decreased and that multilateral assistance be increased. The move in this direction has already started, beginning with the multilateralization of the malaria eradication programs—

> Current U.S. policy indications are for as rapid a thrust toward withdrawal of U.S. technicians as may be consistent with minimum determined staffing requirements. This will be carefully managed to avoid too precipitous withdrawal of U.S. staff with undesirable effects on the program and the individuals involved. A sufficient interim period is required for the necessary services to be transferred to an effective level of WHO financial and manpower resources; however, this need not be a long or difficult transition.
>
> While WHO budget development and approval are lengthy processes, WHO has a considerable field force already at work in country malaria programs, and host governments may have improved technical capacity reducing advisory needs * * *.
>
> A major trend in U.S. foreign assistance is toward reducing overseas U.S. personnel in bilateral assistance programs while encouraging increased responsibility of multilateral agencies for development programs. The worldwide malaria eradication program is a case in point * * *. A.I.D. fully supports this important effort. However, we now are looking to WHO to take greater responsibility for most technical assistance to host governments in their malaria programs.
>
> In conformance with the resolutions of the World Health Assembly for malaria eradication, WHO is already providing the greater part of the technical services requested by participating governments in this program * * *.[203]

Peterson's point that "a predominantly bilateral U.S. program is no longer politically tenable in our relations with many developing countries * * *,"[204] is partly undone by another reality, namely that the Peterson "approach is not certain to commend itself to Congress."[205] Certainly the hearings records examined during the preparation of this study show Congress to be clearly on the side of bilateral programs. For this reason one might be expected to dismiss a report like Peterson's, especially since it does not even mention international health institutions. But there is cause to continue along two lines:

First, and almost surely without knowing it, a good deal of the "thrust" of the Peterson report matches the mode of operation of the

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[202] "U.S. Foreign Assistance in the 1970's" op. cit.

[203] "A.I.D. Policy for Malaria Eradication—Multilateralization of Technical Services." Airgram Department of State, August 8, 1970. (Quoted in part.)

[204] "U.S. Foreign Assistance in the 1970's," op. cit., page 22.

[205] John Franklin Campbell. "What is to be Done?" Foreign Affairs (October 1970), page 97.

World Health Organization—"work out programs and performance standards with developing countries * * * establishing their own priorities * * * the [unrealistic] expectation of immediate results * * * policies and new technologies adapted to the local government * * * strengthening of local institutions * * * the principle that administrators are accountable for achieving objectives * * * restrictions on operations should be held to a minimum * * * all people, rich and poor alike, have a common interest in peace, in the eradication of poverty and disease, in a healthful environment * * *." [206]

Second, a key conclusion of the Peterson Report is its distinct turn away from the short-term, national interest, foreign policy orientation of past U.S. participation in international institutions:

> This country should not look for gratitude or votes, or any specific short-term foreign policy gains from our participation in international development. Nor should it expect to influence others to adopt U.S. cultural values or institutions. Neither can it assume that development will necessarily bring political stability. Development implies change—political and social, as well as economic—and such change, for a time, may be disruptive.[207]

If the national objectives of the United States as a member of WHO and PAHO are perceived within the philosophy of the above paragraph, it might be appropriate to consider a change in the Department of State as the prime mover of the U.S. administrative machinery for these organizations. The line of reasoning for such a change is as follows:

The expansion of national public health interests to global dimensions calls not only for diplomacy or statesmanship of the conventional type; it calls for worldwide experience with science, medicine, and public health as political systems themselves and for experts in the subject matter. The more reliance there is on multilateral organizations for controlling disease and assisting all the countries of the world in improving their state of health, the less need there is for a national or bilateral point of view. The more the health of the State becomes dependent upon the health of the world, the more the interests and technology of the State become blended into those of the world. If and when it appears that the only feasible approach to the problems of human health is indeed a worldwide approach, it will be necessary for knowledge to be shared and exchanged by those who are in possession of it and who by tradition and practice are used to sharing and exchanging it. The multilateral health organizations are simply institutional devices for encouraging this process in the international health profession.

For guidelines on what to change to, if the Department of State does not appear to be the logical home for the WHO and PAHO of the future, the following is a possible alternative for consideration:

Let it be supposed that the national objective of U.S. participation in WHO and PAHO is to protect Americans from disease from abroad by means of rational and accepted public health procedures.

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[206] "U.S. Foreign Assistance in the 1970's," op. cit., selected passages.
[207] Ibid., page 2.

Let a second objective be to attack those diseases endemic to the less developed countries and amenable to eradication or control by means of scientifically based sanitary and medical practices, and to mount such attacks in the common interest of economic and social progress of both the less developed countries and the United States.

Finally, consider a third objective to be to promote on a generally global scale the utilization of readily available and effective medical and engineering technology towards the improvement of the state of health of the human species.

If these objectives are a reasonable approximation of the American purpose in contributions to and participation in the activities of WHO, it may follow that the structure of policy and the working relations between the United States and WHO are a combined function of the Congress in general and of an expert Federal health agency in particular. *Technical assistance is technical and it is good or bad technically before it can become anything else.* As and if U.S. technical assistance in health matters becomes more concentrated in multinational health organizations, the greater the need will be to appraise its results and to apply American technical competence in that field.

The Department of Health, Education and Welfare might well be considered as the future and more emphatic focal point of technical documentation, planning, review, and analysis of issues in connection with U.S. participation in WHO, PAHO, and certain bilateral biomedical programs. DHEW successfully explains and defends a multibillion dollar program before the Congress, which includes overseas laboratories and grants. The extension of that performance to U.S. participation in international health organizations should not be beyond its capacity. By training, by affiliation, by professional contacts with counterpart experts around the world, the DHEW seems to be a logical Federal agency to establish and maintain a working liaison between Congressional appropriation committees and international health organizations to which the appropriations are made.

The World Health Organization is chartered to do a great deal about the health of human beings. It appears to be a satisfactory institution for arriving at international health priorities, even if it is often criticized for not stating categorically what these are. It provides technical assistance and advice to national health services where the need appears to be greatest, but those needs far exceed its resources.

The Regional Directors and Committees of WHO bring both demands and influence from their sections of the world. The World Health Assembly yields to this influence and supports the Secretary-General's program, which is in effect the sum of the regional requirements. The power of WHO's Secretariat, its Executive Board, and its Assembly far exceeds the amount of money which is acquired and dispensed each year by the organization. The funds which WHO spends to maintain its staff at Geneva and elsewhere and the amount it sprinkles around the world on activities it rarely has time to follow up on, is a drop in the international monetary bucket. The power of WHO is not in its budget but rather in the universality of its membership, the high regard in which it is held among scientific and public health people of the world, and its acceptance as the highest medical forum or final consensus of world medical opinion.

It would seem appropriate for the United States to utilize the authority of WHO and the power of its international voice in the support of national as well as international programs. This country has the resources, the systems skills, and the biomedical technology for making WHO a better institution than it now is. The United States can be the instrumentality for preparing and shaping WHO to manage the common global health problems of the future.

Yet WHO will shape nothing without stronger support than is now evident for international health institutions, in the Congress or at Secretarial levels in the Departments of State and of Health, Education and Welfare. The situation seems to be a most peculiar one for world health, namely, commitment without involvement. The United States is meeting its fiscal obligations to WHO and PAHO with very little organizational evidence as yet that it also intends to play a positive determinant role [208] in an area where American technical competence is at its best, where its presence is least offensive, and indeed where American leadership is fully expected by the rest of the world.

Perhaps there is need to mount an educational program so that a larger segment of the public is included in the discourse surrounding the issues of national and global public health. The status of the world's health might become a public issue; and that issue could stimulate scientific, medical, and economic debate. For in the United States, at least, debate is absolutely essential to both clarification and political action.

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[208] Ibid., page 2.

Chapter 11—Beyond Malthus: The Food/People Equation

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TABLES

CHAPTER 11—BEYOND MALTHUS: THE FOOD/PEOPLE EQUATION

I. Introduction

This study explores the interaction of science, technology, and American diplomacy in the extraordinarily complex problem of the changing balance between food and population in the less developed countries (LDCs) of the world. It shows how foreign affairs institutions of the United States Government have responded to the challenges of this problem. Analysis of this particular issue, it was assumed at the outset, would furnish clues to a better understanding of problems involved in the interplay of science, technology, and diplomacy in general.

The substantive conclusion of the study is that the growth of world population is outpacing food production, while available techniques are not being sufficiently applied to improve agricultural production and marketing efficiency on the one hand, or to slow the rate of population increase on the other. Achievement of a global balance of food and population calls for many explicit improvements in political, economic, social, and diplomatic organization and management to achieve stronger human motivation, to improve the acquisition and dissemination of pertinent information, and to design and implement coordinated social programs which can apply existing technology more effectively. Without all of these, the goal of balance will continue to recede with results that seem likely to be tragic.

Science and technology have had an increasingly significant impact on the modern world, penetrating deeply into the substance and conduct of international relations. Traditional modes of diplomacy may not always be appropriate to the resolution of international problems with a substantial technical content; diplomacy may need new capabilities to deal with such problems. There are encouraging signs that this development may in fact be taking place. The question is whether, in the particular issue at hand, it is proceeding fast enough and comprehensively enough. It seems clear that in devising programs to deal with both sides of the food/population balance, urgency is of paramount importance.

U.S. Stake in Resolving the Food/Population Problem

For some twenty-five years, through bilateral pacts and multilateral channels, the United States has been furnishing aid to the LDCs. Other developed nations have followed suit. U.S. motivation in providing development assistance has both humanitarian and political elements. These converge in the goal of fostering orderly political and economic progress, rapid and palpable enough to dissuade the people of the LDCs from destructively radical political solutions in their search for a better life. In the pursuit of this aim, the United States has made the largest national contribution to the modernization efforts of the LDCs. Total U.S. assistance to these countries, 1946–1970.

Note: This chapter was prepared in 1971 by Allan S. Nanes.

amounted to some $93 billion.[1] Food represents a significant portion of that total.[2]

Growth of Population versus Balanced Development

As long as hard-won expansions in food production are matched by population increase in an LDC, the outlook for balanced development and the future of development assistance will be dim. The fact is that from a global standpoint, population has tended to increase faster than food production in the years since World War II. If population increases too fast, it can halt economic development in the LDCs and even worsen conditions in these countries. Recognition of this fact has led in recent years to substantial funding of population-limiting programs by U.S.A.I.D.[3] If economic development becomes a kind of treadmill, with gains in production nullified by gains in population, development aid will have failed. The United States will then have spent many billions of dollars of foreign assistance to no lasting purpose. U.S. public opinion would probably not long tolerate such an outcome. Should runaway population growth lead to a termination of U.S. foreign assistance, the task of U.S. diplomacy in the underdeveloped world could become far more difficult than it already is.

On the other hand, while a solution of the food/population issue will not guarantee the success of U.S. and other development assistance programs, it would presumably enable the assignment of additional resources to other phases of development now receiving less attention. Today, a large investment of resources and technical skills is directed to the improvement of food supplies in preference to other sectors. If it proves possible to strike a balance between food resources and population, the LDCs should then be able to proceed with a better overall balance in their development programs. Such a result would be to their interest, as well as to the interest of the more affluent countries providing the assistance.

Whatever solution is found to the food/population problem, it is evident that it cannot be separated from the total process of development. An important conclusion of this study is that development is a seamless web. One cannot think exclusively in terms of the food/population equation. Rather the problem must be seen in the whole context of development as it relates to attracting investment, creating new jobs, training manpower in new industrial skills, improving public health, and all the other elements that go into the development process.

Scope and Limitations of the Study

The dual subject of this study introduces a great range of highly technical ramifications which cannot be fully explored. However the study does attempt to identify and put in perspective the most salient

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[1] U.S. Agency for International Development. "U.S. Overseas Loans and Grants. Preliminary F.Y. 1970 and Trend Data." Washington, U.S. Government Printing Office, 1970), page 2. (By comparison, the United States had spent some $120 billion on military assistance and action in Vietnam in the six fiscal years 1966–1971, plus an additional several hundred million dollars annually in economic assistance. The U.S. space program, military and civilian, up to the end of the fiscal year 1971, has cost an estimated $62.2 billion. See: U.S. Congress. Senate. Committee on Foreign Relations. "Impact of the Vietnam War." 92d Congress, 1st session. June 30, 1971. (Washington, U.S. Government Printing Office, 1971, 36 pages. Committee Print.)

[2] The total of U.S. assistance in food throughout the program is listed as $15,371,000,000.

[3] Expenditure for population and family planning programs under Title 10 of the Foreign Aid Act of 1961 is listed at $165,172,000 since 1965.

technical issues. To discuss the balance between two variables requires discussion of both. The study needs to deal with food, its availability, the qualities of foods required, and the technologies related to food production and distribution. It needs also to deal with population growth, the technology of birth limitation, and the motivations necessary to forestall the increasingly rapid expansion of population. And finally, the study must be concerned with the organizational concepts, plans, programs, and international arrangements to operate on these variables.

The technologies of food availability and birth control are discussed sufficiently to show their technical feasibility and to make it clear that the problem lies elsewhere. On the other hand, the enormous complexity of the human side of the problem—social, cultural, economic, religious, administrative, political, diplomatic—can only be touched on in barest outline. Enough is said, however, to demonstrate that the problem is real, but that its dimensions are potentially manageable, given concerted and determined cooperative effort among all nations concerned.

II. Defining the Food/People Equation In Developing Countries

The consequences of population pressure on insufficient food supplies are generally recognized. The technologies of expanding agricultural output and of exercising control within the family on numbers of progeny are sufficiently advanced to make famine generally avoidable. The problem of holding food and population in balance appears to lie elsewhere: (1) in stimulating public recognition of the need for concerted action, (2) in devising economic incentives for action, and (3) in developing political programs to make necessary actions feasible and acceptable.

The history of western civilization during the epochal events of the Industrial Revolution affords insufficient guidance for the countries now striving for development and encountering unprecedented pressures of population. The industrialization of Western Europe coincided with enormous emigration to the open lands of America, the expansion of American agricultural productivity, and the broad acceptance of a middle class ethic and living standard. Each developing country has its own special problems of balancing food and people; by and large the circumstances of the United States or Western Europe during the expansionist period of the Nineteenth Century do not apply.

Famine as Perceived in an Affluent Country

From the U.S. perspective of a national economy in which agricultural surpluses have been troublesome for more than half a century, it is hard to comprehend the causes, conditions, or consequences of famine. In the United States, virtually every factor contributing to famine is absent: Relative to population there is abundant arable land, well watered, favored by a long growing season, and worked by educated farm managers; production areas are connected with consuming markets by a network of railroads and highways; economic support is highly institutionalized in the form of farm credit, price supports, and producer cooperatives; farm technology (especially plant genetics, fertilizers, mechanization, and pest control) has been developed over a century of public and private investment and applied in a high-capital, low-manpower system of industrialized, electrified farms: the technology of crop storage is similarly developed in the form of grain elevators, deep-freeze lockers, drying chambers, packing houses, and wholesale warehouses, so that the food carry-over provides a secure guarantee of future supply.

Many of the human factors assuring an absence of famine conditions have developed gradually in the United States, from the earliest settlement of the new Continent. Although pockets of poverty and lagging regions persist, even in the face of many favorable elements,

famine conditions are rare and mass famine unknown. Not all Americans are well fed: Despite conditions of abundance, there are many persons whose dietary habits predispose them to malnutrition; others who are ignorant of what constitutes an adequate diet; and still others whose poverty denies them the means to buy adequate food. But as a general proposition, in the United States the pressure of population on food supplies appears to have been effectively dealt with by a combination of favorable circumstances, in which technology is an important element.

Habits of thought formed by the American experience have made it all too easy to assume that a facsimile of U.S. conditions (with perhaps some substitutions, like irrigation to correct a deficiency of rainfall) can be readily introduced into a given country to solve the problem of famine. Technological factors can be systematically tabulated:

Production technology
Transportation technology
Storage and preservation technology
Urban-rural balance
Market organization
Agricultural credit institutions
Managerial expertise

and systematically imparted to the famine-prone area. To a considerable degree, the assumption that it is enough to concentrate on these factors has been reinforced by European experience.

Achievement and Maintenance of Adequate Diet in Europe

The ability of an expanding population in the United States to feed itself was roughly paralleled in leading industrial states of Western Europe. In Great Britain and Germany, this ability was attained through a combination of improved agricultural techniques and large-scale imports from overseas. For example, "German agricultural production more than doubled and maybe even tripled in the nineteenth century," while Germany's population increased proportionately.[4] "With growing production German agriculture might have been able to provide bread for her ever-larger population. But the demand for higher-quality food, in the form of both finer flour and more meat, which meant the diversion of grain to cattle feeding, necessitated the import of foreign grain after 1871." [5]

The British similarly supplemented domestic food production with imports. The people of France, on the other hand, industrialized at a slower pace and, with a substantially larger portion of the population living on subsistence farms, were largely able to feed themselves. In the Far East, Japan supported a rapidly increasing population by intensive and skillful cultivation of the land and by extensive fishing operations.

The fact that the more heavily industrialized countries were relatively successful in meeting basic food needs appeared to run counter to early theories of the inherent inadequacy of food to sustain popula-

[4] Hajo Halborn. "A History of Modern Germany. 1840–1945" (New York. A. A. Knopf. 1969), page 372. According to Koppel S. Pinson, the region of "Bismarckian Germany" increased in population from 24 million to 68 million in the 19th century ("Modern Germany," New York, Macmillan, 1966).
[5] Ibid., page 371.

tions. The dynamic changes during the nineteenth century, through the development of transportation, massive emigration to the United States, the opening up of unused acreages of fertile lands in the American West, and the development of world trade in agricultural surpluses, all helped the industrialized nations to satisfy the needs of their populations for food. Countries like England and Germany could concentrate on the development of industry and on the furnishing of investment capital and services to other countries, secure in the knowledge that their populations could be fed on imported foodstuffs, particularly on cheap American grain.

The combination of these factors contributed to a sense of self-confidence that these nations need not fear that mass hunger would result even if their populations should greatly increase. But as a matter of fact, in most of the countries of Western Europe, populations remained relatively stable after 1900: After World War I, the populations of France, Sweden, and Ireland actually declined.

Only under the dislocations of war or revolution, or in the relatively less developed territory of Russia, were there even localized episodes of actual food shortage. When these occurred, as in Russia in 1891–1892 and in 1921–1922, they were not perceived as resulting from an excess of population over food supply.

However, the fortunate experiences in Western Europe and the United States obscure the fact that for most of the world, and most notably amongst the huge populations of Asia, the availability of food has been close to the bare minimum necessary to sustain life.

The Malthusian Hypothesis and Its Revival

When Malthus first published his *Essay on Population*, he proposed the poorly supported hypothesis that population increased geometrically (1, 2, 4, 8, 16 . . .) while food resources increased arithmetically (1, 2, 3, 4, 5 . . .). In the more fully documented later editions of his work, he abandoned this idea in favor of the more general assertion that population always tended to outrun food supply. If this theory was not borne out in Western industrialized society, there appears to be some evidence in support of it in the LDCs, where famines still recur with dismaying frequency.[6]

It is an easy assumption that the one missing factor that distinguishes developed countries from underdeveloped countries, famine-free countries from famine-prone countries, is technology. Technology enables expanded agricultural output and the control of numbers of progeny. Unquestionably, therefore, technology plays a powerful role in enabling a population to achieve and sustain a satisfactory food/population balance.

However, the conscious and deliberate balancing of food and population, and the systematic application of technology to agriculture (or to the limiting of population), are difficult policies to implement in a developing country. Many obstacles stand in the way. Among the most notable is the general deficiency in knowledge of the complex

[6] In India there were particularly severe famines in 1838, 1861, 1866, 1869, 1874, 1876–1878, and 1899–1901. In China, there were such famines in 1877–1878, 1887, 1889, and 1916. It is estimated that 5 million persons perished in the Indian famine in 1876–1878, and 9.5 million in the North China famine of 1877–1878. In such countries, where transportation and distribution systems are poorly developed, localized famines are likely to occur in any year.

factors involved. The processes of population growth are not understood. The statistics of food and population are poor. Even the techniques for disseminating improved technology are faulty. Under these conditions, the negotiation of positive diplomatic arrangments and the task of planning programs to achieve the goal of food/population balance tend to be unsystematic and episodic.

It may well be true that people in poor countries, with short life spans, have strong motivation to reproduce: To perpetuate their own families, and to assure old-age protection for themselves, are strongly engrained cultural drives. The availability of technology and the hope of material betterment do not seem sufficient to moderate this motivation. External efforts to aid in the control of the birth rate in a poor country may be met with suspicion and resentment. This combination of factors constitutes an exacting challenge to diplomacy.

Weaknesses in the Fundamental Data on Food and Agriculture

Agricultural production in the LDCs tends to be largely for subsistence. Since the product does not enter channels of trade, and is not concentrated, it is difficult to gather reliable information on the amount of food actually produced in such a country. There is also a deficiency of information concerning storage, credit, transport, farm organizations, marketing and trade, and agricultural manpower requirements. In assisting an LDC in planning an agricultural development program, such information is essential, but constructing an organizational framework to provide it is a long and costly undertaking.

Some other informational shortcomings relative to food production in the less developed countries were described by Dr. Joel Bernstein, Assistant Administrator for Technical Assistance of AID:

> * * * We are impressed by the need for a great deal more knowledge of such elemental subjects as soil and water as they are found in the developing world. Without exhausting the list, one can cite needs for better mapping, more soils analysis, greater knowledge of the interaction of soil and water, better methods of water management. We really know next to nothing about how to farm productively in the humid tropics, where a systematic study of soil and water relationships is only one obvious need.[7]

Other authorities have pointed out that the new high-yielding seed and plant varieties were developed within and for given ecological and climatological conditions. It has been possible to transfer the results over a wide area geographically, but a somewhat narrow one with respect to ecology and climate. Additional information is needed if the area of transferability is to be increased, not only within the limits already defined, but for the development of new genetic stocks suitable to the climatic and ecological conditions of the areas where they are to be grown. The need for information means, of course, a need for research—specifically, for what is known as adaptive research directed to solving urgent and pressing problems, as opposed to that type of research which simply increases the sum total of human knowledge. The subjects for adaptive research in agriculture, according to J. George Harrar and Sterling Wortman of the Rockefeller Foundation, are:

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[7] "The Changing Role of American Technical Assistance in Agricultural Development." Public lecture before the Cornell Workshop on Some Emerging Issues Accompanying Recent Breakthroughs in Food Production" (March 31, 1970).

The development of food crop varieties that have the greatest productive capacity under local conditions and are resistant to the major pests and pathogens which commonly threaten the productivity of local varieties; the identification, through studies of soils, soil and water management, and performance of crop varieties, of practices that will maximize yields in each season of each region; the determination, through studies of the physiology of plants, of nutritional requirements, and how these can be satisfied; and studies of the quality of harvested products and means of improvement.[8]

When the comments of Drs. Harrar and Wortman are added to those of Dr. Bernstein, the weakness of the data base relating to food production is thrown into sharp relief.

Greater knowledge of the relationship of these factors, individually and collectively, to the stimulation of agricultural production could be most useful to development planners and administrators.

Despite great gains in the twentieth century, knowledge about human nutrition—the requirements of diet—is seriously incomplete. There are many variables: Persons engaging in hard manual labor require higher caloric intake; persons with recurrent fevers need high protein intake; different regions have various cultural preferences in diets; there are many geographic differences in the kinds of foods available; standards of quality and food sanitation differ widely; and so on. Statistics cannot readily accommodate all these variables, and simplifications tend to lead to facile interpretations.

Weaknesses in the Fundamental Data on Population

There is a general lack of adequate population statistics in the LDCs. Data on such basic matters as birth rates, death rates, marriages, and internal migration—all of them necessary to formulate a fundamentally accurate description of a country's population—are often less reliable than they need to be. More sophisticated data are even less likely to be reliable, if available at all. A report to the Federal Council for Science and Technology, prepared by the Ad Hoc Group on Population Research, noted that improvements in the techniques of measuring and estimating population size and composition and of recording births, deaths, and population changes were research areas of immediate concern to the Agency for International Development (A.I.D.).[9] That agency has the responsibility for administering Title X of the Foreign Assistance Act of 1961, as amended, which concerns U.S. programs of assistance to the LDCs in the field of population and family planning. The fact that A.I.D. is interested in further research along the indicated lines in itself suggests that available data are unsatisfactory.

Despite the intense public interest in the subject, the Ad Hoc Group found knowledge and understanding of the economic, social, and political consequences of the high rates of population growth and density in the LDCs seriously inadequate. Much additional information is needed on the economic and social correlates of demographic growth and change. The direct and indirect effects of the increased size and rate of growth and changed composition and distribution of popu-

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[8] In Clifford M. Hardin, Jr., "Overcoming World Hunger" (Englewood Cliffs, N.J., The American Assembly, Columbia University Press, 1969), pages 95–6.

[9] "The Federal Program in Population Research." July 1, 1969, Parts I and II, pages 425–541, In U.S. Congress. Senate. Committee on Labor and Public Welfare. "Family Planning and Population Research, 1970." Hearings before the Subcommittee on Health on S. 2108 and S. 3129. 91st Congress, 1st and 2d sessions (Washington, U.S. Government Printing Office, 1970), Appendix E.

lation on the administrative capabilities and political behavior of the LDCs also need further exploration. Finally, there is a need for data on the impact of population growth on the natural environment and the quality of life in the LDCs. This information must come from many different fields of knowledge and research.

Knowledge of the determinants of population growth, according to a summary of a panel discussion at a recent Symposium on the Food-People Balance, held under the sponsorship of the National Academy of Engineering, is "scanty" and lacking in hard evidence to support the various hypotheses. The summary declared that there was an—

> * * * incomplete understanding of those causal factors which affect parents' desires and motivations for additional children. It is clear that, in a general way, the birth rate is negatively correlated with such indices as income, education, and perhaps nutrition. Beyond these general correlations we know very little about the effects of more specific variables on the birth rate.[10]

These comments seem to suggest that both the Malthusians and the critics of the Malthusian hypothesis lack substantial evidence to support their views.

Technical and Cultural Barriers to Birth Control

Although there was some recognition within the U.S. Government. virtually from the outset of its development assistance programs, that modern sanitation and health techniques would lower the death rate and lead to rapid population increase in the third world,[11] little if any emphasis was placed on the possible consequence. Instead, public policy was geared to the improvement of agricultural techniques—to increasing the quantity and enhancing the quality of agricultural products. This country was prepared to teach the less developed countries the newest agricultural methods (appropriate in the United States), and to help provide them with adequate facilities for food processing and distribution. But it was not psychologically and morally prepared to discuss with them the delicate question of limiting their population growth.

Since it is only in the past few years that the consequences of unchecked population growth have generated substantial public concern, the unwillingness of political leaders in the United States to consider programs of population growth mitigation abroad probably accorded with domestic political realities. President Eisenhower at one point explicitly rejected dissemination of birth control information to other countries as being an inappropriate activity for the U.S. Government. In response to a question from the press as to whether the Draper Committee, then studying foreign aid policy, had recommended the inclusion of birth control aid, he declared that he could not "imagine anything more emphatically a subject that is not a proper political or governmental activity or function or responsibility."

> We do not intend [the President went on] to interfere with the internal affairs of any other government, and if they want to do something about what is admittedly a very difficult question, almost an explosive question, that is their business. If they want to go to someone for help, they will go unquestionably to

[10] National Academy of Engineering, "Symposium on the Food-People Balance. Panel on Interactions between World Food and World Population. Summary Report" (Washington, D.C. April 29, 1970), pages 1, 10.

[11] U.S. Congress. House, Committee on Foreign Affairs. "Point Four. Background and Program." 81st Congress, 1st session (Washington, U.S. Government Printing Office, 1949), pages 3, 5.

professional groups, not to governments. This government has not, and will not as long as I am here, have a positive political doctrine in its program that has to do with this problem of birth control. That is not our business.[12]

Although the President's statement received considerable public attention, and dismayed proponents of family planning, it does not appear to have provoked any general public criticism. The population explosion had not then commanded general awareness, and a program to supply birth control information to the LDCs might well have encountered the same adverse public reaction as that voiced by the President. In addition, although specialists in economic development were certainly aware of the negative impact of rapid population growth on the development of the LDCs, introduction of birth control and family planning assistance into the foreign aid program would have been a radical departure not readily adopted by those with policy responsibilities, particularly in view of the President's opposition.

U.S. caution toward dispensing birth control information to developing countries was matched, in varying degrees, by the caution with which the LDCs addressed the problem. Few had instituted family planning programs, campaigns, and clinics by the late 1950s, and in even fewer were such activities being pressed with real energy and resourcefulness. The idea of limiting family size ran counter to the social, cultural, religious, and economic patterns prevailing in much of the underdeveloped world; governments of these countries were understandably hesitant to go forward with programs of this nature, and indeed in some instances were actively opposed to doing so.

Even had the United States been willing to raise the question of population growth with the LDCs, the practical results that might have been achieved in the early days of foreign aid would probably have been insignificant. Advanced methods of contraception—such as, for example, the oral contraceptive ("the Pill") and the intrauterine device ("the IUD")—were not in wide use until the decade of the 1960s. Previous methods of birth control had been termed in 1961, by the President of the Royal Institute of Biology, "so crude as to be a disgrace to science in this age of spectacular technical achievement."[13] Even today, physicians and other scientists continue to express disagreement over the safety of the oral contraceptive, the effects (intended or other) of the IUD, and the enormously complex chemistry of the process of conception. These uncertainties have been communicated to the general public, and reinforce social, religious, and cultural resistances to family planning and general birth control.

Much is still unknown about human reproductive processes. Many anomalies in this branch of physiology remain unexplained. A major research effort has been urged in such fields as the rhythm method of conception control, the synthesis and screening of candidate antifertility compounds, and the physiology of sperm generation.[14] Dr. John

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[12] "Public Papers of the Presidents, Dwight D. Eisenhower, 1959" (Washington, U.S. Government Printing Office, 1960), pages 287–288. However, President Eisenhower reversed his stand in 1965, when he came out in favor of measures authorizing the Government to cope effectively with the need to slow down and then stabilize the world's population growth.

[13] As quoted in Committee on Labor and Public Welfare. "Family Planning and Population Research, 1970," hearings, op. cit., page 37.

[14] See for example, the testimony of John Rock, M.D., professor emeritus, Harvard Medical School. Dr. Rock, author of "The Time Must Come," has long advocated legitimizing birth control methods and information. In "Family Planning and Population Research," op. cit., page 448.

Rock testified at hearings of the Subcommittee on Health of Senate Committee on Labor and Public Welfare that there are many anomalies in the field of reproductive physiology that still remain to be worked out.[15] For example, more is known about the process of sperm generation in the rat than in man.

If the food/population problem in the developing countries is to be brought under control, there must be strong motivation for couples to limit the number of their children. Mere expressions of general interest in the idea of fertility control will not suffice. For example, surveys have been made which suggest that 70 percent of the women interviewed were interested in controlling the size of their families,[16] but experience indicates that this does not mean that all of these women will use family planning services if they are made available. Presumably the same applies to men. In any event, there is little information on incentives and inducements for birth control in the LDCs, particularly where strong motivation is necessary to overcome cultural barriers to contraception.

Among other behavioral matters in which additional data would be helpful are the following: the sociopsychological aspects of male-female interaction; socioeconomic factors affecting human behavior relative to marriage, fertility, and migration; and social processes leading to cultural change. Human behavior is, after all, the most critical factor in maintaining a balance between population and available food resources, and indeed in the whole development process.

Summary Statement of the Food/Population Problem

An examination of the background of the changing food/population balance in the developing countries suggests that the interaction of technical, social, and political factors has obscured until quite recently the gravity of the problem. The United States, whose policies are of particular concern to this study, furnished both technical and material assistance to increase agricultural production in the LDCs but balked initially at furnishing information which might have helped arrest population growth. The less developed countries, for their part, seemed to deal with the problem of population growth in a desultory and inadequate fashion, where they dealt with it at all.

The problem of achieving a relatively stable balance between food resources and population in the less developed countries is one of enormous complexity. It has biological and medical aspects relating to the development and employment of safe and effective methods of contraception. It involves decisions about basic economic questions such as the allotment of resources, manpower needs, the use of incentives, and the establishment of channels of distribution. It calls for the modification of cultural and social values that have existed, in some cases, for millennia. It affects the internal politics of the developing countries, and adds to the strains on their relatively weak administrative machinery. It tests the effectiveness of communications techniques

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[15] Ibid., page 448. It should be noted that not all areas in the LDCs are areas of high population density. The existence of large uninhabited areas within their boundaries is one of the reasons why leadership elements in some LDCs either oppose family planning or take a lukewarm attitude toward it.

[16] National Academy of Engineering. "Symposium on the Food-People Balance. Panel on the Interactions Between World Food and World Population," op. cit., pages 10–11.

and training methods. It requires the development of irrigation systems, intensive use of fertilizers, and in the view of many experts the development of new crops even more responsive to fertilizers; this in turn involves research in plant genetics. The depredation of food supplies by animal and insect pests must be brought under control. Improved food preservation techniques need to be developed. Disease, which cuts down the caloric efficiency of ingested foods, must be fought, so that ill health does not diminish the supply of manpower during a planting season, or cause the loss of a crop. In many instances a market economy must be developed where none existed before.

What needs to be done is virtually endless, and it is all interconnected. This interconnection of very many diverse elements is characteristic of the entire modernization process in the underdeveloped countries, and the solution of the food/population equation is simply a specialized model of that process. As Roger Revelle has pointed out, if the food/population ratio is to be brought into balance it means virtually changing a whole way of life.[17] This is the implication of overall economic development as well.

Yet whatever the social and political barriers to mounting a vigorous attack on the food/population problem, the lack of technical means to deal with the problem effectively needed to be overcome first. Until introduction of modern agricultural techniques resulted in increased food production by means of the "Green Revolution," the rate at which food production increased could not keep pace with the rate at which population increased. The rate of population increase, in turn. could probably not have been effectively curbed with the techniques of contraception then available. Had the technical means not been found for effecting revolutionary increases in food production—and in the absence of a drastic decline in the birth rate—the danger that the underdeveloped world would sink into chaos (as some have predicted) would have been greatly increased. As matters now stand there is at least a chance that development aid, abetted by a skillful and flexible diplomacy and working in conjunction with science and technology, may prevent such a tragedy. This combination could help to bring about a reasonable equilibrium between population and food resources in the so-called third world.

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[17] Remarks at "Symposium on the Food-People Balance," held by the National Academy of Engineering, Washington, April 29, 1970, op. cit.

III. Meeting Food Requirements of Developing Countries

Human dietary requirements are a complex and incompletely researched subject. However, it is not necessary to consider refinements of modern dietary science in dealing with problems of gross malnutrition in the poor countries of the world. The specific need for minute quantities of trace elements and vitamins which usually accompany a sufficient and varied diet is of trivial importance in a region barely surviving on meagre resources of grain and less meat.

These dietary requirements may be viewed as a pyramid of food components of which calorie content (mainly supplied by sugars, starches, and fats) are at the base; proteins or "amino acids" (mainly supplied by animal products like meat, fish, poultry, milk and eggs) are next; and the vitamins and minerals (supplied in part by the foregoing, and also by fresh vegetables and fruits) are at the apex. Food concentrates and supplements have been developed for most of the known human dietary requirements, but only the most basic ones are relevant for this study.

This section of the study will consider, for each dietary component, the consequences of a deficiency, the quantities required to overcome present deficiencies, and the technological options already available or in prospect. The gist of the discussion is that for each category of foodstuffs there are technological means available for providing an adequate diet for the present and for the foreseeable future, but that the problems of doing so, and the consequences of doing so without taking other measures on the population side of the food/population balance, could have serious disadvantages economically, socially, politically, and internationally.

The political and diplomatic aspects of the food problem are developed in the next section of the study.

Defining Calorie Shortages of the LDCs

The most immediate and obvious kind of food shortage is that of energy-providing elements. Sugars, starches, and fats provide a population with human energy; they are the fuel of human labor.

VARYING NEEDS FOR FUEL-FOODS

To determine the calorie requirements of a nation it is not enough to establish an optimum quantitative diet for a standard individual and then multiply this by the numbers of population to be fed. Individual needs differ widely, being influenced by such variables as age, sex, physical size, occupation, health condition, and deep-seated dietary preferences. In formulating policies to achieve sound nutritional conditions in the LDCs, governments must take account of these variables.

A New York longshoreman, of greater height and weight than his East Indian counterpart, will probably require more food to perform his work efficiently. He may well require more simply not to feel underfed. Differences like these point up the difficulty of measuring food shortages in strictly quantitative terms. Furthermore, quantitative shortages are accompanied by qualitative deficiencies. Not only are the people of the LDCs undernourished, they are malnourished as well.

Despite the difficulties in obtaining accurate data, "all authorities are agreed that in most countries in Africa, Asia, and Latin America today the average food consumption falls considerably short of the optimum desirable from the point of view of the health, as well as the efficiency, of the worker." [18] According to the Third World Food Survey of the Food and Agriculture Organization of the United Nations, at least 20 percent of the population in the LDCs received too few calories, while about 60 percent received diets that were of inadequate nutritional quality (that is, their diet was deficient in other components than calorie content—mainly in proteins).[19] The FAO and others concerned with the world food problem can make statements like these because, despite all the variables, it is possible to measure a person's requirements for calories in relation to the work he does. Empirical studies already performed have been helpful in formulating these requirements.[20]

Physiological effects of calorie deficiency were explored in an experiment in starvation which took place in the U.S. during World War II. In this experiment 32 volunteers lived for 24 weeks on a diet of only 1,800 calories a day, with reduced amounts of protein and other nutrients. A decline was soon noticed in the muscle tone and the endurance at work of these volunteers; it continued, along with a loss of body weight, throughout the experiment. At the end of the 24 weeks of semistarvation, muscle strength of the subjects had been reduced by almost 30 percent, and precision of movement by 15–20 percent. Their cardiovascular systems also performed with reduced efficiency. It was also observed that the effects of malnutrition in this particular experiment were more severe, and occurred earlier, than in areas where the population is chronically undernourished and has managed to adapt to that state.

The FAO, through its Committee on Calorie Requirements, has attempted to define levels of caloric intake, depending upon an indi-

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[18] United Nations, Food and Agriculture Organization (FAO), "Freedom from Hunger Campaign. Basic Study No. 5. Nutrition and Working Efficiency" (Rome, Italy, 1962), page 3.

[19] Cited in: "The World Food Problem." A Report of the President's Science Advisory Committee, Vol. II: Report of the Panel on the World Food Supply, May 1967 (Washington, U.S. Government Printing Office, 1967), page 5.

[20] Thus, during and after World War II it was observed that, when German miners in the Ruhr were provided with a daily ration of 4,500 calories, 2,200 were necessary for the maintenance of the body's metabolism, while the remaining 2,300 were available for work. On these 2,300 work calories the miners turned out 1.9 tons of coal daily, or slightly under 1,200 calories per ton. By 1942 these miners had only 1,700 work calories in their diet, and coal output was diminishing. When for some time only 900 work calories were available the workers lost weight. In 1944 the miners had 1,900 work calories, and mined 1.65 tons per day, which again averages out to approximately 1,200 work calories per ton of coal. In a German steel mill which escaped wartime bombing, it was possible to trace a pattern of declining production coinciding with a decline in caloric intake. In 1939, on a ration of 1,900 work calories daily, a worker turned out 120 tons per man per month. By 1944, on 1,150 work calories daily, the same man produced less than 80 tons of steel per month. In both cases, a decline in food consumption resulted in a reduced output in proportion to the caloric intake. United Nations, Food and Agriculture Organization, "Nutrition and Working Efficiency," op. cit., pages 14–15.

vidual's degree of activity. It set up a theoretical individual, called "Reference Man," who is 25 years of age and healthy, weighs 65 kilograms, and lives in the temperate zone where the annual mean temperature is 10 degrees centigrade. Using these standards, a person in a sedentary occupation would need 2,800 calories a day, one whose work made him moderately active would need 3,200, and one doing heavy work would need 4,400. Of course, these are approximate reference points. Within each occupational group there are wide variations in the energy expended to do some particular task. Furthermore, conditions within occupations vary from one country to the next. For all groups, however, inadequate food consumption reduces working efficiency.

FOOD AND METABOLISM

The quantity of basic energy foods an individual can use effectively is determined in part by the amount of protein available to him. Protein provides the "building blocks" of the body—the muscle and sinew that must be replaced when work wears them out. The body compensates for a lower protein intake by reducing the breakdown of its own protein, and an equilibrium is established between protein intake and protein destruction at a lower level than would be the case with a more balanced diet. The effect of protein deficiency is an inability to expend energy at a high rate or to perform strenuous work for a protracted period of time without a loss of weight and perhaps even damage to health. People in the LDCs who subsist on an unbalanced diet tend to avoid prolonged physical work which might cause a breakdown in their precarious metabolic equilibrium. However, since they do less work, they require less of the fuel-foods as well. But the effect is to cut down their physical productivity.

While chronic undernourishment (insufficient energy-food) and malnutrition (unbalanced diet, mainly protein shortage) do not constitute famine, there have been instances in recent years in which food shortages either threatened or actually reached famine proportions. In the mid-1960s, the failure of the Indian monsoon to bring adequate rainfall occasioned a sharp decline in Indian cereal production and India reached the brink of famine.[21] U.S. food stocks eased the crisis, although even these supplies were not as plentiful as they had been in the past. The civil war in Nigeria brought starvation to the Biafran faction. Toward the close of World War II, the exigencies of war brought actual famine to the people of parts of The Netherlands. Real famine, however, is the exception rather than the rule. Generally speaking, hunger is endemic in the LDC, but starvation is not. They need more food, and more especially a better balance in their diets.

Although all elements of diet are important, the first step in overcoming food shortage is to deal with the problem of nourishment—literally, to ease the pain of hunger. The most important sources of high-calorie foods are wheat, rice, and other grains. It is here that some of the most spectacular steps are already being taken, through the introduction of new, high-yield genetic strains.

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[21] U.S. Congress, House Committee on Foreign Affairs, "The Green Revolution, Symposium on Science and Foreign Policy." Proceedings before the Subcommittee on National Security Policy and Scientific Developments of the 91st Congress, 1st session, December 5, 1969 (Washington, U.S. Government Printing Office, 1970), pages 213–214.

Technological Opportunities Opened by Plant Genetics

The hopes of the world that the food/population crisis might be nearer a solution were raised considerably with the advent of the "Green Revolution." The Green Revolution has been defined by Barbara Ward Jackson as "the new farm technology based on hybrids, water, and fertilizer which can double and treble food and work for the world's developing peoples." [22] But Lester Brown, who has been closely identified with the Green Revolution, warns that this "breakthrough" "foreshadows widespread changes in the economic, social, and political orders of the poor countries." [23]

The Green Revolution began in Mexico in 1943 with a cooperative program between the Rockefeller Foundation and the Mexican Government aimed at improving Mexican wheat production. A number of years later the so-called "Mexican wheats" were developed, wheats with a short stiff straw that could stand up with the added load of grain resulting from the application of fertilizers. The first to produce a sturdy short-strawed wheat were actually the Japanese, and seeds from their strains were brought back to the United States, where they were used in wheat-breeding programs at Washington State University. World record yields were produced with these seeds in the irrigated and high rainfall conditions of the Pacific Northwest. Eventually these strains were sent to the Rockefeller team in Mexico, where further experimentation produced a variety of dwarf wheat adaptable to a wide variety of growing conditions. The Mexican wheats began the process of the Green Revolution in yielding redoubled harvests by responding to water and fertilizers.

Recognizing that rice, rather than wheat, is the staple of much of the underdeveloped world, the Rockefeller and Ford Foundations joined to establish the International Rice Research Institute at Los Baños, in the Philippines. Organized in 1962, the Institute produced results within two years. Two strains, IR5 and IR8, also with a short, stiff straw, demonstrated that they too could hold a heavier yield without falling over before the grain was ripe. Like the Mexican wheat, the new rice when properly managed can double the yield of the old. It is more responsive to fertilizer than the old rice seeds, and it has a shorter growing cycle. IR8 matures in 120 days, whereas old varieties took 150–180 days. This means there is time during the year to plant an extra rice crop, or some other crop altogether. Thus the potentialities of each acre of land throughout the rice growing area of the tropics have been dramatically increased.

The same cooperative program of the Mexican Government and the Rockefeller Foundation which had developed the new high-yield wheat applied the same methods to research on corn, another staple food of the LDCs. Although less spectacularly successful than the new wheat and rice, nevertheless corn yields have increased significantly.

Successes of the Green Revolution

Revolutionary increases in agricultural production resulting from the introduction of the new varieties of wheat and rice have occurred in many countries. Mexico, a country whose population has doubled

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[22] Comment quoted on rear dust jacket of: Lester R. Brown, "Seeds of Change. The Green Revolution and Developments in the 1970's" (New York, Praeger Publishers, 1970).
[23] Ibid., page 6.

since 1943, has been able to satisfy its requirements for the production of wheat and corn since the mid-1950's. As progressively increased acreages are planted in the new varieties, further gains are hoped for. Department of Agriculture experts estimate that roughly one-sixth of the total wheat acreage in West and South Asia is planted with the new wheats. It is also estimated that approximately seven percent of the riceland in South and Southeast Asia is used for growing the "miracle" rice.

TABLE I.—EXPANSION OF ACREAGES IN HIGH-YIELDING GRAIN VARIETIES—SELECTED COUNTRIES*

[In thousands of acres]

Crop year	Wheat	Rice	Total
1965–66	23	18	41
1966–67	1,542	2,505	4,047
1967–68	10,173	6,487	16,660
1968–69	19,699	11,620	31,319
1969–70	24,664	19,250	43,914

[1] Most of the wheat and all of the reported rice area was in South and East Asia; of the 1969–70 total for both, 59 percent was in India and 20 percent in Pakistan. Limited areas of high-yielding wheat have been planted in west Asia, north Africa, and Latin America.

*Source: "Indexes of Agricultural Development, Less Developed Countries, 1970," May 1971. Foreign Economic Development Service, U.S. Department of Agriculture, cooperating with U.S. Agency for International Development, page 13.

It must also be remembered that the available data reflect changes in yield for only one crop. But the shortened growing cycle, permitting two and even three crops a year, should further enhance agricultural productivity. In Taiwan, for instance, general agricultural productivity increased 300 percent between 1950 and 1965, as a result of both the adoption of improved rice, and the planting of more than one crop in each growing season.[24]

From the standpoint of plant breeding, the Green Revolution is still going on. A locally developed high-yield rice called ADT–27 has been produced in India, while Ceylon has come up with a variety known as H–4. Scientists are working on wheats that will increase yields under low rainfall conditions and rices that can tolerate flooding. A new variety of rice also developed by the International Rice Research Institute, IR (or TN) 20, has shown rather promising results in Vietnam. More effective seeds are constantly being produced. The new wheats thus far have increased production in Asia as a whole by an estimated 20 percent, and the new rice has increased production by an estimated nine percent.[25]

The Incomplete Promise of the Green Revolution

There is no question but that the breathtaking statistics of the new genetic science of grains offer hope to the hungry peoples of the developing world. Sufficient food for the world is possible for perhaps the first time in history. But, as the American poet, Walt Whitman, warns: "Now understand me well—it is provided in the essence of things that from any fruition of success, no matter what, shall come forth something to make a greater struggle necessary."

[24] Ibid., page 41.

[25] Quoted in: "The Green Revolution. Symposium on Science and Foreign Policy." Proceedings before the Subcommittee on National Security Policy and Scientific Developments, op. cit., page 6.

The essence of the new strains of wheat, rice, and corn is that they yield their abundance by responding to water and fertilizer; these must be provided. Fewer hands are needed on the farm, with the new crops, so work must be provided elsewhere for those no longer required to plant, tend, and harvest. Crops must be protected from pests and decay, delivered to markets, and sold to hungry populations who must somehow secure the means to buy. Capital and credit, organization, and employment for the displaced farm workers are needed in order to translate opportunity into actuality. In particular, adequate credit arrangements are essential to support the development of the infrastructure of modern agriculture.

THE PROBLEM OF WATER

To produce up to their potential, the new seeds require intensive application of water in carefully controlled doses throughout the growing period. Reliance on the vagaries of natural rainfall, even in monsoon Asia, is not enough; irrigation is essential. In most Asian countries, about a quarter to a half of the rice lands are irrigated.[26] For the success of the Green Revolution, additional irrigation facilities are needed. The present alternatives are big dams and irrigation canals or small tube wells drilled locally.

Indian and Pakistani farmers have installed thousands of tubewells (a tubewell is a cylindrical shaft driven into the ground), and have bought thousands of pump sets, both electric and diesel. The advantages of these small-scale irrigation schemes are that they can be set up rather quickly, take much less capital per unit of irrigated land than the large dams, take less land out of production, and can be controlled better from the user's side. From the standpoint of an overall development plan, however, it is difficult to administer and control these schemes; their construction and operation require a large amount of foreign exchange. Furthermore, as the FAO points out, control of exploitation may be difficult if small-scale irrigation facilities are operated by private interests.[27]

Large-scale irrigation facilities bring huge tracts of land under irrigation at one time. They make possible large planned increases in agricultural production. But they take great amounts of capital, often straining or unbalancing the investment capacity of the developing nations. The Mekong River development plan, for example, which covers a broad area in Laos, Cambodia, Vietnam and Thailand, would require $2 billion dollars. Invested over a 20-pear period, it would amount to about one-third of the annual national income of the four countries concerned, and would exceed the annual new investment of all the countries of Southeast Asia combined.[28] Furthermore, large-scale projects take a long time to be finished, with no benefits to the local agriculture while construction is going forward. For example, 72 major irrigation projects were undertaken in India between 1951 and 1965, covering a total of 13.4 million hectares. However, only a

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[26] Clifton R. Wharton, Jr. "The Green Revolution: Cornucopia or Pandora's Box?" Foreign Affairs, (April, 1969), page 465.

[27] United Nations, Food and Agriculture Organization. "Provisional Indicative World Plan for Agricultural Development." Vol. 1 (Rome, Italy, F.A.O., August, 1969), page 60.

[28] Wharton, "The Green Revolution: Cornucopia or Pandora's Box?" op. cit., pages 465–6.

fourth of this area was being irrigated by 1966.[29] The FAO suggests that wherever possible large irrigation schemes should be constructed in increments which can be completed and brought into operation sequentially.[30] But Brown notes that Asian finance ministers are beginning to encourage small-scale irrigation financed by individual farmers to reduce pressure on the government's budget.[31] To expand production in Pakistan by the use of wells and pumps in the dry season is cheaper than to build the flood-control works necessary in the wet season.

Whatever methods are used to increase irrigated acreage, the distribution of irrigated land is still highly uneven, and the total acreage far from adequate. Increasing population pressure on food supplies inevitably means increasing pressure on water supplies as well. The efficiency with which water is used will be an increasingly important determinant of the whole food supply. That is why a solution to the irrigation problem is vital to the ultimate success of the Green Revolution.

THE PROBLEM OF FERTILIZER

Chemical fertilizers are another key element in the Green Revolution. The new cereal varieties require large applications of fertilizer to produce their enormously increased yields. Increased use of fertilizers is needed to obtain high yields in areas of high population pressure, where opportunities for the expansion of arable land are limited. The larger the investment in the irrigation or mechanization of agriculture, the greater the need for fertilizer use. Fertilizers widen the opportunities for crop diversification. They can help bring soils of very low natural fertility into production. Indeed, the expanded use of fertilizers is foreseen not only for food crops, but for industrial crops, and for the modernized cultivation of grasslands under high tropical rainfall.

But there are several bottlenecks to the expanded use of fertilizers. First, the poor countries must be able to produce sufficient fertilizer domestically, or import it at reasonable prices from abroad. Technological development of a process of synthesizing ammonia from atmospheric nitrogen has given the developed countries an excess fertilizer capacity. New potash fields in Canada, in the Mediterranean area, and elsewhere are expected to meet world needs for centuries to come. With supplies plentiful and prices down, the situation would seem made to order for the LDCs to expand their imports of fertilizer from the developed countries. But the LDCs have been increasing their use of fertilizer at the rate of 16 percent a year, and their foreign exchange resources will not support this rate of increase. Foreign assistance can help fill this gap, or the countries involved can try to develop their own capabilities to produce fertilizer. The latter option, however, means that the LDCs have to import raw materials, manufacturing equipment, and technological skills, which imposes a further strain on their foreign exchange reserves. One solution has been to encourage multinational corporations to invest in fer-

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[29] Brown, "Seeds of Change," op. cit., page 26. A hectare is a little less than 2½ acres.
[30] Food and Agriculture Organization of the United Nations, "Provisional Indicative World Plan for Agricultural Development," op. cit., page 60.
[31] Brown, "Seeds of Change," op. cit., page 27.

tilizer plants in the LDCs. Both the United States and the World Bank have exerted pressure in this direction, with a favorable effect on India, for one example. However, other countries are less able to strike an effective balance between imports and domestic production. Lacking the ability either to produce or buy essential fertilizers, an LDC can only look on while other more fortunate countries advance by rapid strides to exploit the Green Revolution. Potentially, at least, the situation threatens to divide the LDCs into two new categories of have and have-not nations.

THE PROBLEM OF FARM MECHANIZATION

One of the consequences of the Green Revolution is that heightened agricultural productivity provides a margin of return that enables successful farmers to replace manpower with machines to increase still further their manpower productivity and incomes. There is much scope for this in the LDCs where more than 90 percent of the labor is agricultural (compared with approximately five percent in the United States). But if agricultural workers are replaced by machines and throng to the cities to join the already massive numbers of unemployed, a new problem will have been created.

The advance of agriculture in the developing world is also held back by deficiencies in machinery to work the land. There are times when adequate mechanization might make a critical difference, as in seedbed preparation, sowing, and harvesting. Additional inputs of human labor and animal draft equipment will not do the job as fast at these crucial times. But at the same time, as already suggested, extreme care must be exercised as to the manner in which additional mechanization is introduced, to avoid substantial displacement of agricultural labor.

Among the tasks for which the FAO experts suggest that mechanization is appropriate are land clearing, including leveling; ploughing and seedbed preparation to allow early planting for increased yields; other cultivation work such as subsoiling, chisel ploughing or stubble mulching; threshing; transport; and pumping water for irrigation. The FAO suggests that such measures could actually increase overall labor requirements since manpower released from one operation could be utilized in some other work for which it was better suited in the farming system as a whole. Among these would be better weeding, more frequent crop protection operations, pruning, more careful irrigation, and improved marketing of produce.[32]

How selective mechanization might actually create jobs is illustrated in the case of irrigation. Traditional methods of irrigation do not supply enough water for the new seeds to yield their maximum crops, and are quite expensive. The introduction of a diesel-powered pump not only cuts costs tremendously but also makes more water available for production. Increased supplies of water mean increased production. In turn, new land has to be prepared, planted, fertilized, weeded, harvested, and threshed, and each of these operations requires more

[32] Food and Agriculture Organization of the United Nations. "Provisional Indicative World Plan for Agricultural Development. Vol. 1," op. cit., page 177.

labor. If multiple-cropping becomes possible on this land, the demand for labor could be doubled or even trebled. In addition, mechanization should theoretically provide work in maintenance and spare parts services—i.e., in the establishment of rural workshops making simple parts, tools, and implements—leading eventually to the domestic manufacture of farm machinery.

The upshot of selective mechanization, as seen by Lester Brown, is that:

> The conventional wisdom that farm mechanization is labor-displacing and therefore undesirable in countries with large numbers of unemployed no longer holds. Selective mechanization can be employment-creating.[33]

This optimistic statement is tempered by the admonition that farm mechanization can be an invitation to social chaos if the benefits and costs of only the richer farmers are considered. Disaster can ensue if mechanization is not selective, and does not encourage intensive use of labor. If tractors, gang plows, cultivators, and combines are imported to bring American-style "factories in the field" to the LDCs, many already unstable countries may find their internal stresses unmanageable. Yet the situation varies from country to country, and where an LDC is actually faced with a declining farm labor force, mechanization may have to be faster and on a broader scale than in a country whose farm labor force gives every indication of continuing to grow.

THE PROBLEM OF PESTS

Agriculture in the LDCs is particularly prone to infestation by pests, both before and after the food has actually been harvested. Insects, rodents, birds, and rot take a toll of food resources, even in the developed countries. How large a loss is hard to estimate; it varies with the type of pest involved, the crop, the season, the time of infestation, and the particular agro-climatic zone in which the damage took place.

In 1965, for example, the U.S. crop losses were estimated at $9.5 billion, $3.7 of which was attributed to insects and nematodes, $3.3 billion to disease, and $2.5 billion to weeds. In 1968 the Indian Food and Agriculture Ministry estimated that rats devoured almost 10 percent of India's grain production, and other estimates put the figure at 12 percent. The FAO cites a figure of 15–20 percent pre-harvest loss of potential cereal production in India due to insect pests, plant diseases, and parasites. The figure for fruits, vegetables, pulses, and oilseeds is set as high as 25 percent. Six different authorities have estimated that total crop losses from pests during the decade of the 1960's was somewhere between $30 and $60 billion dollars, with a leaning toward the higher figure. H. H. Cramer, a German expert in this field, set the total at a minimum of $70 billion, in 1965 prices. Table 2 gives a graphic presentation of the extent of crop losses because of insect pests, diseases, and weeds, in both the developed and underdeveloped regions of the world.[34]

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[33] Brown, "Seeds of Change," op. cit., page 105.

[34] Source: Food and Agricultural Organizations. "Provisional Indicative World Food Plan." Vol. 1, op. cit., page 207.

TABLE 2.—LOSSES OF POTENTIAL CROP PRODUCTION BY REGION*

Region	Actual value (million)	Potential value (million)	Percent losses due to—			Loss as percent of potential value	Value of lost production (million)
			Insect pests	Diseases	Weeds		
North and Central America	$24,392	$34,229	9.4	11.3	8.0	28.7	$9,837
South America	9,276	13,837	10.0	15.2	7.8	33.0	4,561
Europe	35,842	47,769	5.1	13.1	6.8	25.0	11,927
Africa	10,843	18,578	13.0	12.9	15.7	41.6	7,735
Asia	35,715	63,005	20.7	11.3	11.3	43.3	27,290
Oceania	1,231	1,707	7.0	12.6	8.3	27.9	476
U.S.S.R. and People's Republic of China	20,140	28,661	10.5	9.1	10.1	29.7	8,521
Total	137,439	207,786	12.3	11.8	9.7	33.8	70,347

*Source: Food and Agricultural Organizations, "Provisional Indicative World Food Plan," vol. 1, op. cit., page 207 .

Obviously the developing countries must deal effectively with the problem of crop destruction by pests, or much of the upward thrust of the Green Revolution will be lost entirely. Indeed, the Green Revolution itself, by simplifying the agro-ecosystem, may actually create more favorable conditions for pests. New high-yield varieties may lack resistance to indigenous insects and diseases. The extension of irrigation, the greater use of fertilizers, and other modern methods foster higher and more reliable yields, but at the same time can bring about an increase in pests, diseases, and weeds. Double-cropping merely compounds the problem. Chemical agents in great variety are available to combat the depredations of pests. There are insecticides, fungicides, and materials for rodent control. Indications are that except for campaigns against locust-breeding areas, the use of these chemicals has been more for curative than preventive purposes. Further, the emphasis has been more on the protection of industrial and export crops than on domestic food crops. This situation may change as the small farmer becomes more knowledgeable and as advisory services are made more widely available. In the long run the problem will be to control crop losses in the fields without creating serious ecological problems. A great deal of research is necessary to develop cheap and effective crop protection agents which can be applied without the risks to the user or the environment that accompany so many of the present pesticides and insecticides. Research could also focus on the development of genetic resistance to plant diseases, the introduction of predators and parasites of the main insect pests and rodents, and sterilization of the male in some species of pests.

Effective crop protection will also require large-scale experimentation to test the results of research in operation and to work out their costs and benefits. Demonstrations will be necessary so that farmers can learn to use new methods and products developed by research. The extension services of the developing countries can help in these activities and in the organization and execution of pest surveys and control schedules. In general, the chances for effective pest control will be enhanced by strengthening the ministries of agriculture in the LDCs, and by encouraging the farmers to act jointly for the protection of their crops.

Crops also need protection after harvesting, which calls for the design and construction of better storage facilities. Rats, insects, and other pests do much of their damage in the primitive facilities available in the LDC's. Many existing storage facilities offer little protection from tropical rains, which can ruin the harvested grain. It is possible to construct storage bins or warehouses that are ratproof and refrigerated, and can be fumigated with nonpersistent insecticides which are not released into the environment until they have lost their toxicity. It would seem quite important that modern food protection and storage techniques be adopted in the LDCs. The greater the urban population, and the farther that population is from the location of food sources, the more important the need for utilizing such techniques.[35]

At present, the less developed countries will have to rely on simple food-preservation techniques. These involve better designed and more efficiently operated storage facilities—preferably serving whole communities—and more widespread use of well-known methods such as sun-drying, pickling, and preservation with sugar. More sophisticated methods can be introduced as general economic conditions improve.

The widespread adoption of the new seed varieties poses the possibility of heavier losses due to disease and infestation. Previously farmers selected their own seeds, so that neighboring farms might have two or more strains growing simultaneously. This diversity provided a certain built-in protection against widespread plant diseases, because all varieties are not equally vulnerable. But the new wheat from Mexico, which has been introduced in a wide belt running from the Middle East through India and Pakistan, involves only a small range of genotypes. The appearance of some new type of wheat rust in any part of this vast region could cause massive crop damage, since it would involve an entire area, all planted with essentially the same strain.

This potential hazard can be reduced in several ways. One is a diversified breeding program which can more or less regularly come up with new varieties. This should be supplemented by a capable and well-organized plant protection service which can identify serious outbreaks and move promptly to stop them. The prime responsibility

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[35] Other methods of food preservation are dehydration, refrigeration, heat sterilization, radiation, fermentation, brining, and smoking. Dry foods, often preserved by natural field curing in the sun, have traditionally constituted a major food resource and can be expected to do so in the future. They need to be protected from spoilage, rodents, insects, and spillage. Protection can probably be provided more efficiently in larger storage centers, operated either under private ownership, by cooperatives, or by the governments. Refrigeration makes it possible to transport perishables over great distances and also extends their shelf life. The problem with respect to widespread refrigeration is one of cost, including improved highways and rail systems. Increasing urbanization in the LDCs may make it more feasible economically to install cold storage units in warehouses or markets. For the time being, however, it appears unlikely that refrigeration will be adopted on a very broad scale in the LDCs. Heat sterilization in hermetically sealed containers (canning) also appears to be too costly for widespread adoption by the LDCs. Glass or plastic containers may prove acceptable substitutes. Radiation treatment is another potentially useful technology for preserving food and controlling insects.

here rests with the developing country, but the aid-giving countries and the multilateral agencies which have promoted the agricultural revolution need to give attention to the problem as well.[36]

THE PROBLEM OF MARKETING

How do the benefits of the Green Revolution reach the ultimate consumer? How is the farmer to be rewarded for his increased crop yield? At present the marketing systems in the countries which have been the beneficiaries of the new seeds are simply unable to cope with the situation. In 1968 India's wheat harvest was 35 percent greater than any previous record, and the storage transport, grading, and processing operations were all unable to accommodate the surplus. The local market intelligence system was similarly overwhelmed. In one year the number of acres planted in the IR–8 rice in West Pakistan rose from ten thousand to almost one million. The country had an exportable surplus of rice, but no facilities to process it efficiently for the export market. In the Philippines the fast-maturing rice must now be harvested during the monsoon and dried in mechanical driers. It is no longer feasible to let the rice dry in the sun. Countries which imported large amounts of U.S. grain in the 1950s and '60s and geared their distribution networks to moving grain inland may now find those systems obsolete. On the other hand, such older systems as had served to move food from the countryside to the cities have tended to atrophy with disuse. India, Pakistan, and Indonesia have particular problems of this type.

An adequate marketing network requires an adequate transportation system. The more agriculture in the LDCs turns from subsistence to commercial enterprise, the greater this need becomes. In recognition of this fact, one of the most favored development projects for at least a decade has been the farm-to-market road. Both AID and the World Bank have loaned hundreds of millions of dollars for such projects to develop domestic markets, to link the hinterland with port cities, and to reach world markets. Sometimes a road built for another purpose can open up a market to the products of agriculture. A case in point is the highway from Bangkok to Korat, in Thailand. Built essentially to give the military quick access to Thailand's northeast, where Communist guerrillas are active, the highway was important in making Thailand a major exporter of corn because it linked large areas of fertile soil with Bangkok and the world market.

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[36] The simplified ecology implicit in the Green Revolution presents a serious question as to long-range global security. If agricultural production is reduced to a few genotypes, any pest that consumed one of these and that did not succumb to man's chemical controls could wipe out all the crops of a nation or a continent. Such events have happened in the past (the Irish potato famine, for example), and simplified genetic strains increase the probability that they will happen in the future. The best protection against such a catastrophe is a global early warning system to sound the alarm and set in motion the cooperative efforts of plant pathologists and agronomists of all countries. In his Laureate address on receiving the Nobel Peace Prize, Norman E. Borlaug, the agronomist who heads the International Wheat Research and Production Program of the International Maize and Wheat Improvement Center in Mexico City warned: "The only protection against such epidemics, in all countries, is through resistant varieties developed by an intelligent, persistent, and diversified breeding program, such as that being currently carried on in India, coupled with a broad disease-surveillance system and a sound plant pathology program to support the breeding program." This, he said, could help to "checkmate any important changes in the pathogens." (Norman E. Borlaug, "The Green Revolution: For Bread and Peace." Bulletin of the Atomic Scientists (June 1971), page 43.)

Storage, grading, and market intelligence must also be handled efficiently if a marketing system is to be satisfactory. The lack of adequate storage facilities contributes to wide seasonal price fluctuations, costly to small farmers. This same lack can have national consequences. For example, Iran was forced to export some of her bumper wheat crop in 1968 because there were inadequate facilities for storing it. Some storage is also essential for such inputs as fertilizers and insecticides.

Grading systems are important because they give buyers and sellers a comman point of reference and thus can speed the sale of large amounts of grain. Grain can change hands in vast quantities in the United States without being seen by either buyer or seller, because the elaborate grading system provides a standard that is thoroughly understood. In contrast, grain sales in India may consist of no more than a few sacks, which change hands after prolonged negotiations, with the buyer personally feeling, smelling, and perhaps tasting the product. This type of primitive transfer system obviously hampers the full realization of the benefits of the Green Revolution.

Finally, there is the matter of market intelligence. A country can have a surplus of food in one area and a deficit in another, even if it has an efficient transportation system. A developing country needs information on possible export surpluses lest it export too much or be overcautious and export too little. Thus market intelligence can be a very important adjunct to the process whereby an LDC earns foreign exchange, a vital part of the total development process.

THE PROBLEM OF TASTE

It is a particular irony of the Green Revolution that the extra food made available by the high-yielding seeds should meet with consumer resistance. There have been widespread complaints about both the taste and the texture of the new wheat and rice. Research now in progress is focused on the mundane question of cooking and milling properties of the "miracle grains."

Dealing with Shortages of Protein in the LDCs

Probably the most important of the qualitative deficiencies from which the LDCs suffer is the shortage of protein, a class of compounds essential to life.[37] Protein is a generic term for a group of nitrogenous compounds, the amino acids. Protein is essential to the maintenance and growth of the human body, as body protein is continually breaking down and must be resupplied. The need for protein is strongest in preschool children, and pregnant and nursing women. Yet according to AID the typical child in a less developed country usually gets the poorest food in the family. This is because of a common notion that he is able to digest only bland foods, and because most mothers in these countries know nothing of the nutritive value of foods nor how to prepare them so as to retain their nutritional value.

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[37] U.S. Agency for International Development. "The Protein Gap. AID's Role In Reducing Malnutrition In Developing Countries" (Washington, U.S. Government Printing Office, 1970), page 7.

It is essential that the diet contain *enough* protein; it is also essential that the protein consist of an approximate balance among the eight amino acids essential for humans: isoleucine, leucine, lysine, methionine, phenylalanine, tryptophan, threonine, and valine. These amino acids must be supplied through food intake, as they are not manufactured by the body.

HIGH-PROTEIN FOODS

Foods which best supply essential protein are animal products—meat, poultry, fish, cheese, and eggs. Animal protein in general contains a proper balance of the essential amino acids. Plants are less satisfactory as sources of protein, because they do not synthesize and store balanced proportions of the different amino acids. However, approximately five-sixths of the world's population has to obtain its protein supply from plants—that is, from the cereal grains wheat, rice, and corn.

Table 3.—Protein content of selected food staples

Food staple	Protein content (percent)
Pulses:	
Lentils	24.7
Chickpeas	20.5
Wheat (hard red spring)	14.0
Sorghum	11.0
Wheat (soft red winter)	10.2
Corn	8.9
Rice	7.5
Potatoes	2.1
Sweet potatoes	1.7
Bananas	1.1
Cassava	.6

*Bernice Watt and Annabel Merrill. "The Consumption of Foods" (Washington, U.S. Department of Agriculture, 1963), pages 66–67.

Animal foods are costly to produce, costly to transport, and difficult to preserve in tropical climates. Of the 25 million tons or so of high-quality animal protein available annually, most is consumed by the one-sixth of the world's population that lives in the prosperous, developed world. In consequence, more than 300 million children in the LDCs are exposed to threat of retardation in their physical and mental growth and development.[38] When these children become adults, their potential may have already been blighted by malnutrition. Many contract kwashiorkor, a protein-deficiency disease that strikes children particularly, but also assails other vulnerable groups—pregnant women, nursing mothers, and the elderly. Severe kwashiorkor tends to be fatal; even a mild case may weaken the child to the extent that other normally-minor diseases, like gastro-intestinal infections or whooping cough, can be fatal. The irony of kwashiorkor is that those afflicted may have had enough to eat, in terms of calorie intake, but not enough essential protein.

EASING THE SHORTAGE OF PROTEIN

To deal with the persistent shortage of protein in the LDC diet many alternative approaches are offered. The U.S. began this effort during World War II by supplying surplus dry milk powder, first to the

[38] United Nations. Economic and Social Council. "Report of the Advisory Committee on the Application of Science and Technology to Development." (New York, 1968.)

United Nations Relief and Rehabilitation Administration (UNRRA) and later to the United Nations Children's Fund (UNICEF). Under the "Food for Peace" program, additional quantities of surplus milk powder were turned over to UNICEF for payment of shipping charges only. The work of UNICEF, important in terms of saving lives and preventing malnutrition, also spotlighted the new techniques in food processing which made possible the transportation and long-term storage of large quantities of mild protein. These, in turn, stimulated an effort to employ technology to develop alternate sources of protein.

NEW PROTEIN SOURCES

One result of the search for alternate sources was the development of a product known as CSM, a mixture of corn meal, soy flour, and non-fat dry milk. The research leading to the production of CSM was sponsored jointly by AID, the American Corn Millers' Federation, the Department of Agriculture, and the National Institutes of Health. It was first shipped abroad in 1966, and has been distributed not only by UNICEF but by various voluntary agencies and by the Government under the Food for Peace program. By the autumn of 1969 a billion pounds of CSM had been sent overseas, and it was being used daily by 40 million children in over a hundred countries.[39] It was particularly suited to children, and could be mixed with flour in the preparation of local foods in widely separated countries. Containing about 20 percent protein, CSM supplies the child with about half of his required daily nutrients. Fortunately it enjoys wide acceptance in the LDCs.

Another high-protein food, wheat-soya blend, was developed with AID assistance. Shipments of this food commenced in 1969.

FORTIFYING FOODS

The creation of new, protein-rich foods and beverages is one method of attacking the protein shortage of the LDCs. Another is the addition of amino acids, protein concentrates, vitamins, and other essential trace nutrients to staples like bread or milk. Addition of vitamins A and D to milk, the "enrichment" of bread, and the addition of iodine to salt to prevent goiter have long been practiced in the developed countries. What is new, as far as the developing countries are concerned, is that technical progress has made it economically feasible to fortify low-protein foods which are the prime constituents of the diet of millions of people in Asia, Africa, and Latin America. Two of the essential amino acids, lysine and methionine, can be synthesized at a relatively low cost. The addition of even a small amount of lysine to wheat flour significantly improves the nutritive value of that flour, and of bread baked with it.

At the present time India carries on the biggest lysine fortification program in the world. Wheat flour, fortified with lysine and Vitamins A and B, is made into bread at government bakeries. Under the name of "Modern Bread," this fortified product is sold for the same price

[39] U.S. Agency for International Development. "The Protein Gap. AID's Role in Reducing Malnutrition In Developing Countries," op. cit., page 10.

as unfortified bread. Advice from AID and the Department of Agriculture played a role in the decision of the Indian government to fortify bread as a step toward improving the national diet. AID also gave technical help in establishing the new bakeries, as did Canada and Australia, while the Netherlands donated 20 tons of lysine to get the venture underway. The Indian government's target for 1970 was 100 million loaves of "Modern Bread," which would add 1,000 tons of protein a year to India's national diet. If competitive private bakeries also fortify their bread, the supply of protein will be increased accordingly. The figures do not sound like an impressive gain when divided among a population of some 550 million—less than one ounce per person per year. However, it should be recognized that (a) what is added is a highly concentrated protein, (b) it reaches those in urban areas needing it most in the least costly form, and (c) it establishes and gains acceptance for an institutional procedure which can be almost indefinitely expanded.

Another source of additives is vegetable protein concentrates, such as those produced from oilseeds. World production of oilseeds yields some 22 million tons of protein a year. According to the Economic and Social Council of the U.N., "no other single source of unconventional protein could contribute so greatly and promptly toward closing the protein gap." [40] At present the protein produced from oilseeds is used mainly for animal feed; it can create a flavor problem, and since it does not grow in the tropical climate of many of the LDCs it would have to be imported, thus adding to the drain on slender foreign currency reserves of so many underdeveloped countries. Research in food technology is needed, however, to develop products with wide acceptability. Among the various methods available to supplement deficient diets are the following:

Use of peanut or soya protein isolates (concentrates) to extend milk supplies;

Flavoring and coloring of bland vegetable protein concentrates to simulate bacon, beef, chicken, and seafood;

The addition of fish protein concentrate to many vegetables and grains in cooking;

The addition of soya flour or soy protein concentrate to wheat flour.

Another projected source is single cell protein (SCP), research on which is now underway throughout the world. SCP is said to offer "the best hope for major new protein supplies independent of agricultural land use." [41] Some of these new protein sources can utilize inexpensive sources, such as hydrocarbons from petroleum, natural gas, or vegetable starch.[42] Others can use photosynthesis. Despite the great potential of SCP, most experts believe it will be anywhere from 10 to 25 years before it can be processed into foods suitable for human consumption.

One problem with fortified foodstuffs is that they may not reach the peasants in the back country who grow and process their own food.

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[40] U.N. Economic and Social Council. "Report of the Advisory Committee on the Application of Science and Technology to Development," op. cit., page 12.

[41] Ibid., page 13.

[42] See, for example, George A. Doumani. "Protein from Petroleum." *In* Extension of remarks of the Honorable John Wold, Congressional Record (October 29, 1969), pages E9126–E9127.

The distribution of "Modern Bread" in India is a case in point. Only about two percent of the country's population, mainly in the large cities, has the means or opportunity to buy this fortified product. Distribution techniques in other underdeveloped countries are unlikely to be more sophisticated. Consequently more fundamental approaches to the protein malnutrition problem are also under consideration.

Another problem is that of taste. Some of the protein supplements, like some of the new strains of wheat and rice, are unacceptable to the deepseated cultural preferences of those who need them most, or are incompatible with traditional cooking practices.

EXPANSION OF TRADITIONAL PROTEIN SOURCES

Emphasis on new protein sources should not obscure the fact that important gains are possible through more intensive exploitation of long-established protein food sources. Production can be expanded in meat and poultry. Fish resources can be substantially increased, both ocean and inland, through extensive fishing and intensive fish farms. The protein content of grains, while neither abundant nor balanced, is nevertheless an important source.

The next stage for some LDCs might be a poultry and livestock boom. In terms of both cost and technology it is likely that poultry production, particularly of broilers, will undergo the most rapid expansion. Livestock production cannot be expanded so readily. Nevertheless the World Bank, AID, and the Inter-American Development Bank have made substantial loans for livestock improvement, both in Latin America and sub-Saharan Africa. Exports of U.S. breeding cattle doubled in value between 1964 and 1967, mostly to Latin America. The Green Revolution, where it has made a country self-sufficient in cereals, has stimulated agricultural diversification. This in turn can lead to the production of high-protein foods for the home market and for export, provided the developed countries are ready to import more grain and other foods from the LDCs.

The Protein Advisory Group of the FAO notes that estimated world production of fish has almost trebled in the past two decades, from less than 20 million tons to almost 60 million tons as of 1968.[43] It sees an estimated peak of about 120 million tons by the mid-1980s. However, the developing countries have so far enjoyed little of this expansion. The Protein Advisory Group also cites the fact that many of the remaining unexploited stocks of fish lie close to developing countries, constituting good prospects for new viable fishing industries, which will help provide a fairer distribution of fish protein in the future.[44] In a previous study in the series on Science, Technology, and American Diplomacy, George A. Doumani has called attention to the importance of aquaculture as a source of fish protein.[45]

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[43] United Nations. Food and Agricultural Organization. Protein Advisory Group. "Lives in Peril: Protein and the Child" (Rome, 1970), page 47.

[44] Ibid.

[45] U.S. Congress. House. Committee on Foreign Affairs. "Science, Technology, and American Diplomacy: Exploiting the Resources of the Seabed." Prepared for the Subcommittee on National Security Policy and Scientific Developments of the . . . by George A. Doumani, Science Policy Research Division, Congressional Research Service. Library of Congress, July 1971. See vol. I, p. 464.

In contrast with the more optimistic assumptions of FAO are the views of Paul and Anne Ehrlich, and J. H. Ryther. These authors contend that to obtain more than 100 million metric tons of fish would require the harvesting of plankton, which they judge infeasible in the foreseeable future, if ever. Ryther, a marine biologist, points out that in many areas, one-fourth to one-half of fish production is taken from estuaries, many of which are being rendered unproductive through pollution.[46]

Quantitatively, cereal grains still remain the most important source of protein for the developing countries. Every 100 million tons of cereals generally provide 8 to 10 million tons of protein. Since current world protein production is estimated at 85 million tons, it is evident that cereals can make an important contribution to the world's protein needs. The FAO has set a target of 112 million tons of protein as the world's requirement by 1975, so that a gap of 27 million tons needs to be closed in five years.

Achievement of the FAO target seems likely to require intensive utilization of all traditional protein sources, and more vigorous exploitation of new ones. It should be noted that there is also the possibility of genetic manipulation of crop varieties to improve plant sources of protein. Just as new strains have been developed to increase overall productivity, so is the augmentation of protein content believed amenable to the genetic approach.

The same general problems that obstruct increased food production also stand in the way of eliminating the protein shortage. The loss of protein foods to pests must be curbed, and improved storage and marketing facilities must be developed. These, in turn, require ongoing programs of research and training in agricultural science and technology, food processing, and nutrition.

Vitamin Deficiencies and Corrective Measures

Although less dramatic than the protein shortage, the existence of vitamin and mineral deficiencies in the diet patterns of the third world cannot be ignored. The intake of certain vitamins is directly related to caloric intake, and is vital to energy metabolism. Moreover, all vitamins are associated with health and human productivity.

THIAMINE

For example, thiamine, which is important in the prevention of beriberi, is found principally in cereal grains, as far as the diet of people in the LDCs is concerned. Its content can be reduced by processing or cooking; hence, from a nutritional standpoint, it is important to consider methods of conserving it or of enriching food with it. All wheat flour shipped from the United States under the foreign donation program is now enriched with thiamine, among other elements. Because of the direct relationship between calorie and thiamine requirements, the projected thiamine need for the next 15 years will be of the same magnitude as that for calories.

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[46] Paul R. and Anne H. Ehrlich. "The Food From the Sea Myth." Saturday Review (April 4, 1970), pages 53, 64.

RIBOFLAVIN

Riboflavin is necessary for growth. It is found in foods widely consumed in both developed and underdeveloped areas, principally legumes, milk, eggs, meat, fish, and vegetables. Cereal products which are consumed in such large amounts in the LDCs do not have a high riboflavin content; so once again fortification is used. Like thiamine, riboflavin is added to U.S. flour under the foreign donation program.

NIACIN

Niacin is necessary to prevent pellagra, but the measurement of man's requirements for niacin is complicated by the fact that the amino acid tryptophan can be converted into niacin. The term "niacin equivalent" has thus been accepted by the FAO–WHO Expert Committee which made recommendations, several years ago, on vitamin requirements. There is a further complication in that good information on the tryptophan content of many foods is not available. However, according to the Report of the President's Science Advisory Committee, "it can be assumed that if protein needs are met or exceeded, there will be an adequate supply of niacin from conversion of tryptophan." [47] Forms of niacin are found in the basic grains of corn, wheat, and rice, and fortunately little of this vitamin is lost in cooking or storage. Nevertheless, niacin is also added to flour distributed under the U.S. foreign donation program.

VITAMIN A DEFICIENCY

Vitamin A deficiency is a frequent cause of blindness in children less than 5 years old. Symptoms of Vitamin A deficiency are frequently associated with protein-calorie malnutrition. Vitamin A intakes in some parts of the Near East and Africa are anywhere from 2 to 18 times less than in the United States and Western Europe. Vitamin A is found in the LDCs in fruits and vegetables, but fortification is probably required. The need is for foods fortified with Vitamin A which can be produced on a commercial or semi-commercial basis in the less developed countries and which can attain wide acceptance.

CALCIUM INTAKE

Calcium intake (in association with phosphorus) tends to differ widely in the developed and underdeveloped countries. Low calcium intake, together with repeated pregnancies, is reputed to cause osteomalacia (softening of the bones) "although evidence to support this conclusion is meager." [48] In addition, estimates of calcium requirements have proven difficult, as wide differences in intake have been found in populations apparently enjoying good health.

Studies based on metabolic balance have indicated that where there has been a greater calcium intake in the past, a greater intake is required. People in the developed countries thus apparently need more calcium, but on the other hand they have little difficulty obtaining it

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[47] "The World Food Problem," Vol. II, op. cit., page 61.
[48] Ibid. page 64.

because milk and milk products are such a good source and are in wide use. This is not the case in the LDCs. There calcium comes from cereals, leafy vegetables, and to a smaller extent animal products. If cereals are the principal food item and the principal source of calories, calcium intake can be increased by consumption of substantial amounts of pulses and nuts as well. As with vitamins, the ability to meet calcium requirements will be closely linked to the ability to meet calorie and protein requirements.

OTHER NUTRITIONAL DEFICIENCIES

While other nutritional deficiencies exist in the LDCs, they do not appear to constitute a major barrier to development. Rickets, the childhood form of osteomalacia, is due to vitamin D deficiency, but can be prevented by sufficient exposure to sunlight. It has not been a major health problem in recent years. Vitamin C, necessary to prevent scurvy, can be found in many vegetables, including potatoes and members of the cabbage family, as well as in citrus fruits. Foods containing vitamin C can be found in most countries of the world. It may occasionally be necessary or desirable to fortify food products or supplement diets with a synthetic form of this vitamin.

In some underdeveloped countries there is a problem of endemic goiter (thyroid enlargement due to iodine deficiency). A very good source of iodine is seafood, but this is eaten in relatively small amounts in many LCDs. Iodization of salt is the most common preventive measure against goiter, but in some countries there are technical problems connected with this process.

Iron deficiency anemia is apparently quite common in Africa and Latin America, even though the iron intake in these areas has been found to be far in excess of the dietary standards suggested for the United States. Obviously this is a research field in which further information is required. The same thing can be said for other nutrients, vitamins and minerals, for which requirements cannot be estimated at the present time, either for the world or for specific countries.[49] Some so-called "trace elements"—minerals required in very tiny amounts—can easily be overlooked, yet they are vital to health and even to life.[50] It has been suggested that they may not be consumed in large amounts in the LDCs, and that research is required on this subject.

Dietary Deficiencies, Public Health, and Economic Development

One aspect of the problem of dietary deficiencies in the underdeveloped world that has perhaps not received the attention given to the protein gap, is the devastating and cumulative effect of disease on the entire problem of nutrition. Malnutrition, especially protein deficiency, lowers resistance to disease. Acute infection may precipitate nutritional deficiencies because infectious diseases accelerate the metabolism of the victim. (Each Fahrenheit degree of fever raises the metabolic rate by 7 percent.) What is more important, however, is the specific effect on protein metabolism. In the normal, steady metabolic

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[49] Ibid., page 67.

[50] Paul R. and Anne H. Ehrlich. "Population, Resources, and Environment." (San Francisco, W. H. Freeman, 1970), page 346.

state, the amount of nitrogen excreted by an adult equals the amount of his intake. But during acute or chronic infectious states the individual suffers a negative nitrogen balance, exhausting protein faster than he can take it in, even with a thoroughly adequate diet. If the diet is inadequate, so often the case in the LDCs, an individual may never achieve a nitrogen balance. His diet will never satisfy his requirement for protein, and indeed, the gap between requirement and intake will continue to enlarge.

The various yardsticks suggested by different governments, international organizations, and private groups appear to be predicated on the good health of the population in the LDCs. It would seem important to take some approximate account of the impact of disease as it affects these standards. For example, respiratory tuberculosis increases basic requirements about 20 percent, while malaria and dysentery, in their acute stages, increase metabolic requirements 20 to 40 percent. In addition, worms and other parasites reduce the caloric efficiency of ingested foods, and use up small amounts of iron and protein. In the case of malaria and yaws, a drain of calories and protein is accompanied by a distinctive side effect: Highest incidence of these diseases occurs during the planting season: agricultural workers suffering one of these ailments may miss a planting (or harvesting) season.[51] An epidemic of either disease can thus seriously deplete the food supplies of the country or region in which it occurs.

Protein deficiencies are reported to do permanent damage, especially to small children. It has long been known that they contribute to dwarfing or delayed physical maturity, even if an original insufficiency had been overcome. Now it appears that protein deficiency in infancy or early childhood can result in permanent brain damage. Furthermore, studies in Central and South America have found a strong correlation between nutritional levels and physical and mental development in preschool and school-age children. In Santiago, Chile, a comparison was made of two groups of slum children and a group of middle-class children. One group of slum children was put on a supplemented diet, and received medical care. This group soon resembled the middle-class group both in physical and mental development, although apart from the food, the environment of the two groups of slum children was very similar. "Of the malnourished children, only 51 percent reached the normal range of development, compared with 95 percent of the supplemented group and 97 percent of the middle class group."[52] In another study, a group of children who had had marasmus (often defined as protein and calorie deficiency) as infants, and then had been given medical care and supplemental food, were all found to have an intelligence level considerably below normal 3 to 6 years later. Finally, although the results of animal studies can be applied to humans only with considerable caution, studies on rats suggest that malnourished mothers may produce children whose brain development is impaired.

Accordingly, the higher the incidence of disease, the more difficult the task of the developing country seeking to provide its people with

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[51] This subsection down to this point is based on the remarks of Dr. Herbert Pollack at the "Symposium on the Food/People Balance," sponsored by the National Academy of Engineering, April 29, 1970, and pages 3 and 4 of the summary report of its Panel on World Nutritional Resources.

[52] Ehrlich and Ehrlich. "Population, Resources, Environment," op. cit., page 77.

an adequate diet. The greater the number of malnourished infants and toddlers, the smaller proportionately, and perhaps absolutely, will be the eventual number of those qualified to carry out the more sophisticated tasks of economic development. This is a discouraging prospect for the developing countries, and for the United States and other developed countries which seek to assist them.

IV. The Politics and Diplomacy of Food

The preceding section indicated that a solid base already exists, with many opportunities for further advances, in the technology of food production. Whether it is possible administratively, economically, politically, socially, and diplomatically to achieve an end to malnutrition by exploiting this technology is much more uncertain.

The humane and diplomatic interest of the United States in this outcome is of long standing. This section of the study discusses the dimensions of the U.S. effort directed toward this end.

Evolution of U.S. Technical Assistance to Agriculture in the LDCs

The food relief program in the famine areas of Europe during and after World War I was the first U.S. experience with large-scale international relief operations. Although these programs had the single nonpolitical objective of feeding hungry people, they called for special administrative machinery, and considerable international cooperation. Further and broader experience was gained when foreign assistance operations were organized again, during and after World War II. During that war, materials and food supplies were sent to allies under the authority of the Lend-Lease Act. Assistance was made available to the civilian populations of occupied areas. When the United Nations Relief and Rehabilitation Administration (UNRRA) was organized in 1943, the United States provided the bulk of its support. Immediately after the war the Congress responded to pleas to relieve distress in Europe by enacting several short-term relief programs. The legislation establishing these programs contained safeguards against political misuse of relief supplies, such as that which had occurred in both Poland and Yugoslavia with UNRRA-furnished items.

The United States also took a leading role in the creation of the International Bank for Reconstruction and Development (World Bank) and the International Monetary Fund, both of which began operations in 1946. These agencies were envisioned as the principal multilateral monetary instruments through which the U.S. could assist in rebuilding the war-ravaged countries and in stabilizing their currencies. Today these agencies, especially the World Bank, figure importantly in world development projects, and are giving considerable emphasis to those relating to the food/population question.

During the early postwar years, leaders in the United States expected that with appropriate assistance the developed countries receiving Marshall Plan assistance would be able to get back on their feet, and once more would be able to feed themselves, either through domestic production or by import. The severe stringencies that existed after World War II were simply viewed as an emergency situation, and not as arising from any persistent food/population imbalance. However, Marshall Plan assistance went also to the underdeveloped

world, since an important feature of the program was "the carrying out of what was in fact a large-scale technical assistance program in the overseas territories of the participating countries." [53] President Truman publicly recognized the needs of the less developed countries in the fourth point of his 1949 inaugural address, calling for a "bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas." [54] The ensuing program of technical assistance, known as the Point IV program, launched the United States into direct involvement with the problems of developing nations, now the main focus of all foreign aid. The United States was also involved indirectly, through contributions to U.N. technical assistance and through bilateral assistance to those countries with colonial dependencies.

U.S. FOOD AID TO DEVELOPING COUNTRIES

The United States moved into the field of technical assistance to the developing countries at a time when food shortages had become a worldwide problem. There had been famine in India following a crop failure in 1943, and in 1952 starvation threatened both India and Pakistan. The struggle between the Chinese Nationalists and the Chinese Communists had disrupted food production over wide areas of the Chinese mainland, and there was famine among the refugees from that conflict. The Arab countries were inundated with refugees from Israel, and lacked sufficient food resources to handle the influx.

At this time when the LDCs were desperate for food, U.S. food surpluses were beginning to accumulate. No machinery existed for transferring this surplus abroad. Furthermore, although it seemed both morally and politically sound for the United States to set up such machinery, it needed to be done without adversely affecting the food production and commercial trade of other countries. The solution devised for this problem was the Agricultural Trade and Development Act of 1954, popularly known as "P.L. 480."

This Act declared that the policy of Congress was "* * * to make maximum efficient use of surplus agricultural commodities in furtherance of the foreign policy of the United States." To achieve this objective the law provided that "surplus agricultural commodities in excess of the usual marketings * * * may be sold through private channels, and foreign currencies accepted in payment therefor." [55] The foreign currencies thus acquired could be used, among other things, "for promoting balanced economic development and trade among nations." Some of the "soft currency" earned by the United States in this manner has been spent in the countries of origin to cover maintenance costs of U.S. embassies, for example, or military installations. A substantial part of it, however, has either been loaned or granted to the receiving countries to be used in development projects.

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[53] William Adams Brown, Jr. and Redvers Opie. "American Foreign Assistance" (Washington, The Brookings Institution, 1953), page 433.

[54] "Public Papers of U.S. President Harry S. Truman: 1949" (Washington, U.S. Government Printing Office, 1964), page 117.

[55] Section 2, Public Law 480, 83d Congress. Also section 104 (e) 68 Stat. 454, approved July 10, 1954. See "Agricultural Trade Development and Assistance Act of 1954 and Amendments." Compiled by Gilman G. Udell, Superintendent, Document Room, House of Representatives (Washington, U.S. Government Printing Office, 1971), pages 1, 3.

Between 1954 and 1961 the amount of food shipped abroad under P.L. 480 grew steadily. However, since the law required that only commodities in surplus could be shipped under its terms, the main thrust of the program was the disposal of U.S. surpluses.[56] When U.S. stocks were reduced to what were considered reasonable levels, offers to give or sell such commodities under P.L. 480 were withdrawn. This happened, for example, to butter, dry skim milk, cheese, and vegetable oils. Wheat, however, continued to be in surplus and was shipped abroad in large quantities.

There is no doubt that food aid under P.L. 480 has been massive, and that the proceeds from the sale of P.L. 480 food have made a substantial contribution to development. Agricultural exports under P.L. 480 for the period 1954–1967 amounted to $17.2 billion, of which about $11.0 billion was shipped under Title I of the act (sales for foreign currency). Food was supplied to 116 countries containing half the world's population.[57] The development of Taiwan, Israel, and South Korea benefitted markedly from P.L. 480 assistance. In the view of at least one informed observer, India would not have survived as a democratic state without the great transfer of food on a concessional basis provided by P.L. 480.[58] In Tunisia, food donated under Title II was used as wage payments on work relief projects.

In the 1960s food aid began to be used as an instrument of development. President Kennedy, on January 24, 1961, called for the constructive use of "American agricultural abundance" to promote peace and "to play an important role in helping to provide a more adequate diet" in the LDCs.[59] Orville Freeman, then Secretary of Agriculture, urged similarly that the United States use its agricultural abundance to encourage economic growth in underdeveloped areas.[60] Congress extended and expanded P.L. 480 assistance in 1961, and again in 1964 and 1965.

PRESENT STATUS OF PUBLIC LAW 480

As the program evolved, various defects became evident. Sometimes, a developing country would use U.S. surplus food shipments to replace commercial food imports, diverting the credits to the purchase of consumer goods which would not contribute to development. Sometimes the surplus imports were used to postpone the making of hard decisions in the modernization of a country's agriculture, or with regard to an explosively increasing population. Cochrane implies that the use of food in this manner lay behind the failure of food aid to make a significant contribution to development in those Latin American countries which received it.[61]

Food assistance need not lead to unbalanced or lopsided development. But it can release officials in developing countries from the pressing obligation of taking distasteful steps necessary to sound development, by mitigating an immediate food shortage. The argument has been advanced that P.L. 480 assistance in the 1950s, by failing to oblige developing countries to take steps to limit popula-

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[56] Orville Freeman. "World Without Hunger" (New York, Praeger, 1968), page 29.
[57] Willard W. Cochrane, "The World Food Problem" (New York, Crowell, 1969), page 134.
[58] Ibid., page 138.
[59] Ibid., pages 29, 30
[60] Ibid., page 30.
[61] Ibid., page 139.

tion growth as a condition of receiving U.S. food aid, actually encouraged them to ignore the problem in the belief that food from the United States would always be available in a time of crisis. Such an argument, however, overlooks the fact that even today family planning is reluctantly accepted in the developing countries. The problem did not seem so apparent or so pressing in the 1950s, and many developing countries were probably not as ready to adopt measures that would restrict population growth as they were to become a decade later. It is even possible they would not have accepted U.S. assistance for such activity, or would have pursued it in very desultory fashion, had P.L. 480 food been linked to population planning.

In 1966, P.L. 480 underwent a major overhaul; the program of food assistance was tied directly to the efforts of the developing countries to limit their population growth. These changes can be found in the Food for Peace Act, P.L. 89–808. In the first place, the entire rationale of the law was changed. Instead of a device to dispose of U.S. agricultural surpluses, the new law advances a program to combat hunger and malnutrition and assist economic development, particularly in those countries that do the most to help themselves. In line with this program, the President is directed, in negotiating and carrying out agreements for the sale of agricultural commodities, whether for dollar credits or foreign currencies, to take account of the efforts of the other countries to meet their problems of food production and population growth. In the Foreign Assistance Act of 1968 one of the purposes for which agreements concerning the use of foreign currencies can be made is that of " * * * activities, *where participation is voluntary*, related to problems of population growth * * *. Not less than five (5) percentum of the total sales proceeds received each year shall, if requested by the foreign country, be used for *voluntary* programs to control population growth." (Emphasis added.) That same law also contained a provision stipulating, as one of the self-help criteria the developing country must meet in order for the President to agree to the sale of agricultural commodities, the criterion of "carrying out voluntary programs to control population growth." This is stronger language than that which would merely take account of LDC efforts at self-help.

Thus today the distribution of U.S. foodstuffs abroad under P.L. 480 is definitely linked to action by the receiving country to deal with its population problem. Obviously, this linkage does not apply when there is a natural catastrophe, such as the earthquake in Peru or the floods in East Pakistan. In those instances food is likely to be made available whether or not the stricken country is doing anything to alleviate its population problem.

Otherwise food assistance, if implemented in accordance with the law, will be geared in with total development. Such aid is no longer an outlet for surpluses, but rather a catalyst to induce the developing countries to go forward with their own food production, and to establish and support family planning activities. The food that is shipped no longer has to be in a surplus category. Whether this may simply be a short-term phenomenon, derived from the elimination of U.S. surpluses, or a really long-term trend, remains to be seen. If

U.S. food production generates domestic surpluses once again, the demand for a return to the surplus disposal philosophy could become a very live issue.

Institutional Resources for Orderly Development of Agriculture

The extent to which agricultural policy can be implemented is limited by the nature of agriculture itself—whether in the small farm, managed by a single owner, or the large farm, handled like a substantial business firm. Operating decisions in agriculture are usually an inherent prerogative of land ownership in the non-communist developing countries. This principle limits the scope and effectiveness of national agricultural policy, and complicates the role of international organizations formed to coordinate or promote balance in the development of global or regional agriculture. As Dr. A. H. Boerma, Director General of the Food and Agriculture Organization of the United Nations (FAO), complained, despite a quarter-century of FAO efforts the agricultural scene today was "a very mixed one still containing distortions, imbalances, injustices, and deep unrest."

> For what do we have? [Boerma continued] On the other hand, there are vast regions where neither the land nor the waters of the earth are properly cultivated, where the majority of mankind is in one way or another badly fed, where the countryside is inhabited by millions of people living in extreme poverty, and where most of them are unable to find work. On the other hand, there is a smaller part of the earth where it seems that far *too much* food is being produced, where governments are either actively paying farmers to cultivate less of their land or dispensing huge sums to keep up the prices of their overproduction, and where large numbers of people are dying from diseases at least partly brought on by overeating. Could there be a more illogical pattern than that currently presented by the completely unbalanced situation of world agriculture and food consumption?[62]

As a practical matter, the dislocations Boerma referred to are the focus of a considerable organized effort by agricultural institutions at all levels—private, public, instructional, commercial, local, national, regional, and global. At the global level, there is the FAO itself stimulating cooperation, encouraging international participation of nations in food contribution programs, collecting statistics, disseminating information and training, and setting up global objectives, priorities, and plans.

There is regional cooperation in agriculture through organizations such as the Alliance for Progress, the Organisation for Economic Cooperation and Development, and the United Nations Economic Committee for Asia and the Far East. These generally serve as regional counterparts to FAO. In addition, of course, each country has its own internal organization for agricultural development and stimulation.

Although the United States has led in time and volume of agricultural and food aid, most of the developed countries have followed suit in contributing to the agricultural development of the LDCs. The complex U.S. program of agricultural and food assistance involves the Department of State, U.S.A.I.D., the Department of Agriculture, the various congressional appropriations and oversight committees, mon-

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[62] Addeke H. Boerma, (Director-general of FAO), "Address to the Eighteenth General Conference of the International Federation of Agricultural Producers on the Occasion of its Twenty-fifth Anniversary" (Paris, France, May 14, 1971), page 4.

itoring by the Office of the President, and the less formal assistance of private groups like the Rockefeller Foundation. A vast network of private international organizations has been constructed, to provide assistance in areas such as labor standards, technical information, marketing, credit, and capital.

Despite the great amount of effort, and the multiplicity of agencies, engaged in various parts of the task of encouraging agricultural development in the LDCs, the total result seems disappointing. Boerma observes that "there has not been much meaningful cooperation among countries for the harmonization of national policies or measures affecting agriculture." The Pearson Report finds a similar lack of direction.

The international aid system today, with its profusion of bilateral and multilateral agencies, lacks direction and coherence. A serious effort is necessary to coordinate the efforts of multilateral and bilateral aid-givers and those of aid-receivers.[63]

The Peterson Report, while offering no explicit criticism of things as they are, is suggestive of these dissatisfactions in the recommendations it offers for change (paraphrase):

> Private investment is under attack. Enlightened trade policies toward the LDCs are an essential element in achieving international development. Accepting imports is one of the responsibilities of industrial countries. More reliance should be placed on international organizations; an international organization like the World Bank, with no political or commercial interests of its own, is able to obtain good results. Strengthen the capabilities of international organizations and build more coherence into their operations. Encourage them to take a broader view: to give increasing attention to the management, social, technical, scientific cooperation, and popular participation aspects of development. Encourage them to be diplomatic, flexible, sympathetic, and persuasive—but prepared to say no and to withstand political pressure. With respect to U.S. assistance, there is an excessive number of statutory and procedural requirements that encumber the program and reduce its flexibility. A number of departments and agencies have competing interests and responsibilities with the result that too many issues go to the President for resolution, and opportunities to take initiatives in policies toward developing countries are sometimes lost.[64]

Boerma's analysis suggests the need for a more comprehensive and more vigorous global approach: "The developing world as a whole is in need of help. The developed world as a whole must provide it." Subjects that call for action, he says, are: "* * * population, employment, agrarian reform, nutrition, research, marketing, credit, agricultural extension, training, and the improved processing of agricultural products * * *." The world of agriculture is interconnected, and "the level of national agricultural production in any one trading country automatically affects the siutation in others. * * * In the world of today, agricultural policies can no longer be formulated in an exclusively national or even regional or subregional context." Moreover, in dealing with these problems "what is required is in-

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[63] Lester B. Pearson, et al. "Partners in Development, Report of the Commission on International Development" (New York, International Bank for Reconstruction and Development, 1969), page 22.

[64] "U.S. Foreign Assistance in the 1970's: A New Approach," Report to the President from the Task Force on International Development, March 4, 1970 (Washington, U.S. Government Printing Office, 1970), 39 pages.

creased dynamism * * *."[65] All these comments add up to one conclusion: That the diplomatic, economic, political, social, and administrative aspects of the Green Revolution lag behind the technological aspects, and that the problem of orderly agricultural development on a balanced, global basis is far from being solved.

Conflicting Agricultural Plans and Programs

On the one hand it is asserted (by Boerma, for example) that "too little attention is paid to agriculture." Industry has been given priority in the allocation of scarce financial resources. On the other hand, it is suggested that insufficient emphasis on urban industrial opportunity will result in hardship for those released from the new, highly productive agriculture. (Even this conclusion is controversial, in view of the belief held by some analysts that the Green Revolution will cause an increase in agricultural employment. See pages 20–21.)

Boerma calls for more liberal trade policies toward the developing world, a global balance of agricultural supply and demand, more and better international commodity agreements—hopefully combined into an integrated scheme for international commodity control—and agreement on guidelines for national agricultural policy as well as on procedures for reviewing their strict application.

One related issue concerns the rate at which the Green Revolution should be pressed. Various observers have pointed out that dissatisfactions and tensions are likely to accompany the Green Revolution in the LDCs, and that if it proceeds rapidly the tensions will be the more severe to the point where actual conflict and revolutionary activity may occur.

Another issue may be that well-intentioned diplomats and scientists are urging a faster pace of acceptance of new agricultural technology than is warranted by the technology itself. For example, Dr. Borlaug, in describing his program in Mexico, advocated that exploitation begin immediately of the "better" without waiting for the "best."

> In Mexico [wrote Dr. Borlaug], as soon as significant improvements were made by research, whether in varieties, fertilizer recommendations, or cultural practices, they were taken to farms and incorporated into the production programs. We never waited for perfection in varieties or methods but used the best available each year and modified them as further improvements came to hand.[66]

Yet elsewhere in his report, Dr. Borlaug noted that a variety [IR8] of rice introduced into monsoon areas of India and East Pakistan was not well adapted to climatic conditions there and had had only a "modest and occasional impact."

Dr. Borlaug has also appealed for "the will and commitment of governments to support national production campaigns." It seems evident that when national or even international mobilization of a vigorous administrative and political effort is required, careful attention should be given to the question of whether the technology is sufficiently perfected and properly adapted to local conditions before it is applied.

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[65] Boerma. "Address to the Eighteenth General Conference of the International Federation of Agricultural Producers . . ." op. cit., pages 14–15.

[66] Norman E. Borlaug. "The Green Revolution . . .," op. cit., page 44.

Difficult though the development of a technology may be, it is quick, cheap, and easy compared with the political problem of mounting a concerted human effort. If political effort is mobilized to apply an imperfect technology, yielding disappointment and costly failure, the political effort may be fruitless and the failure may add greatly to the difficulty of mounting a second political effort after the technology is perfected.

A third issue is reflected in differences between the Peterson Report and the position of FAO as reflected in Boerma's recent statement. The primary thrust of the Peterson Report is that necessary organization, motivation, and administrative control can be best mobilized for the development of the LDCs by skillful use of the management leverage supplied by an international credit institution, viz., the World Bank. Without playing down the importance of money, credit, and markets, Boerma in his address to the International Federation of Agricultural Producers says he believes that "there has been too much emphasis on the economic at the expense of the social aspect." It is, he says, "a mistake to plan for development solely in terms of economic growth, which neither necessarily nor automatically covers such problems as unemployment, malnutrition, and education, to mention the most obvious."

The United States has an obvious interest in the conflicts that seem to have been provoked by agricultural progress in the LDCs. However, in the management study reported to the Secretary of State by his Deputy Under Secretary for Administration, November 20, 1970, the recommendation was made that agricultural officers (up to now, supplied by the Department of Agriculture) be assigned to missions abroad on the priority basis of (a) whether the countries are actual or potential customers of U.S. agricultural exports, or (b) whether they are competitors of the United States. The need to observe ongoing agricultural change is accorded no priority.[67] Contemporary agricultural literature contains various references to the problems encountered by U.S. agricultural emissaries abroad in their contacts with their counterparts; in particular, suspicions as to U.S. motives need to be overcome. The report cited above implies motives that seem to feed rather than to allay such suspicions.

An Enumeration of Non-Technical Obstacles

A considerable literature has appeared in evaluation of the consequences of the Green Revolution in the developing countries. After the first wave of optimism, a note of apprehension has been sounded and seems to be growing stronger. Fears are expressed on the one hand that the expanded availability of food will be delayed too long, and will frustrate the expectations of those experiencing the pain of shortage, leading to the violence of organized protest; on the other hand, there is concern that the vigorous exploitation of new agricultural technology will lead to serious dislocations of food supply, monetary systems and—above all—people.

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[67] "Diplomacy for the 70's: A Program of Management Reform for the Department of State" (Washington, U.S. Government Printing Office, 1970), page 475. Department of State Publication 8551.

SURPLUS VERSUS SHORTAGE

It is a characteristic of technology that it cannot be exploited in the same way or to the same degree in all parts of the world. Effective use of technology relates to climate and geography, level of education and technical training, ability and willingness to adopt new methods, receptivity to new diets, relative accessibility of information, and decisions as to the extent and kind of mechanical equipment to acquire. Given the proper combination of these factors—and particularly the careful use of irrigated water and fertilizers—the genetic advances of the "Green Revolution" can yield a two- to four-fold increase in grain production. Historically, the United States has been a grain exporting nation. Other nations, like Australia and Canada, have likewise achieved sustained surpluses. These have been both a source of income from export, and a means of saving lives in times of acute or chronic food shortage in other countries. Those countries that have vigorously accepted the opportunity of the "Green Revolution" have converted from conditions of shortage to conditions of surplus and will not need to rely on foreign surpluses. But as they have achieved surpluses themselves, they need to find markets for them. Here they come into competition with countries long accustomed to exporting surpluses, introducing complications into the global picture of supply and demand.

On a smaller scale, it is possible for a single country to be divided into regions that are large producers of surplus, and regions that are in serious shortage: for example, West and East Pakistan.

In some countries, transportation facilities are so poor that shortage and surplus situations can occur locally; this was long the situation in China, for example.

Unless surplus grain becomes available to those who need the food, it fails to serve its functional purpose. When grain remains in surplus it tends to fall in price, thereby reducing the incentive of those embarking on programs of expanded food production. The success of the Green Revolution depends substantially on the assurance that economic and administrative arrangements are in operation to deliver the product to the consumer.

ECONOMIC DISLOCATIONS

U.S. contributions of grain to developing countries have been distributed in these countries by sales to consumers, with the proceeds used for development purposes. When these countries, by virtue of their own advances in productivity, are able to supply their own needs, and even to export surplus grain, the revenues they formerly received for development will be cut off. There will be no further opportunity to convert revenues from the sale of P.L. 480 foods into investment capital for urban industrialization. It might be possible to replace these funds in any of several ways: for example (a) by taxing the exports of grain surpluses, (b) by ensuring that the proceeds from overseas sales are channeled into urban industrialization (or at a minimum into the kinds of farm mechanization that are least likely to reduce labor requirements), or (c) by taxing the producing farmers. Historically, the need for encouraging production of grain has been so keen that farmers have largely been exempted from taxation; accordingly, re-

sistance is to be expected to any change in this policy, particularly since affluent farmers largely comprise the leadership and the apex of the power structure of the developing countries. An export tax would be equally unpopular for the same reasons. Earmarking of proceeds from overseas grain sales would be difficult administratively.

An internal dislocation also results from the Green Revolution. The more prosperous farmers are best able to exploit the new grains. They are able and likely to invest their expanding income in capital equipment for further increased production. Most farm capital equipment replaces human labor, particularly the kinds of capital equipment useful on larger farms. Cash and credit resources will tend to be concentrated on the larger farms, while the increased productivity will result in lowered grain prices, thereby discouraging and inconveniencing the smaller farmers. Considerable emphasis is placed, in current literature, on the need to limit farm mechanization to equipment that increases productivity per acre, but does not replace manpower.[68] How feasible this policy is remains to be seen.

Markets for a country's grain must be found primarily in the cities, but if the bulk of revenue accruing from the Green Revolution goes to the larger farmers, and is invested in further agricultural productivity, financial resources must be found elsewhere to invest in urban industrialization so that there will be an urban market for the new farm abundance. The prospect is that with P.L. 480 funds cut off, the available resources for urban development will be less, not more.

The question of the balance-of-payments position of the LDCs is a constant concern of international development. Most of the LDCs still depend on agricultural products to earn them the foreign exchange to pay for the imports of the many items essential to development. Others have oil and mineral resources desired by the developed countries. Some realize considerable earnings through tourism, while others would like to develop tourist attractions. By and large, however, the future of the developing countries is tied to their ability to expand their export trade. The Pearson Report showed, for example, that the growth rates of individual countries correlate more closely with export performance than with any other economic index.[69]

From 1953 to 1968 exports from the LDCs grew at an average rate of 4.7 percent a year.[70] In the decade of the 1960s the export earnings of the LDCs grew at an annual rate of more than 6 percent.

At the same time, however, the total volume of world trade was growing at an even faster pace. In relative terms, the LDCs were lagging behind. Moreover, the terms of trade—that is the prices of their imports as compared with the prices of their exports—moved against them. The value of their exports increased, but much less rapidly than that of world trade as a whole. The problem was compounded by the instability of world commodity prices, so vital to the LDCs, which earn some 90 percent of their foreign exchange from

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[68] The critical importance of finding ways of creating more rather than fewer jobs was affirmed repeatedly by speakers at the 12th World Conference of the Society for International Development in Ottawa, May 16–19, 1971. (The theme of the conference was "Development Targets for the 70's: Jobs and Justice".)

[69] Pearson, et al. "Partners in Development. Report of the Commission on International Development," op. cit., page 45.

[70] Ibid.

the export of foodstuffs and other raw materials. It was also compounded by competition from synthetics produced in the industrialized countries, and by the increased supplies of raw materials, including foodstuffs produced in some industrial countries for protected markets at home.

The competitive position of the LDCs in world trade is serious for another reason: their increasing burden of debt service. One reason for this increase is the decline in the ratio of grants to loans in the bilateral aid programs of a number of countries. Furthermore, the increased burden of debt service is on harder terms than previously, in both dates of maturity and rates of interest. According to an estimate by the Development Assistance Committee (DAC) of the Organisation for Economic Cooperation and Development (OECD), assuming the present terms and conditions of aid continue until 1975, the total annual debt service payable to DAC members will increase threefold from 1967 to 1975.[71] India, Pakistan, and Indonesia have very severe debt-servicing problems, while debt-service payments from other Asian and African countries doubled between 1963 and 1968.[72]

The tremendous increases in agricultural production resulting from the introduction of the new seeds and allied technology complicates, rather than simplifies, the problem of the LDC foreign exchange position. For as long as domestic population continues to increase, the additional supplies of home-grown food will have to be used domestically to feed the additional mouths. Production levels will have to continue to increase, requiring continued imports of fertilizers, pesticides, and agricultural machinery, with continually increasing foreign exchange expenditures to secure these inputs.

Ironically, if an underdeveloped country is fortunate enough to have a surplus of cereals, the prospects are against any substantial betterment of its foreign exchange position. The market in the developed countries may already be saturated, and even where it is not, the LDC would have to compete with an established supplier from the developed countries. In fact, at prevailing prices, the developed countries currently have an excess agricultural capacity, encouraged by price supports and subsidies that effectively serve to shut out grain imports. A prime example can be found in the European Community (Common Market), where grain prices in the member countries are in many cases double those in world markets, but export subsidies are so large that not only are outsiders excluded from the Market itself, but the EEC countries can undercut other exporting nations in world markets.[73] Many developing countries also support agricultural prices, further compounding the problem. Other types of trade discrimination are practiced, and as previously mentioned there is increasing competition from synthetic materials to replace agricultural raw materials like rubber, sisal, abaca, and kapok.

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[71] Committee for Economic Development. "Assisting Development in the Low Income Countries." (New York, 1969), page 44. DAC Secretariat estimate.

[72] Organisation for Economic Cooperation and Development. "1968 Review: Development Assistance." Report prepared by Edward M. Martin, Chairman of the DAC. (December 1968), page 135.

[73] Lyle P. Schertz. "Food Supplies and Economic Growth in Developing Countries." Quoted in "The Green Revolution: Symposium in Science and Foreign Policy," op. cit., page 21.

HUMAN DISLOCATIONS

Increased agricultural productivity, concentrated selectively on the larger farms, means that fewer farm workers will have jobs, that smaller farmers will encounter hardship, that machines will replace hand labor, and that the influx to the cities—already causing serious crowding, social tensions, and urban unemployment—will be greatly increased. According to FAO Director-General Boerma, there is already unemployment in the developing countries, excluding mainland China, of some 100 million. The increase by 1980 in the working-age population in these countries is estimated at 250 million, so that to employ the available labor force by 1980 will require the creation of about 350 million additional jobs, even without taking into account the additional displacement resulting from the Green Revolution.[74] How much additional agricultural unemployment and drift to the cities will be caused by the Green Revolution is difficult to estimate, but it seems likely to be a significant addition to an already strained situation.

THE NEED FOR SOCIAL REFORM

One of the most serious obstacles to the success of the Green Revolution lies outside the field of technology altogether—although technology could conceivably play a role in solving it. That obstacle is the often negative answer to the question: Are the benefits of that revolution distributed for the good of society as a whole? Unfortunately, in a number of instances the Green Revolution has had the effect of widening the gap between the rich and the poor. The initial impact of the new agricultural breakthrough has been to benefit the more efficient, more well-to-do farmers. As Wharton points out:

> For them, it is easier to adopt the new higher-yield varieties since the financial risk is less and they already have better managerial skills. When they do adopt them, the doubling and trebling of yields means a corresponding increase in their incomes.[75]

In short, the rich farmers can become richer, and may even capture some of the markets earlier served by the small semi-subsistence farmer. The poorer farmer, seeing the increasing share of the new wealth going to those who already precede him on the economic ladder, may grow increasingly resentful. The landless poor, seeing the increased availability of food supplies, quite naturally want a larger share of any increased prosperity, and may be willing to take action to get it. The clash two years ago in Tanjore, India, between landlords and landless workers, in which 43 people were killed, is a very pertinent illustration of the explosive situation which to some degree exists in India already, and could easily be duplicated elsewhere.[76]

Equally worrisome, in the long run, is the prospect of technological unemployment in the wake of agricultural progress. As fewer people are needed to produce more food, those displaced tend to gravitate

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[74] Boerma. "Address to the Eighteenth General Conference of the International Federation of Agricultural Producers. . . .," op. cit., page 5.

[75] Wharton. "The Green Revolution: Cornucopia or Pandora's Box?" op. cit., page 467.

[76] An example which could be readily repeated is that of the so-called Naxalite movement in India, which involves land seizure by violence and is encouraged by the Maoist wing of India's Communist party.

to the cities in search of work. Unless they find it, they are forced to live in shacks and slums, adding to the potential for revolutionary agitation. Even if the displaced peasant finds work, housing shortages may compel him to live in appalling conditions. The consequences of involuntary urbanization are a major problem for many of the developing countries. The toppling of the Ayub Khan government in Pakistan by urban riots was an example doubtless lost neither on other LDC governments nor on would-be revolutionaries. Obviously the governments of the LDCs face the need to find constructive ways of dealing with this problem.

Although the outlook seems gloomy, it also contains elements of hope. There is some evidence that the growing urbanization of the LDCs is not as destabilizing as has commonly been assumed.[77] Also, if mechanization is employed selectively it can actually create jobs rather than terminate them. Taiwan has been singled out as a good example of how selective mechanization, combined with intensive land use, creates jobs. (However, selective mechanization must be carried out as part of a wide range of economic policies which permit industrialization and agricultural modernization to go forward together, if it is to result in a rise in agricultural employment. Even then, it is difficult to see agriculture as providing employment for a vastly increased population.)

Perhaps the most important action the governments of the LDCs can take to sustain the momentum of the Green Revolution is to move promptly and effectively either to pass land reform legislation or to implement legislation already enacted. The peasant farming his own land is more likely to have the incentive to maximize production than if he is merely a tenant on a large estate. Indeed, countries where land is widely distributed can be shown to maintain a better agricultural performance than those where land is concentrated in a few hands.[78]

However, there is a dilemma facing the LDCs which want to press forward with land reform. Large estates, if efficiently run, may prove better suited to putting the new techniques into practice on a large scale, just as they are better adapted to take initial advantage of these techniques. It is Lester Brown's view, however, that farm size is not as important as Western analysts often rate it in evaluating agricultural efficiency.[79] Japan and Taiwan, each with farms averaging less than three acres, are among the leaders in agricultural development. Selective mechanization, combined with the essentially free input of family labor, can render the small farms as as efficient as the large ones.

Actually, the choice need not lie between large and small farms. Alternative measures have already been adopted in some LDCs. One such measure is joint or consolidated farming, where farmers voluntarily band together to get both the advantages of intensive family farming and the economies of larger scale operations. In Malaysia, for example, this type of farming is practiced because water management is effective only on a multifarm basis. Barbara

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[77] See Joan M. Nelson, "Migrants, Urban Poverty, and Instability in Developing Nations." Occasional Papers in International Affairs, No. 22, Center for International Affairs. (Cambridge, Harvard University, 1969), 83 pages.

[78] Brown, "Seeds of Change," op. cit., page 111.

[79] Ibid., page 113.

Ward Jackson has suggested rural agricultural centers where peasants forced off the land by the Green Revolution could be employed in "agro-industries" such as warehouses and fertilizer plants. Other measures are doubtless being contemplated, as the LDCs seek to reconcile the need for maximum food production with a much wider pattern of land ownership. Again, the United States has a vital stake in the methods chosen by the LDCs to redistribute land ownership.

AGRICULTURAL AND SOCIAL REVOLUTION

In short, the consequences of genetic developments that produced the new grains are likely to be revolutionary, not only in the technological sense, but politically and socially as well. Vu Van Thai, in a paper presented to the Southeast Asia Development Advisory Group, June, 1969, identified a number of forms of tensions that he could foresee:

> * * * Modernization causes instability by shifting the relative importance and status of the various classes, thus generating social stresses.
>
> * * * The emergence of a political force in the rural areas undergoing the "Green Revolution" is all but ineluctable. The questions are only whether the political institutions of the country will evolve fast enough to allow for the peaceful emergence of this force into the national political fabric, and whether governments would be able to design and implement policies which would solve or at least keep under control the problems generated * * *.
>
> * * * The richer farmers will become richer. * * * Such a development could well lead to a net reduction in the income of the smaller, poorer, and less venturesome farmers. This raises massive problems of welfare and equity. If only a small fraction of the rural population moves into the modern century while the bulk remains behind, or perhaps even goes backward, the situation will be highly explosive.
>
> * * * One might foresee that the issue of giving priority to developing one area over another will become increasingly a politically loaded matter.
>
> Unless countries revise drastically their economic development strategies and policies, to give first priority to the objective of creation of employment; and unless they take measures to reduce income disparities and to further extend incomes to the poorer classes, many people will still go hungry or remain underfed. * * * Thus, if internal demand is not enlarged, measures to restrict production will have to be adopted.
>
> * * * The "Green Revolution" is likely to increase tensions between landlords and tenants [and generate] pressure on the part of tenants for greater agrarian reform * * *.
>
> * * * We are facing a kind of vicious dilemma: in order to keep demand up to the level of increased agricultural production, a government must either accelerate considerably the rate of growth of the economy or else embark on large expenditures for welfare. To do either of these, it must mobilize more and more resources from the agricultural sector; by so doing it is slowing down the rate of increase of farmers' real income, thus triggering discontent.[80]

An analysis by Richard Critchfield sees the situation as posing a new form of competition between communist and non-communist countries. He declares: "Virtually every FAO official I interviewed believes some form of social revolution will follow the agricultural revolution in all too many of the poor countries." Moreover, "The general feeling seemed to be that the allegiance of the poor countries is likely to go to whoever can devise a system that allows the fastest

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[80] "Agricultural Innovation and Its Implications for Domestic Political Patterns in Southeast Asia." *In* "The Green Revolution: Symposium on Science and Foreign Policy," op. cit., pages 188–95.

economic growth and that both the West and Communist bloc are starting with major handicaps." [81]

Not all authorities are in agreement that the unemployment problem in the LDCs will be exacerbated by the Green Revolution. Lester R. Brown, as previously noted (page 21), suggests that it may result in an increase in agricultural labor requirements:

> Where the new seeds are in use, two or three crops are becoming the norm where only one crop grew before. Cultivation of the new seeds, and the harvesting of bigger crops both require more labor. Higher yields encourage, even necessitate, more investment in land reclamation, irrigation, construction of storage facilities and warehouses, road building, marketing and transport. All these factors are leading to a sizable increase in the demand for labor, pushing wages up to higher levels, and providing employment throughout the year rather than only seasonally.[82]

However, it seems a likely conclusion on the basis of experience in both the United States and in Europe, that "the great advances in agricultural technology have made the small-farm structure * * * obsolete for the production of most basic crops." [83]

The Impact of Food Programs on U.S. Diplomacy

The food situation in the less developed countries impinges on U.S. diplomacy and the conduct of that diplomacy in countless ways. In their everyday relations with host countries, U.S. missions in underdeveloped countries may be called on to make recommendations as to whether U.S. food shipments are needed in that country, or whether, for example, improvements in local food processing might suffice to overcome specific food shortages. A U.S. mission in an underdeveloped country will need an agricultural capability that extends beyond the reportorial function. It may be asked for advice on broad problems of agricultural policy, or on technical methods of food fortification and similar problems of limited scope. If U.S. assistance is furnished, the mission will want to observe its distribution and use. In short, U.S. diplomatic activity in countries where food supplies are inadequate and malnutrition is common will probably be concerned to a considerable degree with the problems arising from this situation. The information garnered by U.S. agricultural attaches and other mission personnel may be useful in stimulating research on the solution of these problems, particularly if there are well developed relationships between the U.S. foreign affairs establishment and the U.S. scientific community. Conversely, U.S. missions may be able to stimulate research by scientists in the LDCs.

However, massive and complicated impacts on U.S. diplomacy will result from the concerted attack launched on hunger in the LDCs represented by the Green Revolution. Some of these changes are

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[81] "Can Politics Keep Up with Technology?—Feeding the Hungry." *In* ibid., page 187. Mr. Critchfield, author of "The Long Charade," is on leave from the Washington Star to write a book on world hunger. His article was reprinted in the hearing from The New Republic October 25, 1969.

[82] "The Social Impact of the Green Revolution." International Conciliation (No. 581, January 1971), page 49.

[83] Boerma, "Address to the Eighteenth General Conference of the International Federation of Agricultural Producers . . ." op. cit., page 12. Although he was speaking of Europe, the same trend is observable in the United States. See part 3 of this series: U.S. Congress. House Committee on Foreign Affairs. "Science, Technology, and American Diplomacy: The Evolution of International Technology." Prepared for the Subcommittee on National Security Policy and Scientific Developments of the. . . . by the Science Policy Research and Foreign Affairs Divisions, Legislative Reference Service, Library of Congress. December 1970 (Washington, U.S. Government Printing Office, 1970), especially pages 31–33.

already evident; how they are managed will determine to a substantial degree the ultimate outcome of the Green Revolution. Managed with skill, the Green Revolution can do much to reduce malnutrition and hunger that is endemic in the underdeveloped countries. But if these changes are mismanaged, if the developing countries are not able to cope effectively and in timely fashion with the social implications of the Green Revolution, the promise of the massive agricultural transformation could be aborted and even turn into a disaster. One of the most important tasks for U.S. diplomacy, therefore, would seem to be that of lending encouragement and support to the efforts of the less developed countries to persuade their populations to adapt systematically to the changes necessitated by innovative agricultural technology. When prodding is called for, experience has shown that by and large the United States needs to exercise its influence as unobtrusively as possible, and preferably through indirect channels such as the FAO or the World Bank.

The Green Revolution will not solve the food/population problem. Rather, it extends the margin of time in which programs of family planning can be brought to a peak of effectiveness. Leaders in the underdeveloped countries are beginning to perceive the problems accompanying the Green Revolution, such as the forcing of the poorest peasants off the land, the huge capital investments required for irrigation, the need to modernize now inadequate marketing systems, the requirement for educating the farmers to new skills, and the need for institutional reforms.[84] In addition, as the Second World Food Congress recently demonstrated, these leaders attribute world hunger to more than the inadequacy of foodstuffs. They see such shortages as caused by a lack of purchasing power, both internal and external, which can be overcome by liberalized trade policies on the part of the advanced countries, coupled with a broad attack on the root causes of world poverty.

Trade Demands of the LDCs

Breaking down barriers to their exports has now become the focus of trade policy by the underdeveloped countries. Through the United Nations Conference on Trade and Development (UNCTAD) they have demanded preferential treatment by the developed countries. Their demand has been accepted in principle by the developed countries, including the United States, but little visible progress has been made toward this goal. The Latin American countries, in the so-called Consensus of Vina del Mar in May 1969, unanimously arrived at a list of demands for U.S. action to correct what they saw as inequities existing in the economic relations between this country and its neighbors to the south.

Despite these demands, it seems questionable to suppose that the LDCs will succeed in becoming substantial grain exporters in the near future. The FAO, working on the assumption that the developed countries would continue their present production and trade policies, foresees a growth in agricultural exports from the LDCs to the developed countries of only 1.8 percent per annum, from 1962 to 1975.

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[84] Wharton, "The Green Revolution: Cornucopia or Pandora's Box?" Op. cit., pages 464–476.

Future growth rates might be even lower.[85] When these possibilities are balanced against the demand for imports by the LDCs, it is difficult to see any gain in the latters' trading position. It is more likely, in the short run at any rate, that the developing countries will be thrown back on themselves. This is not necessarily a bad thing, again considering the short run. For the developing countries would be compelled to look to their own internal commercial markets as a force for growth. They could explore the possibilities which do exist for expanding agricultural trade among themselves. In addition, a number of the developing countries have the potential to substitute locally produced agricultural items—besides cereals—for commodities which they now import. If the shortage of foreign exchange helps in the realization of these possibilities, the result could actually be helpful to the LDCs involved.

In the long run, however, a collaborative attempt will have to be made by the developed and the developing countries to solve the latters' foreign exchange problems, lest the process of development grind to a halt. The United States would seem to have a stake in the success of any such collaborative effort for two reasons. First, this country has been committed to international development as a cornerstone of its foreign policy for two decades. If development stagnates for lack of foreign exchange, U.S. policy will have received a stunning setback and will have to search for a new direction, a task which can be accomplished neither quickly nor easily. Second, if the developed countries of the West refuse to let the LDCs earn their way in world markets, the developing countries might well conclude that it is the desire of the richer countries to keep the LDCs in a perpetual state of dependency. If such an idea is given any credence it could be most damaging to U.S. relations with these countries. The poorer countries have a better bargaining position since the advent of the Green Revolution. They will also have a greater incentive to press their position forcefully, assuming that the new agriculture will have created new jobs.

The Necessity for Balanced Development

Finding a solution to the food/population dilemma is the central problem of international development. It is interwoven with every other aspect of development. Thus it will not be solved in isolation. If population growth is checked effectively, and the growth and diversification of agriculture goes forward as hoped, the entire development process will benefit immensely. On the other hand, for the new agricultural revolution to make its most forceful impact, there must be enormous developments outside agriculture. Asian peasantry has demonstrated that it is not as resistant to change as it was so often thought to be. It has responded to the economic incentives offered by the Green Revolution; these incentives would scarcely be present, however, without the development of a market economy. Either the LDCs must be able to earn the foreign exchange to purchase the inputs necessary for agricultural progress, or these imports will have to be produced domestically, usually with foreign aid funds. Such domestic production helps establish sufficient purchasing power in the domestic market so that

[85] Food and Agricultural Organization of the United Nations. "Provisional Indicative World Food Plan for Agricultural Development." Vol. 1, op cit., page 21.

the additional food produced by the new methods can be bought at prices high enough to make it worthwhile for the farmer to utilize the new technology. This process requires economic growth on a broad scale: "The tremendous interaction and interdependency which exists between agriculture and other sectors on both the demand and supply sides make it impossible to separate the problem of food production as such from that of overall economic development." [86]

But more than general economic development is involved. What is also involved is distribution of income. The benefits of economic development should certainly be distributed so that, at the very least, lower-income groups can purchase the additional food that the Green Revolution has made available. Unless such distribution is accomplished, not only will food intake and nutrition continue at inadequate levels, but social unrest will be sure to follow.

Finally, only as the general drive toward modernization and development gains momentum can there be sufficient employment and income to eradicate hunger. Unless the economies of the LDCs continue to expand, there will not be jobs available for the additional millions that the population explosion will send into the labor market. If these new entrants can find no jobs, the cycle of hunger and malnutrition will begin all over again.

Thus far the new agricultural technology has increased labor requirements per acre because of multiple cropping and fertilizer application, while simultaneously decreasing labor requirements per unit of output because of the great increase in yield. The net effect, so far, seems to have been the creation of additional employment and increased income in the rural sector. But as the new technology continues to advance, and becomes diffused ever more widely through the LDCs, economic development and employment outside agriculture become ever more crucial.

Requirements Imposed on U.S. Diplomacy

The job of U.S. diplomacy generally speaking is to advance and illuminate the goals of U.S. foreign policy. With regard, especially, to a problem as complex and delicate as that of achieving a food/population balance, it must do so without offending the sensibilities of the countries concerned. As noted earlier the United States seeks to promote the Green Revolution and concomitant economic development. It is evident from what has been said already that this U.S. posture creates or exacerbates some difficult diplomatic problems.

U.S. diplomats are faced with the job of urging technological change on the leaders of the LDCs, even though such change may have unsettling social and political consequences. Indeed, it is even possible that the very leaders who take U.S. advice may find themselves deposed as a consequence of the social instability introduced by technological innovation. It seems paradoxical for the United States to encourage the LDCs to adopt the new agricultural technology knowing that there is a high risk of social turmoil, if a principal aim of U.S. development assistance is to help bring about stability in those countries. However,

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[86] National Academy of Engineering. "Symposium on the Food-People Balance. Panel on the Interactions between World Food and World Population," op. cit., page 4.

it is the U.S. hope that any destabilizing effects of the Green Revolution can be confined to the short run, and that eventually the position of the United States vis-à-vis the LDCs will be stronger, as the role of the Green Revolution in overall economic development becomes clearer, and its benefits more manifest.

Another responsibility of U.S. diplomacy as it confronts the Green Revolution is that of explaining to the governments of the LDCs the concept that technological change necessitates a degree of social change—that if the benefits of the Green Revolution are not distributed widely among all the population the result may be far greater unrest than if no changes were made at all. U.S. missions in the LDCs will be called upon to act persuasively but unobtrusively to put this point across.

The missions may also be called upon to defend U.S. policy when that policy is deemed by the LDCs to be unresponsive to their needs. Insofar as the Green Revolution is concerned, for example, they may be asked to explain why the U.S. does not give preferential treatment to the agricultural products of the LDCs.

V. Technology for Controlling the Population Explosion

The problem of balancing food and population involves the manipulation by governments of two sets of variables: (a) The problem of increasing food supply without achieving unmanageable agricultural surpluses or overtaxing marketing arrangements, and (b) The problem of ensuring that the rate of population increase does not exceed available food supplies or a nation's ability to assure productive employment. The first set of variables has been shown to have a well-developed technological component, and a poorly developed political (including diplomatic) component. At issue in the next two sections of the study is whether the technology and politics of national population management in the LDCs present a similar relationship.

Current Growth Rates in Asia, Africa, and Latin America

Population is growing faster now than at any previous time. It took all of recorded history for world population to reach half a billion by the middle of the 17th century. Population doubled to 1 billion by about 1840 or 1850—that is, in 200 years. It doubled again to 2 billion by 1930, or in 80 years. By 1960 another billion had been added, in only 30 years' time.[87] Present estimates place the world's population at 3.6 or 3.7 billion, or even slightly higher. The current annual rate of population growth is generally estimated to average nearly 2 percent. On that basis the world's population is increasing by at least 70 million people a year. One set of population projections show a world population of 4.933 billion by 1985, and anywhere from 6.1 billion to 7.5 billion people by the year 2000.[88]

Moreover, population is growing fastest in those areas that can afford it least, the underdeveloped countries. Thus, while the current rate of population growth in North America is 1.2 percent, in Western Europe .6 percent, and in the USSR 1 percent, in Africa it is 2.7 percent, in Asia 2.3 percent, and in Latin America 2.9 percent.

TABLE 4.—POPULATION GROWTH RATE, SELECTED COUNTRIES*

Country	Percent
Brazil	2.8
Colombia	3.4
Costa Rica	3.8
India	2.6
Pakistan	3.3
Indonesia	2.9
Laos	2.5
Thailand	3.3
Algeria	3.2
Nigeria	2.6
Zambia	3.0

*Source: Population Reference Bureau, Inc., "1971 World Population Data Sheet." (Washington, D.C., August 1971.) Data from the developing countries are not always accurate, and in some instances estimatas made by the U.N. Secretariat are incorporated in the figure cited.

Note.—Central America has the highest rate of population growth of any region in the world.

[87] "The Population Explosion." Department of State News Letter. (December, 1966), page 22.

[88] The totals shown for the year 2000 are based upon U.N. estimates, the lower figure representing the so-called U.N. Medium Variant, the higher figure representing the U.N. Constant Fertility Variant.

TABLE 5.—THE 15 MOST POPULOUS COUNTRIES*

[In millions]

Rank	Country	Population	Cumulative
(1)	Mainland China	772.9	772.9
(2)	India	569.5	1,342.4
(3)	U.S.S.R.	245.0	1,587.4
(4)	United States of America	207.1	1,794.5
(5)	Pakistan	141.6	1,936.1
(6)	Indonesia	124.9	2,061.0
(7)	Japan	104.7	2,165.7
(8)	Brazil	95.7	2,261.4
(9)	West Germany	58.9	2,320.3
(10)	Nigeria	56.5	2,376.8
(11)	United Kingdom	56.3	2,433.1
(12)	Italy	54.1	2,487.2
(13)	Mexico	52.5	2,539.7
(14)	France	51.5	2,591.2
(15)	Philippines	39.4	2,630.6

*Source from "1971 World Population Data Sheet—Population Reference Bureau, Inc." (Washington, D.C., Population Reference Bureau, 1971.)

By virtue of current high birth rates and short life expectancy, the underdeveloped world has a very high percentage of young people. Some 42 percent of the population of the LDCs consists of people under the age of fifteen.[89] As these young people move into their reproductive decades a progressive baby boom can be anticipated at the very time when, in the view of the great majority of development experts, there should be a maximum effort to cut back population growth.

It is perhaps the greatest irony of the development process that success in driving down the death rate has helped produce the population explosion. In a sample of 18 underdeveloped areas, for instance, the average decline in death rates between 1945 and 1950 was 24 percent.[90] Some other figures—if the period from 1920–1924 is taken as a base and compared with 1957—give the following percentages of decline in death rates: Chile, 57 percent; Taiwan, 67 percent; Japan, 64 percent; British Honduras, 56 percent; El Salvador, 40 percent; Jamaica, 65 percent.[91] Perhaps the most spectacular decline in the death rate took place in Ceylon, where it was cut in half in approximately three years, an accomplishment which had taken decades in Europe.[92] These spectacular results were the products of victorious campaigns against such diseases as malaria, yellow fever, smallpox, and cholera. The decline in the death rate was highest among young adults and children.

Their very success has put some health workers in the LDCs on the defensive, as if the cutbacks in death rates, through adding to the population, were somehow responsible for impeding economic development. No one seriously contends, however, that the less developed countries should let their health care slide in order to deal with the

[89] U.N. Working Paper No. 30. (December 1969), page 1.
[90] Ehrlich and Ehrlich. "Population, Resources, and Environment," op. cit., page 22.
[91] Quoted from William Vogt. "The Arithmetic of People." *In* U.S. Congress, Senate. Committee on Government Operations. "Population Crisis." Hearings on Foreign Aid Expenditures on S. 1676. By the Subcommittee on Foreign Aid Expenditures of the . . . 89th Congress, 1st session. Part 3–A (Washington, U.S. Government Printing Office, 1965) page 1509.
[92] "The Population Explosion," Department of State Newsletter, op. cit., page 23.

population explosion.[93] Not only is it unthinkable in terms of the values of all cultures, but, as Carl Taylor, Director of the Division of International Health, the Johns Hopkins University, put it:

> It is demographic nonsense to think that the population problem can be postponed by maintaining high death rates. In underdeveloped countries, if high birth rates had not been biologically adjusted to high death rates, the population would have faced extinction.[94]

Taylor points out that the death rate is sure to fall as part of the development process, and that this happened in Western countries with little if any assistance from health and medical services. The reality was that the peasant families of the LDCs had to have six or eight children in order to be sure that three or four would grow to maturity. Once the parents feel more secure that their children will survive, they may be more inclined to limit the size of their families.

The contribution that better health conditions can make toward solving rather than complicating the food/population paradox has been suggested earlier in this study. Widespread disease adds to the burden on available food supplies and exacerbates protein deficiencies. A population in good health gets maximum benefit from its food supplies. Its productivity is higher. Malaria control in Ceylon made possible a mass migration to formerly thinly populated parts of the island, to the benefit of the country's economy.[95] A mass mosquito control program in Nepal opened up the Rapti Valley to settlement and to agricultural production.

Widespread acceptance of family planning is, as we have seen, generally agreed upon as essential, for both economic and political reasons, to the success of the entire modernizing effort. Assistance to family planning is now the top priority of the U.S. foreign aid program. Helping the LDCs manage their population growth is an important objective of U.S. foreign policy. Health workers who have contributed so signally to development in the past will unquestionably be called upon to contribute to the achievement of this crucial objective.

The Impact of Population Growth on Economic Development

The extent to which population growth, if allowed to pursue its natural course, will impede economic development can be illustrated in a number of ways. One example might be the case of the Aswan Dam in Egypt: That dam has made available for cultivation approximately 2 million new acres of land and generates three times the amount of electricity produced in Egypt as of 1963; it may increase agricultural production in Egypt by as much as 45 percent. Yet the Egyptian population has risen commensurately while the dam was

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[93] Some development economists may privately think in these terms, however. At least one publication, *World Population and American Responsibility*, by Arthur F. Corwin, rather sardonically highlights the contributions to the population explosion of privately financed American public health programs. On the other hand, Gunnar Myrdal, John H. Bryant, and other students of development emphatically reject the idea of permitting continued high mortality as a means of population control. *See* the section on "The Complex Issue of Health and Overpopulation. In U.S. Congress, House, Committee on Foreign Affairs. "Science, Technology, and American Diplomacy: The Politics of Global Health." Prepared for the Subcommittee on National Security Policy and Scientific Developments of the . . . by Freeman H. Quimby, Science Policy Research Division, Congressional Research Service, Library of Congress, May 1971. See vol. II, pages 751–754.

[94] Carl E. Taylor, "Health and Population." Foreign Affairs, (April, 1965), page 475.

[95] Ibid., page 478.

under construction so that the effect of the dam on Egyptian living standards will be zero.[96]

Population increase also means increased financial burdens; hard-pressed governments must find additional funds for education, health, housing, and water supply. Inevitably they fall further and further behind, and foreign aid does not necessarily make up the gap. Each year in Latin America, where the population increases at the rate of 8 million people, a million new homes are needed. Yet in 1967, when the Alliance for Progress was 6 years old, only 350,000 housing units either had been constructed or were in the process of construction.

The best efforts of the LDCs in raising their own production levels are thwarted by the rampant growth in population. A large percentage of the increase in the gross national product (GNP) of the underdeveloped countries is consumed by population growth. In Latin America there has been a relatively high overall economic growth rate of 4.5 percent since the Alliance for Progress was launched. But with annual population increases of almost 3 percent, the per capita gain in GNP amounted to only 1.5 percent, affording meagre progress toward the better life that the people of the LDCs are seeking.[97] In fact, the gap between the rich nations and the poor nations is widening. In the years from 1960 to 1968 the total GNP of the less developed countries increased roughly 149.8 percent, compared with 147.8 for the developed countries. However, once population is taken into account, the figures change to 122.9 percent for the LDCs compared to 134.7 for the developed countries.

At present, Latin America elementary schools serve about 65 percent of the children; the other 35 percent—18.6 million children—have no schools. If present fertility rates continue, and if Latin America manages only to keep pace by continuing to provide schools for 65 percent of her children of elementary school age, in 30 years there will be 47 million children without schools.[98]

All of these problems are in addition to the immediate one of finding enough food to feed this ever-increasing population—plus the stress on the natural environment imposed by the population explosion. All phases of development, such as rising real incomes, modernized social organization, technological advance, health, education, and rising personal aspirations depend on finding solutions to the rising tide of population.

One of the most important aspects of the population problem in the LDCs is the changing pattern of population distribution. The developing impact of the new agricultural technology may render some rural workers surplus. Driven to the city they would become food consumers rather than producers. Moreover, urban population growth is a function of general population growth. As the national populace swells by natural increase, so does the urban populace.

The results of wholesale urbanization can be dramatically highlighted by a few statistics. According to U Thant's report at the U.N. Economic and Social Council's Committee on Housing, Building,

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[96] Robert L. Heilbroner. "The Great Ascent." (New York, Harper and Row, 1963), pages 55–56.

[97] U.S. Agency for International Development. "The Population Explosion—A *Present* Danger." (Undated), pages not numbered.

[98] Ibid.

and Planning (Document E/C6/102), the combination of rural-to-urban migration and population growth has swamped the facilities of the LDCs. The report estimates that from 1920 to the year 2000 the urban population of the LDCs will have grown from 100 million to an estimated 2 billion, a twentyfold increase. In developed countries, for the same time period, the increase is put at fourfold. This staggering population shift in the LDCs has created a housing situation verging on disaster in some countries. During the next 20 years it will be necessary to double the housing, sanitation, education, power, and other facilities. As U Thant puts it, there are "exploding cities in unexploding economies"; thus the prospects are dim of meeting the needs of the millions who will flock to the cities of the underdeveloped world. Bombay and Calcutta may reach the fantastic totals of 20 and 30 millions respectively before the end of the century.[99] Acute threats to health are caused by the overcrowding and poor sanitation in the cities of the LDCs. The pollution, traffic congestion, and noise common to the big cities of the developed countries are engulfing cities of the developing world as well.

The changing pattern of population distribution in the LDCs is chronological as well as geographical. An increasing percentage of the population is young, and eats but does not produce. The nonproductive children are a greater burden in the underdeveloped countries than in the developed ones. For every 100 productive adults there are 85 nonproducers in the LDCs, consisting of 79 children and 6 aged persons. In a developed country the ratio tends to be about 100 productive adults to 57 nonproducers. Since developed countries often extend the nonproductive period through age 20, a more accurate figure might show 100 to 76 for such countries.[100] Whatever ratio is selected, however, the age composition of the LDCs compares unfavorably with that of the developed countries in terms of producers and consumers. In addition to imposing a greater burden on the producers, this type of age distribution also means that income goes for subsistence, leaving less savings for investment, so necessary to development. Furthermore, the greater the percentage of the population entering the years of fertility compared with those growing beyond their fertile years, the greater the pressures for huge population growth.

Population growth generates many physical and social problems.[101] Not only must an increasing population be fed, sheltered, and clothed, but it must be educated, and jobs must be found for those of employable age. More and more of this increasing population is jammed into cities, compounding the difficulty of feeding and housing, education, health care, and employment, and putting tremendous pressures on the existing social and political structure.

Another source of pressure is technological change itself, which caused problems in the industrialized countries during their own era

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[99] Report quoted in "Survey of International Development," Vol. VI, No. 7, (Sept. 15, 1969), page 2.

[100] Jean Bourgeois-Pichat. "Population Growth and Development," International Conciliation. (No. 556. January, 1966), page 46.

[101] Professor Philip Hauser has added the category of population "displosion" to that of explosion and implosion (urbanization). By displosion he means an increasing diversity of population who will be sharing the same living space. This diversity encompasses culture, race, ethnicity, values, religion, and similar categories. Presumably this diversity will also be a source of domestic and international tension.

of development. The same process is recurring in the developing countries today, but at a time when the tempo of technological change is perhaps more rapid. The very speed of that change, rubbing against traditional values and social arrangements, exacerbates social tensions.

Opposition to the Limiting of Population Growth

It is the consensus of most U.S. students of the subject that fertility in the LDCs must be reduced to enable those countries to develop. There is a contrary view: Economic development requires population growth; powerful industrialized states have large populations; development must achieve economies of scale, which fact implies a large internal market; large areas of uninhabited land must be inhabited to support industrialization. Some Brazilians, for example, have argued in these terms.

Many Marxists in the LDCs view with a jaundiced eye the interest of the United States and other developed countries in limiting population growth. They suggest that the idea of limiting population is just a U.S. or Western device to contain their economies in a dependent and semi-colonial status. Apart from their Marxist outlook, their thinking appears to parallel that of persons of a more moderate or even rightist persuasion who believe that large population and industrial prowess go hand in hand.

A racial note is introduced by some leaders in the LDCs, who maintain that family planning and other programs designed to limit population growth are simply devices to maintain white domination over the non-white peoples of the world. This claim is often coupled with the accusation that the developed countries want to keep the LDCs in economic subjugation.

Still another view is that it is wrong to project present population trends simplistically. Little is known about the forces shaping population growth and flat predictions are risky. Moreover, concern over the gap between living standards in the developed and the less developed countries is futile, since it is impossible to close that gap anyway. The important goal, in this view, is to concentrate on attaining the greatest possible economic progress within the LDCs in terms which will benefit the people, thus generating support for continued development.

The Technology of Controlling Conception and Birth

The population explosion that places such a brake on development in the LDCs is attributable to a powerful combination of human motives. In addition to the general motivations of the sex drive and the desire to perpetuate the species, there are special motivations that operate with particular force in the LDCs. One is the prestige reward of the mothers of large families and the "machismo" of male virility. Another is the role of children as a form of old age insurance in the close-knit families of the LDCs. This combination of motivations makes implementation of birth control technology uncommonly difficult. The technology itself has the effect of separating the individual function of sex gratification from the social function of human reproduction. Both functions are at the core of strong emotions, long-established social mores, and profound religious beliefs. One basic uncertainty involves the extent to which any technology, however neutral or unobtrusive, ca· win acceptance over these opposing forces.

THE ORAL CONTRACEPTIVE (THE PILL)

Of all the methods of inhibiting conception, the ingestion of synthetic hormonal compounds has perhaps received the most attention in recent years.

The oral contraceptive, generally known as "the pill," is the most effective means of conception control known today, apart from sterilization. When taken faithfully according to medical instructions, it is virtually 100 percent effective.

The pill regimen involves the oral administration of estrogen, the female hormone, and progestin, a synthetic substance chemically similar to progesterone (a natural substance produced by a woman's ovaries), taken either sequentially or in a combined form. It is presumed that the pill acts to suppress ovulation. Taken daily for 20 or 21 days of a normal 28-day cycle, it will commonly regularize the menstrual cycle of a woman who may never have had regular cycles before.

The pill may have unpleasant side effects in 20–25 percent of the instances in which it is used. These resemble some of the symptoms of pregnancy, such as nausea, retention of fluid, headaches, weight gain, and swelling of the breasts. The side effects do not appear to inhibit the use of the pill to a significant degree in the developed countries. What may in time have this effect, in both developed and underdeveloped countries, however, is the question of whether or not the pill causes cancer or embolisms. A number of inquiries have been launched to look into the pill's safety, and some of them have been completed. Studies conducted in this country by the Food and Drug Administration concluded that there was no proof of any causal connection between the dangers attributed to the pill and its actual use. The same conclusion was reached by the World Health Organization, and by a British research committee. It has been generally recognized, however, that all the evidence is not in, and that the pill must continue to be examined. A study sponsored by Planned Parenthood of New York showed that certain "precancerous" changes in the cervix were more common among women using oral contraceptives than in a control group using diaphragms. Yet the condition involved did not always precede cancer of the cervix, and in any event is curable, so the results of the study were inconclusive. Studies in England did indicate that women over 35 who were using the pill had a significantly higher chance statistically of dying of thrombophlebitis or pulmonary embolism than women of the same age not using the pill. The FDA now requires that the pills be labeled so as to carry a warning of potential hazard to women with a history of venous disorders. The risk is less than half as high for women under 35. In both age groups, however, the risk of death is far less from using the pill than it would be from pregnancy.[102]

In underdeveloped countries there is another drawback to the use of the pill than the question of its safety. That is the fact that it must be taken each day, for most of the cycle. For a woman in the LDCs to submit to this discipline requires a higher degree of motivation than she may ordinarily have. According to the Indian Planning Commis-

[102] Ehrlich and Ehrlich. "Population, Resources, and Environment," op. cit., page 216.

sioner, the pill has failed in India because illiterate peasant women cannot be persuaded to take one daily.[103]

THE INTRAUTERINE DEVICE (IUD)

A contraceptive device employed widely, especially in India, is the intrauterine device, or IUD. This is a plastic or metal object inserted in the uterus, and left there for as long as contraception is desired. The device comes in several shapes, such as a spiral, a double coil, a loop, a ring, and a bow. As in the case of the pill, precisely how it works is not known. Different theories hold that it may interfere with implantation of the embryo after conception, or that it interferes with fertilization by stimulating the ovum to travel through the fallopian tubes very quickly.

One of the drawbacks of the IUD is that it may be spontaneously expelled, often without the wearer's knowing it. This happens to roughly 10 percent of the women who have had the device inserted, and is more likely to happen to young women who have had no children than to those who have had several. Other disadvantages are menstrual bleeding and pain, which are normal when the IUD is first inserted, but may continue thereafter, necessitating the device's removal. If the IUD is retained, and if the discomfort subsides, the device is second only to the pill in effectiveness.

From the standpoint of the LDCs, the big advantage of the IUD is the fact that it does not require the sustained motivation or the education associated with daily use of the pill. Once inserted, it can theoretically be forgotten. Strictly speaking, however, this is not the case, because it must subsequently be checked by a physician or a paramedical technician. Furthermore, there may be the discomfort already mentioned.

India also furnishes the foremost example of country where the IUD—specifically, the Lippes loop [104]—was used on a large number of women. Results were mixed: Half the women dispensed with their loops because of excessive pain, nausea, and bleeding. Even with better medical attention, others are now reluctant to try them.[105]

STERILIZATION

Sterilization is the most reliable form of contraception. It is a far easier procedure in the case of the male than that of the female. A vasectomy takes 15 or 20 minutes, and involves cutting and tying off the vas deferens, so that sperm is eliminated from the male ejaculate. The sterilization of a woman is an internal surgical operation, and hence entails greater risks. The abdomen is opened, and a section of each of the fallopian tubes is removed, so that ova cannot pass through.

Formerly the fact that sterilization was considered an irreversible procedure caused some hesitancy on the part of people who contemplated it. But a reversal operation is now possible in both men and

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[103] Claire Sterling. "India's Birth Control Progress." Washington Post. (September 30, 1970), editorial page.
[104] Named for its inventor, U.S. physician Dr. Jack Lippes.
[105] Sterling. "India's Birth Control Progress." op. cit.

women, with chances for success in the former case of 50–80 percent, and in the latter of 52–66 percent.[106] However, given the psychological comfort of knowing that it can be done, few individuals of either sex are likely to request restoration of their fertility.

To take India as an example again, nearly 7.5 million people there have been sterilized since 1966. Vasectomies have been done on an assembly-line basis, in places such as the Bombay railway station. The Indian government offers a small payment to the individual undergoing a vasectomy.

CONVENTIONAL METHODS

Although the pill, the IUD, and vasectomy have all gained prominence as technical means of effecting birth control, the so-called conventional methods which have been known for a longer period are still widely used. Some of these methods are relatively effective in preventing conception, others are less so. By and large they are not viewed as acceptably reliable solutions to the problem of population control in the LDCs. It seems likely that they will give way eventually to other methods yet to be discovered.

These conventional methods comprise the condom, the diaphragm, the cervical cap, various creams and jellies, the douche, the rhythm method, and others. The condom, or sheath, is widely known and extensively used in the developed countries; when properly used, its failure rate is comparatively low. Among the developing countries, India has a state factory with the capacity to turn out 144 million condoms annually, but whether this method, which to many connotes prostitution and adultery, will find ready acceptance in the LDCs may be problematical. The diaphragm, which has to be prescribed and fitted by a doctor, seems impractical for mass use by the women of the LDCs. The same objection can be made to the cervical cap. Spermicidal jellies and foams are easier to apply, but probably are less effective than the condom or the diaphragm. The rhythm method, which has the sanction of the Catholic Church, involves abstention on those days when conception should be possible. But this period is sometimes so difficult to determine, particularly if the woman has an irregular menstrual cycle, that it may require abstention for a good part of the month. Accordingly, the rhythm method is relatively ineffective, and it may strain conjugal relationships. Also, it seems ill-adapted to the needs of the developing countries.

NEW LINES OF SCIENTIFIC RESEARCH

Prompted by the widespread concern over the population explosion and the success of the Pill, a substantial scientific effort is underway to develop birth control techniques with fewer disadvantages and greater acceptability. The prime need for additional measures is in the developing countries, but the effort is being carried on in the developed countries, chiefly the United States.

Research is going forward on the so-called "micro-dose" pill, which would be taken every day, continuously, regardless of a woman's cycle. Since the dose is so tiny, it may be that such a pill would be safer than

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[106] Ehrlich and Ehrlich, "Population, Resources, and Environment," op. cit., page 220.

those now in use. Research is in progress toward development of a contraceptive injection that would be good for six months. Since the people in developing countries have become more familiar with inoculations, a reliable injectable contraceptive might find wider acceptance among them than the methods now in use. Research with dramatic possibilities is being conducted on what is known as the cylastic (or silastic) implant, a tiny cushion of absorbent plastic, superficially implanted in a muscle and releasing a measured dose of hormone which would prevent conception for a very long period of time, perhaps as much as 20 years. Conception could occur, should a couple desire a child, by removing the cushion, or perhaps by taking estrogen. One of the most promising lines of investigation now underway has to do with prostaglandins—fatty acid compounds occurring naturally in the body. They may be used once a month for fertility control, and may be administered orally, or by injection, or intravaginally.[107] Another line of investigation is concentrating on the "morning-after pill," which would be taken for three days after intercourse and would prevent implantation of the ovum in the endometrium (membrane lining the uterus).

Whether any of this research will bear fruit in time to benefit the developing countries is uncertain. The Food and Drug Administration (FDA) requires 10 years of testing of chemical contraceptives on monkeys. There are clinical trials involving large numbers of human subjects with follow-up laboratory testing. Because this research is so sophisticated, it can be done only in those countries that are scientifically advanced, and under less pressure to limit births. Obviously, it also takes considerable time. According to Carl Djerassi, before any developing country will accept a contraceptive agent for wide use it must have been approved by the FDA in this country or an equivalent European authority. If the safety of a particular contraceptive is questioned in any developed country, the latter takes both political and moral risks if it encourages a developing country to use the agent in question. The answer that Djerassi envisions to the entire problem of developing new chemical methods of contraception is for independent bodies of experts to act as "final courts of scientific appeal," with authority that supersedes that of government regulatory agencies. Such a body would be chosen in this country by the National Academy of Sciences, and internationally by the World Health Organization. He believes that a solution of this nature will compel the advanced countries, particularly the U.S., "to take a global rather than a parochial view of novel contraceptive approaches." He also foresees that such a solution will force the pace in the development of new approaches, a pace which at present is far too leisurely, given the enormity of the problem.[108]

ABORTION

One of the oldest forms of birth control, but one which has traditionally been subject to social disapproval, is abortion. To abort a fetus is to terminate a pregnancy in its early stages by one of several

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[107] Jan Palmer. "Ugandan Presses Prostaglandin Research," War on Hunger. A.I.D. Washington (September, 1971), page 3.

[108] Carl Djerassi. "Progress for the Development of Chemical Birth-control Agents." Science (Oct. 24, 1969), pages 469, 473.

methods. The standard method of performing abortions had been what is known in medical jargon as a "D and C": that is, dilatation and curettage of the uterus. This process removes and destroys the fetus. Other methods now in use include a vacuum method—developed by doctors in the U.S.S.R.—which is safer than dilatation and curettage, and a saline induction method.

The morality of abortion is the subject of debate, not only in the developed countries but in the underdeveloped ones as well. Opposition to abortion as immoral can be found among Roman Catholics, fundamentalist Protestants, and some Orthodox Jews, in this country. Although many clergymen favor legalized abortion, there are a number who would support it only if necessary to save the mother's life.[109] A survey made in Nagoya, Japan, in 1964, of 153 married women who applied for abortion, showed that "only 8 percent did not think it was morally evil; 17 percent thought it was evil rather than good; 16 percent thought it was quite evil; and 59 percent thought it was very evil.[110]

In the United States 33 states permit abortion only to preserve the life of the potential mother or, in some instances, to protect her health as well.[111] Seventeen other states have liberalized laws, ranging from those which permit abortion for causes such as fetal deformity or rape of the mother to the absence of any restriction save the recommendation of a physician.[112] It has been estimated that in the past fifteen months 400,000 American women obtained legal abortions; comparatively few of these had strictly medical reasons for seeking their abortions.[113]

While the recent trend has been toward easing abortion laws in this country, it is by no means certain that trend will gather momentum. Indeed, there is little movement on this issue at present. In most of the world, including the developing countries, abortion is illegal. Even those countries with liberal laws do not permit abortion on request. Japan, where the control of runaway population growth is usually attributed to the legalization of abortion, requires that a woman apply for and receive official sanction before the procedure can be performed.

Japan is often cited as the model for the underdeveloped countries to follow in checking rampant population growth. Japan legalized abortion, and it is sometimes implied that developing countries should do the same. But Japan is an inappropriate example to hold out to the LDCs. Moral questions aside, it is obvious that Japan is a highly developed country, with the skills and facilities to operate a large scale abortion program. The less developed countries do not have these skills or facilities. They lack sufficient doctors and hospitals to operate national abortion clinics except at high cost to other branches of their health services. In addition, with legalized abortion held out as an alternative, it would become that much harder for a developing coun-

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[109] Time Magazine (September 27, 1971), page 67.

[110] Arthur McCormack. "The Population Problem" (New York, Thomas Y. Crowell Company, 1970), pages 196–7.

[111] U.S. Department of Health, Education, and Welfare. National Center for Family Planning Services. "Current Status of Abortion Laws—January 1971" (Washington, U.S. Government Printing Office, 1971), table.

[112] Idem.

[113] Time Magazine, op. cit., page 67.

try to administer family planning programs based on contraceptive technology.

At this juncture there does not appear to be any real thrust in the less developed countries, with the exception of India, for the legalization of abortion. As long as a social stigma attaches to the practice, and as long as it contravenes the moral feelings of many people, it seems unlikely that political leaders in the LDCs will want to roil the waters by championing abortion reform as the key to population control.

The Problem of Medical Support

There are also operational barriers, in the form of inadequacies in the staffing and administration of family planning programs in the LDCs. The Indian physician needs a present incentive to participate in what are for him the boring and professionally unrewarding tasks of inserting IUDs and lecturing at birth control clinics. The same arguments would apply to the trained physician in other developing countries. Presumably the antipathy of most physicians to this type of work might be overcome if the financial incentives were high enough. Yet even with sufficient remuneration many physicians might participate unenthusiastically. Furthermore, doctors could find themselves in a conflict of values. On the one hand they may be trying to reduce infant mortality, on the other to reduce fertility. Many find at least a surface incompatibility between these two programs. Some doctors may be able to work on both with equal dedication, viewing them as different aspects of the broad concept of health care. Others however, more deeply affected by the traditional outlook of the medical profession, may feel more comfortable with programs to reduce infant mortality than with those seeking to reduce parental fertility.

The shortage of trained physicians, and the ambivalent attitude with which a number of them approach the subject of birth control, points up the need for large numbers of paramedical personnel to carry out programs of family limitation. Such personnel could be given sufficient training to advise on contraception, insert IUDs, etc., but need not receive the broader training of regular nurses. Paramedical people trained in this fashion might not only be useful in the execution of family planning programs, but in some instances might spell the difference between success and failure. Before adequate numbers can be trained, however, the medical associations in a number of countries would have to abandon the rather unsympathetic attitude they have usually tended to hold toward paramedical personnel. In addition, there would have to be adequate incentives for the paramedics, just as for regular medical workers, and for the men and women at whom the birth control programs are aimed.

One category of paramedical personnel already on the scene are the village midwives who sometimes serve as abortionists as well. These women have a certain amount of influence with the other women in the villages and may feel threatened by the introduction of family planning programs. Hence it may be important for the success of such programs to win these women over. The easiest way to do so would probably be through some form of financial inducement. The most effective way might be to combine such inducement with training in the administration of the family planning programs, where feasible, to preserve but redirect their influence in the community.

VI. Political and Diplomatic Issues of the Population Problem In the LDCs

Despite the persuasive logic, at the national level, of applying restraints to the multiplication of populations, powerful economic and cultural forces resist the implementation of national policy in villages and households. Administrative resources and skills in the governments of the LDCs are quickly overtaxed and their efforts tend to be modulated by fear of antagonizing the electorates. A different problem confronts the United States. There seems to be a clear perception in this country of the need to achieve a food/population balance, and of the need for population measures in particular in those countries receiving U.S. assistance. However, bilateral programs of aid conditioned on population measures run the risk of engendering hostility among populations of recipient countries as well as a sense of frustration among their leaders. It is possible that a more promising approach to the population problem is by the combining of resources of developed and underdeveloped countries alike in multilateral programs under U.N. or regional sponsorship. However undertaken, the invasion of this sensitive and deeply emotional issue is fraught with great difficulties. Only the vital necessity of solving the problem justifies the attempt.

Social Resistance to Birth Control and Family Planning Programs

Probably the main hurdle to the successful implementation of birth control and family planning programs in the LDCs is the system of cultural and social values that confront these programs. That system has traditionally placed a premium on large numbers of children for religious, economic, and societal reasons.

THE STATUS OF WOMEN

One reason why women in the LDCs lack motivation to take the pill regularly, or employ other contraceptive methods, is that in traditional societies such as those that prevail in Asia and Africa, a woman's prime obligation is to provide sons for her husband. A childless woman bears a stigma, and an unmarried one may be even less well regarded. In India, the expression "Two hands, one mouth" epitomizes the usefulness that children are thought to have as potential agricultural workers, producing more than they consume and thereby enriching the farm family. Children, particularly sons, in a country without old age insurance constitute a form of social security.

The more children a woman bears, the more assurance she has that she will be taken care of in her old age. Social and economic pressures thus militate in the direction of high fertility, and the ordinary woman has little incentive to resist these pressures. Indeed, studies made in Asia, Africa, and Latin America suggest that couples in a number of countries consider four to eight children to be an ideal number, de-

pending on the area and the group being studied.[114] In many instances where family planning clinics are operating, or family planning information is available, the women who take advantage of these facilities are in the later years of their reproductive period, and have already borne all the children they desire (or believe they need), and even more.[115] At this point, of course, it is too late to stem the consequences in terms of present and future population growth.

As long as woman's role in the LDCs is essentially restricted to a familial one, fertility is likely to remain high. Since the alternative of independent self-support hardly exists (although this situation too is changing in Latin America), women in the LDCs have little choice, in both economic and social terms, other than marriage and a family. If birth rates are to be reduced in any marked way, it would seem that the LDCs need to afford the women of those countries greater degree of freedom of choice regarding their role in life than they can now evercise. This suggests the need for upgrading their educational and employment opportunities, perhaps to the point of reserving a certain quota of jobs for childless and unmarried women. Strong measures along these lines are likely to assure great opposition, and not only from men. Nevertheless, leaders in some developing countries may conclude that they must move in this direction to check population growth.

THE MASCULINE IMAGE

A comparable set of cultural imperatives apply also to men. A man's status in some of the LDCs is enhanced by the number of children he fathers. The same compulsion for security in old age presumably motivates the men as well as the women to have large families. Sometimes, moreover, there are cultural factors which increase the likelihood of illegitimate births. Thus, according to one authority, in the middle sectors of Latin American society "free sexual activity may be regarded by the man as a sign of his *machismo*." [116] This concept of manliness is a valued ideal in Latin American culture, and is composed of elements such as self-assurance and orientation to action, as well as sexual prowess. It may be that the concept of *machismo* is in no way responsible for the great rapidity with which the population is increasing in Latin America, but since the *macho* is an admired figure, a certain subtle pressure would seem to be exercised on many Latin American males to live up to the image.

CULTURAL INERTIA

Operating as a general constraint on the limitation of family size in the LDCs is what might be called "cultural inertia." Gunnar Myrdal, in his comprehensive work *Asian Drama*, points out that suspicion of

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[114] Ruth B. Dixon, "Remarks to the Symposium on the Food-People Balance, Proceedings of the Symposium." (Washington, D.C., National Academy of Engineering, 1970), page 28.

[115] Ibid. However, Professor Dixon's view is not necessarily upheld by the figures of abortions in Latin America, which indicate that in that area, at any rate, many women do want to regulate the number of their children while still in their fertile years. In a Santiago study, for example, 85 percent of the induced abortions occurred among married women. A woman desperate enough to have an abortion might be expected to take advantage of whatever family planning service might be available.

[116] Dwight B. Heath and Richard N. Adams, eds. "Contemporary Cultures and Societies of Latin America." (New York Random House, 1966), pages 272, 509.

change and experimentation is characteristic of the populace in the developing countries he investigated, and that this attitude is a cultural obstacle to development. As he says,

> The great bulk of historical, anthropological, and sociological evidence and thought suggests that social stability and equilibrium is the norm and that all societies, and underdeveloped societies in particular, possess institutions of a strongly stabilizing character. In view of these findings the real mystery is how they can escape from equilibrium and develop.[117]

Attitudes and institutions that are part of an inherited culture do not change easily or rapidly, as a general rule. To bring about change there has to be sufficient motivation for change. Insofar as family planning is concerned, the evidence seems to suggest that despite cultural barriers it is not as difficult to motivate couples in this direction as toward some other aspects of development.

RELIGION AND POPULATION

Certain religious beliefs held by people in the developing countries constitute barriers to family planning, but these barriers are sometimes more ostensible than real. For example, Hinduism postulates four stages in the life of man, one of which is that of householder, producing sons and fulfilling his family duties. Indeed, preservation of the family, in Hindu ethics, is second only to preservation of the social order as a whole.[118] The traditional family system was a joint one: that is, a family comprised all or most of the kindred related through both maternal and paternal lines. The head of the household, usually the most important male member of the family, was the steward of the family's property. Under this system polygamy was permitted, although it was not approved except when a first marriage produced no living male children. Polygamy was not forbidden by law in India until 1955.[119] (The Indian government has also outlawed such traditional practices as child marriage, and has legitimized widow remarriage.) While Western influences have modified the Hindu outlook, and while educated Indians may be somewhat skeptical of traditional Hindu beliefs and practices, a large majority of Indians cling to their religion, and what has been called a "pro-natalist" philosophy. In the light of this situation, which would appear to militate against the success of family planning, it is remarkable that the Indians have been able to attain any measure of success in their ambitious program.

In Buddhist teachings, procreation and family life are considered to be matters of lesser importance. Buddhist priests are celibate. The religion stresses the avoidance of extremes, either of sensuality or asceticism. Thus pressures to marry and have children do not come from within the religion itself, but arise from extraneous cultural circumstances.[120]

In Islam, on the other hand, one can find pro-natalist teaching. Allah creates sexuality and determines fertility or barrenness. To restrict the birth of offspring by artificial means would seem, therefore,

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[117] Gunnar Myrdal. "Asian Drama. Vol. 3, Appendix 2." (New York, Pantheon, 1968), page 1871.
[118] "Encyclopaedia Britannica." (1964 edition. Vol. 11), page 511.
[119] Ibid.
[120] A. McCormack. "The Population Problem." op. cit., page 157.

to be against the divine will. Nevertheless, modern religious opinion has found Islamic principles which provide a sanction for contraception. Moslem leaders, like the Shah of Iran, King Hussein of Jordan, former Prime Minister of Malaysia Tunku Abdul Rahman, President Bourguiba of Tunisia, and the late President Nasser of Egypt all signed the document known as the Statement of Population by Heads of State, which urged family planning as the remedy for rapid population growth.[121]

In the encyclical *Humanae Vitae*, proclaimed on July 25, 1968, Pope Paul VI reiterated the opposition of the Catholic Church to artificial birth control, declaring that each and every marriage act must remain open to the transmission of life. All artificial interference with conception was banned, as was abortion and even sterilization, whether temporary or permanent. If a Roman Catholic couple wishes to limit the number of their children, they should, he said, either abstain or limit intercourse to the woman's infertile periods (the rhythm method).

In expounding his views, the Pope recognized the special problems that runaway population growth posed for the less developed countries. He contended, however, that the solution of these difficulties should envisage the social and economic progress of the individual as well as society, and should maintain a respect for "true human values."

The encyclical evoked protest both within and outside the Catholic Church. Dr. John Rock, a pioneer in developing the birth control pill and also a Catholic, sharply attacked the Pope's message. The Association of Washington (D.C.) Priests declared that they would refuse to counsel obedience to the ban on birth control, while the National Conference of Catholic Bishops issued a statement in support of the Pope. Abroad, Cardinal Alfrink and the Netherlands Catholic Bishops refused to support the encyclical. It was criticized by Italian papers of varying political coloration because of the appeals it contained to government authorities in the LDCs. Among the Catholics who accepted and supported the papal encyclical were those who nevertheless expressed apprehension that adherence to its principles would severely test the faith of many of their fellow Catholics. The Pope persisted in his position, however, and has not modified it in subsequent remarks.

Since the Catholic countries of Latin America are experiencing the most rapid rate of population increase in the world, the question naturally arises as to what connection, if any, there might be between their Catholicism and the ongoing rush of new births. The evidence appears to be mixed. For example,

> Dr. Benjamin Viel of Chile has pointed out that in Santiago, among wealthier families of strong Catholic persuasion, the birth rate is only 20 per 1,000 while among the lower class where "Catholicism exerts a doubtful influence * * * the birth rate, even with two abortions for every five births, reaches 40 per thousand."[122]

The only explanation for this difference, in Viel's view, was that upper class couples used contraceptives unknown among the lower classes.

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[121] Ibid., page 158.

[122] "Latin America at the Crossroads," (Victor Fund for the International Planned Parenthood Federation, Report No. 3, September 1966), page 21.

Surveys in Rio de Janeiro, Argentina, and Lima and Chimbote in Peru indicate that women from poor circumstances are more aware of the disadvantages of additional children than women from a more privileged background, but again, because of their ignorance of the latest contraceptive techniques, the poorer women have more children. But these same poor women also show a startling high incidence of induced abortions, despite the fact that the Catholic Chuch proscribes abortion.

Such evidence, combined with the fact that predominantly Catholic countries outside the Western hemisphere have achieved low birth rates, led former Senator Joseph Tydings to conclude that Catholicism would not necessarily be an obstacle to family planning in Latin America, and that the United States should continue to encourage such programs in that area as an integral aspect of total economic development.[123] However, there is also evidence to suggest that Church sentiment against birth control exercises considerable influence on the population policies of some Latin American governments. Thus, while some form of family planning education or research is carried on in almost every Latin American country, in only a handful of these is there any kind of public, government-supported program. In Mexico, Brazil, and Argentina, certainly three of the most important Latin American countries, the official policy is anti-birth control. One element contributing to this stand in each country was the negative attitude of the Catholic Church.[124] Uruguay also officially opposes birth control. After the Pope issued *Humanae Vitae*, the government of Colombia postponed a family planning program it had been preparing to adopt.

The authorities in Puerto Rico, a self-governing commonwealth whose people are U.S. citizens, remained undecided on the issue of family planning as long as the island's Church authorities were hostile to it. In 1970 the Archbishop of San Juan signified "conditional approval" to a government-sponsored family planning program, and now it is thought that the Commonwealth government will give more enthusiastic support to the program.[125]

In summary, the evidence appears to show that the poorer classes in Latin America are receptive to the idea of family planning, despite the teachings of the Church. The Church as an institution, however, retains sufficient influence to constitute an important component of those elements in Latin America which inhibit the introduction of family planning on a larger scale, and thus limit the range of choice by which these poorer classes may keep down the number of their offspring. Yet some of the younger, radical Latin American priests not only reject the Pope's pronouncements on contraception, but actually participate in birth control programs.

Administrative Weaknesses in the LDCs

Perhaps the greatest operational difficulty in running programs that would limit family size is the general administrative weaknesses of the LDCs. Managerial skill sufficient to administer large-scale programs effectively is difficult to come by in the developed countries. It

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[123] Joseph D. Tydings. "Born to Starve." (New York, Morrow, 1970), page 31.

[124] The opposition to family planning is found more among the hierarchy and the older priests. The young priests working in the slums tend to be favorably inclined toward birth control and family planning. Source: Conversation with Mr. Thomas Lyons, Population Office, AID.

[125] "People." (Washington, D.C., Population Reference Bureau, May 1970), page 3.

is even scarcer in the LDCs. The governments of those countries are often fragile and afraid to tackle problems that would upset internal equilibrium, which development so often does. This is one reason why development lags in some areas. The governments may substitute talk for action, or they may draw up elaborate development plans but fail to carry them out. Such ploys are hardly the exclusive characteristic of bureaucracy in the LDCs, but again, their negative impact may be greater than similar tactics in the developed countries.

Over the years the United States has devoted a good deal of aid money to training in public administration. The effective implementation of family planning programs is likely to strain further the already slender administrative resources of the LDCs. One consequence may be an even greater emphasis on public administration training in the U.S. aid program. Programs may be devised which are devoted exclusively to preparing trainees to administer family planning and birth control programs. Yet administrative and technical training cannot instill the ability to step smartly through political thickets. Thus the most effective administrators of family limitation programs in the LDCs will be individuals who are not only trained in the techniques of administration, but who are adept in using the political system in their own countries to generate popular and governmental support for achieving the program's objectives.

U.S. Diplomatic Mobilization to Deal with the Population Issue

The delicacy of the task facing American diplomacy with respect to family planning activities in the LDCs exceeds that required in the case of the Green Revolution. U.S. missions can show how unchecked population growth is hurting development. They can also inform officials in developing countries of the types of assistance relating to family planning they can receive under the U.S. foreign aid program, as well as of resources available from the private sector and international agencies. U.S. mission personnel themselves need to be apprised of the latest developments in research on fertility control, so they can pass this information on to the countries in which they are stationed. These functions would seem to be essentially a matter of maintaining good liaison between the appropriate officials in AID and the State Department, and between Washington and the field. While they can offer advice, if requested, it would seem essential that U.S. diplomatic personnel leave the choice of a birth control or family planning strategy to the host government.

EVOLUTION OF U.S. CONCERN

Toward the end of the 1950s the United States began to become aware of what has been called the "developmental equation"—viz., available resources divided by number of people equals degree of well-being. Development planners had long been aware, of course, that improved health and sanitation resulting from U.S. technical assistance would cut down the death rate and thus increase the population. At the same time, there were innumerable complaints that U.S. aid was inefficiently administered, and that it was not bringing results commensurate with the financial drain it imposed. A presidential committee headed by General William H. Draper was appointed to

look into the matter. The Draper Committee was impressed with the fact that in one country after another U.S. aid was being overtaken by burgeoning populations. As a result, the Draper Report to the President, published in 1959, recommended that the United States assist countries requesting aid in formulating their plans for dealing with rapid population growth.[126] Questioned at a press conference about this report, President Eisenhower replied that as long as he was President the government would support no birth control programs, because "that is not our business." [127]

Although the Administration did not respond positively to the Draper suggestions, the recommendations in that report did call public attention to the fact that population growth was a hindrance to development so that the issue was opened up for examination. In December 1962 the United States voted for a General Assembly resolution, the first in the history of that body to recognize the relationship between population and economic development. It proposed that the United Nations encourage and assist the governments of the underdeveloped countries "in obtaining basic data and carrying out essential studies of the demographic aspects" of their development problems.[128]

In that same year, 1962, AID began to work on the outlines of potential U.S. programs to assist family planning in the LDCs. AID analysts, along with others, had noted that population growth was hampering development, but because of previous U.S. policy constraints there had been no encouragement to develop programs to meet this situation. However, by 1962 it seemed appropriate to proceed with such plans.

The following year, the Congress passed and the President signed a foreign aid bill which contained an authorization for funding population studies. In the same year this country granted $500,000 to the World Health Organization in support of population research. The United States strongly supported another U.N. resolution calling for a study of the population problem. AID missions were directed to assist host governments, at the latter's request, in responding to questionnaires circulated by the UN's Population Commission.

In January 1964 AID established a special population unit in its Latin American Bureau, the first time this had been done by the agency. Training programs were set up for AID's staff. The Latin American Bureau then moved to establish population and family planning programs within the framework of existing health institutions. The agency's missions in Latin America were instructed to explore the attitudes of officials in the host countries toward such programs.

THE STRENGTHENING OF U.S. POLICY

Although its actions in 1962–1964 indicated that the U.S. Government was becoming alert to the dangers of the ongoing population explosion in the LDCs, U.S. policy may be said to have really turned

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[126] U.S. President's Committee to Study the United States Military Assistance Program. "Interim Report." (Washington, 1959.)

[127] See page 9 above.

[128] U.N. doc. A/C.2/L.657, as revised. Reprinted in "Department of State Bulletin," (Jan. 7, 1963), pages 19–20.

the corner in 1965. In his State of the Union message in that year President Johnson said:

> I will seek new ways to use our knowledge to help deal with the explosion in world population and the growing scarcity in world resources.[129]

In making this statement the President was committing the United States to come to grips with the population question in a positive way. His words constituted an explicit declaration that the United States intended to play a more active role in dealing with the problem. Later that same year, in speaking to the 20th Anniversary Commemorative Session of the United Nations, he called upon the members to—

> * * * face forthrightly the multiplying problems of our multiplying populations and seek the answers to this most profound challenge to the future of all the world. Let us act on the fact that less than $5 invested in population control is worth $100 invested in economic growth.[130]

This last sentence aroused some negative comment, for it was taken by some to mean that aid for family planning should be substituted for aid for overall economic growth. However, it appears to have been the President's intention to emphasize the relatively small cost of family planning assistance in comparison with other types of aid.

With policy direction clearly set by the Chief Executive, AID was encouraged to move more directly into the population field. Whereas in the fiscal year 1964 the Agency had obligated no funds for family planning and population programs, in the fiscal year 1965 it obligated almost $3 million for this purpose. In mid-1965 the Agency issued a statement outlining its policies with respect to family planning and population. The gist of that statement was as follows: (1) AID would not advocate any specific method of family planning. (2) Assistance would go only to those countries which permitted complete freedom of choice to the individual as to whether or not to participate in any program, and complete freedom of choice as to method if the individual chose to participate. (This is still U.S. policy, although some countries, India for example, by concentrating heavily on one method of contraception at a particular time, have raised a question as to whether the individuals participating in the program really have much freedom to choose the method.) (3) Official family planning programs would not be a criterion for receiving U.S. aid. (4) Assistance would be provided on request only. Guided by these criteria, AID increased its obligations for population and family planning programs to almost $5.5 million in the fiscal year 1966, but cut back to approximately $4.3 million in the fiscal year 1967.

Comprehensive hearings were launched in 1965 by the Subcommittee on Foreign Aid Expenditures of the Senate Government Operations Committee. These hearings, which were continued in 1966, 1967, and 1968, were chaired by Senator Gruening of Alaska. His bill, S. 1676, proposed to create an Assistant Secretary of State for Population Problems and an Assistant Secretary (in HEW) for Health, Medical Services, and Population Problems. It would also have authorized the President to call a White House Conference on Population in

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[129] "Public Papers of the Presidents. Lyndon B. Johnson, 1965." Vol. 1. (Washington, U.S. Government Printing Office, 1966), page 4.
[130] Ibid., Vol. 2, page 705.

1967. There were a number of cosponsors for S. 1676 in the Senate, and a companion bill was introduced in the House.

While no specific legislation emerged from the Gruening subcommittee hearings, they were notable for the depth and breadth of the information they elicited. One of the purposes of the hearings, in the chairman's words, was:

> * * * to help our Nation and all other nations determine the extent of the population problem, to inaugurate meaningful programs, and to provide man with the technical, medical, and sociological knowledge for implementing self-determined policies.[131]

In bringing together so much information in one place, and making it available for dissemination, the Subcommittee helped substantially to alert the public to the dimensions of the problem. Information developed by the Subcommittee may have helped persuade Congress to incorporate specific provisions dealing with the population explosion in both foreign aid and PL 480 legislation.

In 1966, legislative action was finally taken when the Foreign Assistance Act of that year provided that U.S.-owned or U.S.-controlled foreign currencies, accumulated primarily through the sale of U.S. commodities abroad, could be used to aid friendly foreign governments and private non-profit U.S. organizations to carry out voluntary family planning programs in countries requesting such assistance. The act required that the President receive assurances that no one was to receive family planning assistance unless he desired it. The Food for Peace Act, as previously noted, also contained provisions for the use of excess U.S.-owned currencies to assist in population control programs in the LDCs. However, at first the programs supported under these authorities were modest in scope and effect. U.S. aid was used for such activities as specialized training, the dissemination of information, and the manufacture of medical supplies. Programs seeking to limit family size received no direct U.S. help.

In May 1967 AID took the innovative step of making contraceptives eligible for financing under assistance programs, along with equipment for their manufacture. Contraceptives had previously been ineligible as foreign aid items. In September of that year it was announced that the first shipment would go to India, at its request.

The importance of this step went beyond the fact that contraceptives were to be made available through AID financing. For the fact that this action was taken with only the barest show of protest signalled a major change in public attitudes from those of only a few years before. This display of initiative on the part of AID may have been a factor influencing Congress to pass the liberalized legislation which was adopted in the same year. In any event, 1967 saw the enactment of Title X, which amended the basic Foreign Assistance Act of 1961 by authorizing the appropriate foreign aid agencies and the foreign aid program itself to help developing countries and institutions carry out programs relating to population and family planning. This is the crucial congressional authorization for the policies which the country follows today.

But the Foreign Aid Act of 1967 not only put the stamp of approval on U.S. assistance to family planning programs in the LDCs; it also

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[131] Committee on Government Operations, "Population Crisis," hearings, Part 1, op. cit., page 11.

earmarked funds, for the first time, for this specific purpose. The amount so designated in 1967 was $35 million. Thereafter the amount was to increase annually.

In 1968 the legislation renewing PL 480 (PL 90–436) also earmarked funds for population-related programs. This law imposed the constraint that "not less than 5 percent of the total [local currency] sales proceeds received each year shall, if requested by the foreign country, be used for voluntary programs to control population growth." The law also specified that one of the criteria of self-help which the President was to take into account before entering into an aid agreement for the transfer of food to a developing country was the extent to which that country would implement voluntary programs of population control. The effect of this provision was to make family planning an important consideration in the extension of PL 480 assistance to any country.

By the end of fiscal 1968 AID had committed $34.7 million for population assistance, or eight times the amount of the preceding year, and help was going to 26 countries. The Foreign Assistance Act of 1969 earmarked $50 million for population assistance, and subsequent legislation increased the amount to $75 million and then to $100 million. Table 6 summarizes AID's dollar obligations for population and family planning through fiscal 1970.

TABLE 6.—SUMMARY OF AID DOLLAR OBLIGATIONS FOR POPULATION AND FAMILY PLANNING PROJECTS, BY FISCAL YEARS *

[In thousands of dollars]

Project	1965–66	1967	1968	1969	1970
Nonregional:					
Office of Population	1,554	525	10,623	17,398	22,013
Office of International Training	91	41	38	40	304
AID administration (D.C.)	119	405	435	1,431	1,908
U.N. Fund for population activities			500	2,500	4,000
Nonregional total	1,764	971	11,596	21,369	28,225
Near East-South Asia:					
Country missions	[1] 2,100	337	[2] 9,061	3,336	22,861
Regional projects			655	976	324
Near East-South Asia total	[1] 2,100	337	[2] 9,716	4,312	23,185
Latin America:					
Country missions	361	1,178	5,457	3,072	5,437
Regional projects	1,670	1,191	2,468	7,255	5,518
Latin America total	2,031	2,369	7,925	10,327	10,955
East Asia:					
Country missions	112	334	3,475	6,388	8,673
Regional projects		350	1,325	1,608	623
East Asia total	112	684	4,800	7,996	9,296
Africa:					
Country missions	19	4	404	983	2,485
Regional projects		30	259	457	181
Africa total	19	34	663	1,440	2,666
Vietnam		50	50		180
Country and regional total	4,262	3,474	23,154	24,075	46,282
Grand total	6,026	4,445	34,750	45,444	74,507

*Source: AID, "Population Program Assistance," Washington, 1970, p. 17.

[1] A development loan to Turkey, originally for $3,600,000, signed October 1966.
[2] Includes $2,700,000 loan to India for program vehicle parts.

The extent to which congressional convictions have crystallized concerning the importance of assistance to underdeveloped countries in the field of population control can be found in the Foreign Assistance and Related Appropriations Act of 1971, PL 91–619. In making assistance available to multilateral organizations, including a specific amount for the U.N. Children's Fund, that law provides that no part of the appropriation is to be used to initiate any project or activity which has not been justified to the Congress, "except projects or activities relating to the reduction of population growth." In an era when Congress is concerned with reasserting its constitutional role in the conduct of foreign policy it seems significant that it should be willing to exempt from its oversight international projects for checking population growth.

U.S. POLICY TODAY

In July 1969 President Nixon became the first President to send Congress a message dealing explicitly with the subject of population. It was, he said, a problem the world could not ignore; the United Nations and its specialized agencies and other international bodies should take the lead in responding to world population growth. He pledged full U.S. cooperation with any U.N. efforts, but also pointed out that the United States could help, and was helping, efforts initiated by other governments. He noted that he had asked the Secretary of State and the Administrator of AID to give population and family planning "high priority for attention, personnel, research, and funding among our several aid programs." [132] The Secretaries of HEW and Commerce and the Directors of the Peace Corps and the U.S. Information Agency were also asked to give close attention to population matters in planning their overseas operations. The President further declared that all U.S. efforts in this area should give additional recognition to the important resources of private organizations and university research centers. Finally, he called upon other nations to enlarge their efforts to assist family planning and population programs.

The attention given by the President to the subject demonstrates its new importance in U.S. foreign policy. From a minor element in the foreign aid program it has risen to very high priority. Its importance is also confirmed by the number of other agencies besides AID involved in U.S. efforts to help contain population growth in the LDCs.

U.S. Agencies with Overseas Population Programs

As overseas interests of the Federal Government have extended to population matters, various agencies of the executive branch have established programs to collect information, to devise policy, and to establish relationships abroad. Demographic studies have long been conducted in the Census Bureau and the Department of Labor of comparative statistics from overseas. Some sociological research in foreign areas has been sponsored in recent years by the Department of Defense—with arrangements for coordination by the Department of State. However, the brunt of U.S. operational concern in foreign

[132] U.S. Agency for International Development. "Population Program Assistance." (Washington, D.C. October 1969), page 14.

population problems is centered in the Agency for International Development. Second only to the work of AID is that of the Department of Health, Education, and Welfare, with its expanding relationship to the World Health Organization.[133]

THE DEPARTMENT OF STATE

The Department of State is perforce involved in the U.S. effort to cope with the worldwide population explosion. The impact of the expanding population on international relations is a pervasive one. The Department has concluded that its officers serving abroad must have a greater knowledge of population dynamics, and the Foreign Service Institute has introduced material on population and family matters into its courses for junior, middle level, and senior personnel. In addition, the Institute conducts a series of seminars on population for key officers at State and other foreign affairs agencies. The Special Assistant for Population Matters, whose office was established by the Secretary of State in 1966, consults with other agencies which have responsibilities in the population field and also acts as the Department's liaison man with U.S. embassies, particularly in the LDCs. He sees to the exchange of information on developments in population matters. In addition he maintains liaison with private organizations active in population work. In each regional bureau an official is now designated as the Population Officer for that bureau; moreover an official is similarly designated in each of the U.S. embassies, including those in countries where there is no AID mission.

THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

The Department of Health, Education, and Welfare is directly concerned with U.S. international population programs, principally in the field of research. Under the Public Health Service's administrative umbrella, the National Institutes of Health, the Health Services and Mental Health Administration, and the Consumer Protection and Environmental Health Services are all conducting research, both in this country and abroad, on aspects of family planning. The Center for Population Research of the National Institute of Child Health and Human Development coordinates the research programs carried on in those countries where the United States owns excess local currencies accumulated under PL 480. A number of such projects are currently going forward.

The Center for Population Research is also the focal point for HEW's contract research program in contraceptive development, which was initiated in 1969. This program looks to the development of contraceptive methods that will be effective, safe, reversible, inexpensive, and adapted to the diverse needs of the world's varied population. Research has been concentrated in four areas: corpus luteum function, sperm capacitation, oviduct function and gamete transport, and the biology of the ovum; each has demonstrated particular pro-

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[133] For a discussion of the relationship, see Chapter Nine, "The Politics of Global Health."

mise for the development of new methods to regulate fertility. Investigations are also going forward on the medical effects of contraceptive agents now in use, particularly as to whether there is any connection between the use of oral contraceptives and the incidence of cerebrovascular and other disorders.

In 1970 the Center supported nine projects on the medical effects and mechanism of action of steroid contraceptives and IUDs, fields in which research is considered important for family planning the world over. The Center also funds considerable contract research in demography, as well as projects in the social and behavioral sciences. A number of contracts relate specifically to population problems and programs in the developing areas: for example, one study covers urbanization, migration, and fertility in Thailand.

The Food and Drug Administration supports research to evaluate the safety of oral contraceptives. The Health Services and Mental Health Administration supports research in mental health and behavioral aspects of fertility, and in the operational aspects of family planning services. It also provides academic training or field observation for foreign physicians and health personnel in family planning. The Social and Rehabilitation Service, another HEW unit, supports research overseas in the operational side of family planning projects. and also provides training opportunities in the social aspects of family planning for paticipants sponsored by the U.N., AID, or other national or international organizations. For example, it cooperated in planning the 1970 International Conference on Social Work Education, Population, and Family Planning, which was sponsored by the Council on Social Work Education and supported by AID.

THE UNITED STATES INFORMATION AGENCY

In contrast with the role of HEW, that of the United States Information Agency (USIA) is relatively modest. However it is not insignificant. Its principal function is to disseminate information, particularly to foreign opinion leaders, in order to increase awareness and understanding of population growth and family planning. In those LDCs with programs to check expanding populations, the USIA tries to strengthen public interest in and support for these programs, but within the bounds set by the policies of the particular country and the sensitivities of its people. Its information activities relate population problems to housing, education, health, and the ability of the particular country to achieve its own development goals. Materials are prepared in support of U.S. policies and programs, but emphasis is also given to the role of international agencies, especially those connected with the U.N., and even to programs sponsored by agencies in other countries. USIA posts and libraries abroad make available copies of pertinent speeches, articles, and other materials on population and family planning prepared by governments, by international institutions, and by private organizations and individuals. This service is in line with USIA's recognition of the fact that population growth and distribution are matters of worldwide concern.

THE PEACE CORPS

Since 1966, the Peace Corps has also been involved in family planning progress, though on a limited scale. Some 100 volunteers are working in established national programs or in programs set up through local initiative. This assistance is furnished only to those countries that have asked for it. In some countries Peace Corps assistance is technical, using physicians and highly skilled nurses. In other places generalist volunteers are used in the education and training aspects of the program and in staff referral centers.

THE AGENCY FOR INTERNATIONAL DEVELOPMENT

AID has the most extensive responsibility in the U.S. effort to help the LDCs check the steady climb in population in the third world and to restore equilibrium to the food/population balance. That responsibility is centered in the Office of Population, under AID's Bureau for Technical Assistance. In addition, there are population officers in AID's regional bureaus in Washington and in its missions abroad.

Consideration of space precludes a full discussion of AID activities but what follows may be taken as typical. AID views action to reduce high birth rates as primarily a task in extension education. People need to know, first, the advantages of a lower birth rate, then how to achieve it, and then where to obtain clinical advice and contraceptive supplies.

Since the success of population programs depends on mass public support and on millions of individual decisions to practice contraception, programs of information and education, particularly through mass media of communication, have drawn active AID encouragement. The Agency has supported such programs in India, Pakistan, Korea, Tunisia, Morocco, Kenya, Ghana, and other countries. It has also aided private organizations working in this field, such as the International Planned Parenthood Foundation and the Pathfinder Fund. A project at the East-West Center at the University of Hawaii which would provide a continuing inventory, analysis, and evaluation of information/education/communications support activities, and would train specialists in this field, is considered to be one of the most important population activities of the Agency. AID also makes an effort to interest national youth groups in the population problem. But it sees the principal means for fostering information, education, and communications in the programs undertaken by the developing countries themselves. To assist such programs AID provides financial aid, commodities, training, consultant assistance, and other help.

Support of research is another major function of AID in the field of population. It emphasizes applied or "goal directed" research, which will contribute to the success of AID-assisted population programs. Four areas of research are particularly pertinent: (1) descriptive demography; (2) population dynamics; (3) operational research; and (4) the development of new or improved methods of fertility regulation, more suitable to conditions in the LDCs. Some typical projects in these areas are as follows: (1) Establishment of population laboratories at universities in various LDCs which would seek to improve the reliability and predictive value of the data used for population

and family planning programs; (2) research into the attitudes and values held by husbands and wives that affect their utilization of available family planning services; (3) actual operation of family planning programs, staffing patterns and training methods for program workers, and best methods for educating or motivating users of the program; and (4) improving the acceptability of some specific method of contraception.[134]

AID also helps private and government-sponsored programs to provide contraceptives and clinical supplies which will increase their effectiveness. As of June 30, 1970, more than 18 million monthly cycles of oral contraceptives had been purchased with AID financing for use in developing countries. Purchases of oral pills, IUDs, and condoms are made through the General Services Administration. In this way, AID can standardize specifications of quality and safety, and encourage competitive bidding. It buys only those oral contraceptives which are covered by what is known as an approved New Drug Application (NDA), and it requires that the safeguards of the Food and Drug Administration with respect to information requirements for medical personnel and patients as stipulated for the United States be applied to purchases made for consignment to the LDCs. On request, this information will be translated into the local language. (Approximately two-thirds of the oral contraceptives financed by AID through June 1970 were on behalf of private nonprofit programs, while bilateral government-to-government assistance accounted for the rest.)

AID also helps to train the manpower to carry out family planning and population programs. Preliminary surveys in 37 countries indicate that over the next ten years manpower requirements for these programs will exceed 50,000 physicians, 150,000 nurses and nurse-midwives, 45,000 health and family life educators, 100,000 health and family planning home visitors, and 20,000 medical social workers.[135] There will be an additional need for small numbers of demographers, behavioral scientists, communications specialists, and training specialists.

To meet this challenge AID has stepped up development of manpower analysis skills in AID-assisted institutions, looking for a formula applicable to different countries and situations. It has also expanded its support of training in the skills needed in this field. Some of this training takes place overseas, although not necessarily in the specific country of the trainee; other trainees come to the United States. The training consists of special seminars, on-the-job training, academic work, or some combination of two or more of these. Four U.S. universities receive AID institutional support grants for training in this field. They are Johns Hopkins, North Carolina, Michigan, and Hawaii. A grant is also made to the Population Council to support advanced training of a small number of students overseas. Table 7 shows the total number of students receiving family planning and population training in the United States, both long and short term, through special courses funded by AID, as of October 1970.

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[134] The ideal method is described as one in which a "nontoxic and completely effective substance or method" can be self-administered on a single occasion and ensure the absence of pregnancy at the end of a monthly cycle.

[135] U.S. Agency for International Development. "Population Program Assistance," 1970, op. cit., page 24.

TABLE 7.—STUDENTS RECEIVING FAMILY PLANNING AND POPULATION TRAINING IN AID-FUNDED COURSES GIVEN IN THE UNITED STATES*

Institution and type of training	Number
Census Bureau:	
Population studies	66
Data processing	36
Sampling	7
Total Census	109
Planned Parenthood Association, Chicago:	
Family planning operations	42
Family planning administration and communication [1]	121
Total PPA	163
National Center for Health Statistics: Measurement of population change [2]	23
East-West Center, Hawaii: Population Studies	18
Government Affairs Institute for the Study of Human Reproduction, Columbia University: Clinical training	37
Foreign Service Institute, Department of State: Orientation in population/family planning	87
Grand total	450

*Source: AID, "Population Program Assistance," 1970, op. cit., p. 27.

[1] Participants in University of Chicago, Community and Family Studies Center, summer workshop who get field training at PPA.

[2] Includes Vital Statistics, Survey Statistics, and Evaluation of Family Planning Programs.

In addition, AID directly or indirectly assists the training of population program personnel in more than 30 countries. For example, in the Philippines some 1900 people underwent training at three separate institutions, while training personnel of the Philippines Health Department were themselves undergoing training in family planning in order to launch a department-wide course. In Chile more than 900 individuals received some form of short-term training.

AID Assessment of Program Requirements

Nevertheless, the number of people being trained in family planning and allied fields seems likely to fall far short of the requirements projected for the next decade. To train sufficient numbers would appear to require a greater cooperative effort, involving the developing countries, other donor countries, and international agencies, as well as the United States. AID itself, in the evaluation it conducts of its programs and projects, reached the following conclusions at its 1970 Spring Review: [136]

First, family planning programs need to stress quality as well as quantity. Initial emphasis on quantitative targets could be self-defeating. Second, greater emphasis should be placed on the private sector, that is, on people who do not utilize clinics and hospitals. Abortion, of considerable importance in reducing fertility in countries where it is legal, also warrants increased attention. Third, younger "lower parity" mothers, mothers with fewer living children, should be reached with newer techniques like the pill. Present programs tend to reach older individuals who have already had several children. Fourth, family planning services should not be held back when more comprehensive health programs are lacking, even though it is extremely beneficial for a family planning system to operate in relation

[136] Ibid., page 28.

to general health services. Fifth, population activities need to be considered in the broader context of total development planning, rather than simply as elements of health and family planning programs, "since birth rate declines depend on the development process itself as well as on the availability of family planning services." On this point AID's evaluation is consistent with prevailing opinion among development experts.

In the light of these conclusions, it was suggested that expansion of AID-assisted programs to reduce LDC birth rates will depend on action on three related fronts: (1) greater and more effective use of currently available contraceptive techniques; (2) research and experimentation with new and relatively untried contraceptive techniques and the means of delivering them; and (3) research and experimentation on accelerating the integration of family planning with the continuing process of social, cultural, and economic change.[137]

Besides subjecting to analysis its overall performance in the field of family planning and population, AID supports projects which evaluate its work in this field in specific countries, including quantitative projections designed to predict how changes in fertility rates will affect various aspects of economic development. A model to test cost-effectiveness of family planning programs has been developed in a contract with Pennsylvania State University. Broadened by AID and programmed for computer execution, some of the series generated by it are shown in Table 8 below:

TABLE 8.—SELECTED MEASURES OF FAMILY PLANNING PROGRAM PERFORMANCE*

Country	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Equivalent dollar expenditure per eligible couple:										
Coverage:										
Chile				0.17	0.31	0.79	0.75	1.22		
India	0.04	0.07	0.07	.12	.22	.23	.43	.47		
Korea		.10	.17	.32	.39	.70	.73	1.00		
Malaysia							.41	.56	.64	
Pakistan						.35	.56	.76		
Taiwan				.09	.33	.29	.33	.42	.44	
Tunisia								1.13		
Percent of eligible couples contracepting via the program at end of year:										
Acceptance:										
Chile				1.2	4.6	7.2	8.8	12.7		
India	.4	.5	1.1	1.6	3.0	4.4	6.3	8.1		
Korea		.1	.7	8.1	13.2	18.8	20.4	20.1	23.0	
Malaysia							.9	4.3	7.0	
Pakistan						2.8	7.9	14.0	17.8	
Taiwan				2.3	6.2	8.9	11.4	13.1	14.0	
Tunisia				.3	1.8	3.1	3.4	3.9	5.0	
Births averted as percent of births expected in absence of program:										
Effectiveness:										
Chile					1.3	5.2	8.1	9.8	14.0	
India	.2	.4	.5	1.0	1.5	2.8	4.1	5.9	7.5	
Korea			.1	.6	6.2	10.5	15.2	16.2	15.7	18.1
Malaysia								.9	4.4	7.2
Pakistan							2.3	6.5	11.6	14.9
Taiwan					1.9	4.9	6.8	8.6	9.5	9.9
Tunisia					.3	1.9	3.2	3.5	4.0	5.1
Equivalent dollar expenditure per birth averted:										
Cost-effectiveness:										
Chile				13.99	11.03	19.08	14.30	17.76		
India	11.54	16.35	10.94	12.26	10.88	8.01	8.67	10.60		
Korea		47.43	13.90	7.79	7.66	9.36	11.70	19.57		
Malaysia							113.84	33.20	32.99	
Pakistan						28.67	16.62	10.68		
Taiwan				10.04	17.30	13.76	14.07	17.20	17.81	
Tunisia								58.63		

*Source: AID "Population Program Assistance," op. cit., page 29.

[137] Idem.

Successful operation of family planning programs requires institutional support. Institutions must be available and equipped to perform research, training, consulting assistance, and evaluation. Funds have been provided since 1965 to four U.S. institutions to develop expertise in these services. These are the four previously mentioned: Johns Hopkins, North Carolina, Michigan, and Hawaii Universities. AID believes those developing countries which have population programs ought to have appropriate institutional support, where feasible. Presumably AID intends to expand its field services in this direction.

With so many government agencies concerned with population programs, a problem of coordination is likely to arise. Recognizing the need for a forum which would air suggestions and comments on world population problems, Secretary Rusk in 1967 suggested the creation of an Interagency Committee on Population Matters. This Committee was duly formed of representatives of the State Department, AID, the Defense Department, HEW, the Interior Department, the Commerce Department, the Labor Department, the Agriculture Department, USIA, the Peace Corps, the White House Office of Science and Technology, the National Science Foundation, the National Academy of Sciences, and the Bureau of the Budget (now the Office of Management and Budget). A Working Group on Population Matters was set up to coordinate the foreign affairs agencies with an interest in this field. It consisted of representatives from State, AID, the USIA, and the Peace Corps. The function of both of these groups was essentially informational—that is, to alert the various agencies of the Government to the nature and scope of the population explosion, so that the departments which might be concerned would think about the problems it posed and the action the United States might take to cope with them. Neither of these bodies is now functioning, and policy coordination is the responsibility of the Secretary's Special Assistant for Population Matters, who exercises it through a variety of informal channels. On the other hand, neither of these bodies has been officially terminated.[138]

The Assistant Administrator of AID for Technical Assistance, within whose jurisdiction AID's Population Office is located, holds conferences twice a year at which Government representatives and those from private organizations interested in the population field exchange ideas and comment. These conferences serve, at present, as the formal channel for people in the executive branch concerned with the population explosion in the LDCs, and their counterparts in private organizations, to compare notes and coordinate their activities.

The Congressional Role

The evolution of U.S. policy toward the food/population equation in the LDCs has been affected by congressional action. Voices were raised in Congress and resolutions introduced on the problem of controlling population growth as early as 1963, at about the time that the highest echelons of the executive branch began to indicate support for programs in this area.[139] Congress has been responsive to executive

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[138] Conversation with the Office of the Special Assistant to the Secretary of State for Population Matters.

[139] Philip Appleman. "The Silent Explosion." (Boston, Beacon Press, 1965), pages 114–6.

requests for funds in this area, and is equally responsible with the executive for assigning the highest priority under the U.S. foreign aid program to family planning and population activities.

Consequently any assessment of the impact of the food/population crisis on both the mechanisms and substance of U.S. diplomacy should note this congressional role. Like the State Department, AID, and other national and international agencies, the Congress is concerned lest unchecked population growth lead not only to starvation in the LDCs, but to the wreckage of international development as well. It seems likely that the Congress will continue to monitor events in the field of population with a view to the possible passage of legislation to make U.S. policy in this area more effective. The strong interest of the Congress in environmental problems also points in the same direction.[140]

Multilateral Programs Dealing with the Population Problem

The burgeoning of global populations has begun to provoke action in the United Nations and associated agencies with increasing impetus. As principal custodian of global statistics, of course, the U.N. has long had a role in the study of the subject. In particular, the planning activities of FAO necessitated early attention to the population side of the food/population balance. For example, as early as 1947, FAO undertook a small study in methods of encouraging rural industries as a means of stabilizing the displaced agricultural population to counteract the trend toward the cities that was already evident at that time. By 1969, the Pearson Report was to warn that "If present trends continued, the largest city in India would have over 35 million inhabitants by the year 2000." [141]

> No other phenomenon casts a darker shadow [warned the Report] over the prospects for international development than the staggering growth of population. It is evident that it is a major cause of the large discrepancy between rates of economic improvement in rich and poor countries.[142]

United Nations activity in the field of population was formalized with the establishment by the Secretary-General in 1967 of the United Nations Fund for Population Activities (UNFPA). In 1969 the Secretary-General vested responsibility for managing UNFPA in the Administrator of the United Nations Development Program (UNDP) which is the center for U.N. technical and development assistance programs. By the end of 1969, $5 million had been pledged to the UNFPA, of which $4 million was contributed by the United States. Other contributing nations were Denmark, Finland, The Netherlands, Norway, Pakistan, Sweden, Trinidad and Tobago, and the United Kingdom. Most of this money has been obligated for a variety of projects, involving not only the usual training activities and research, but also support for nonconventional equipment and supplies.

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[140] See: U.S. Congress. Senate. Committee on Interior and Insular Affairs. "Congress and the Nation's Environment: Environmental Affairs of the 91st Congress." Prepared by the Environmental Policy Division, Congressional Research Service, Library of Congress, February 10, 1971, 92d Congress, 1st session. (Washington, U.S. Government Printing Office, 1971), 288 pages. (Committee Print.)

[141] "Partners in Development." Report of the Commission on International Development, op. cit., page 61.

[142] Ibid., page 55.

A considerable expansion of this program is anticipated and as Administrator of the UNDP, Mr. Paul Hoffman proposed a goal of $15 million in pledges for 1970. The United States responded by pledging to contribute up to $7.5 million, subject to matching contributions from other donors. In the fiscal year 1971 the U.S. pledged $12.5 million to the U.N. for population activity, again on a matching basis. In 1970 roughly $10 million was obligated by the UNFPA for programs and projects of the United Nations and its specialized agencies. The fund has been active in supporting expanded population programs by the U.N.'s regional commissions for Africa, Asia and the Far East, and Latin America.

The Population Division of the U.N. Secretariat will continue its traditional role of demographic research and projections, technical information services, and support for conferences funded from the U.N.'s regular budget. It will also serve as an executive agency for the UNFPA in providing technical assistance to requesting countries in areas within its competence.

Some of the U.N.'s specialized agencies are both interested and active in the population field. These include the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the Food and Agriculture Organization (FAO), and the International Labor Organization (ILO). Some UNFPA money will be funneled to WHO for its training programs, and advisory and technical services to member countries, etc. Some of its funds will also go to the FAO, which is interested in policy-oriented research into the implications of population trends for agricultural development and in the integration of family planning into home economics education. ILO will also receive funds from the UNFPA for activities including exploratory missions to several countries on such matters as the relationship of population and family planning to industrial health and welfare services. The United States pays regular assessments to FAO and WHO, while U.S. contributions to UNICEF are normally financed through the foreign aid appropriation. The second installment of the U.S. assessment to ILO for 1970 was not paid, however, because of congressional dissatisfaction over the growing direction being taken by ILO (specifically, a belief that Communist influence was excessive in the affairs of the Organization). This item was not included in the 1971 State Department appropriations bill that cleared Congress.

The Organisation for Economic Cooperation and Development (OECD) has also established a Population Unit, which has received its chief support thus far from Sweden and the United States. The purpose of this Population Unit is to promote awareness, among both donors and recipients, of the population factor in international development, and to disseminate current information on the subject. It has organized several conferences and seminars for this purpose.

The World Bank, the most important multilateral lending institution, is moving increasingly into population and family planning activities, particularly since Robert McNamara assumed its presidency. It set up a Population Projects Department in fiscal 1969, and made its first loan in this field in June 1970. World Bank activities in this field are of special interest to the United States inasmuch as this country is the Bank's largest contributor, subscribing over 24 percent of its capital as of June 30, 1969.

RECOMMENDATIONS FOR FUTURE U.N. POPULATION MEASURES

The Pearson Report has urged a stronger role for international organizations "to slow the growth of population." Special attention was directed at "the training of population and family planning specialists." Other important contributions proposed were in the development of "social policies which reduce the dependence on the family as the sole source of security" in order to lessen the motivation for large families in the LDCs, and a worldwide mobilization of scientific research to develop a "genuinely satisfactory method for fertility control." [143]

In a separate section of the Report devoted to "Population Policy," five recommendations were offered for future action. These were:

> That bilateral and international agencies press in aid negotiations for adequate analysis of population problems and of the bearing of these problems on development programs;
>
> That developing countries identify their population problem, if they have not already done so, recognize the relevance of population growth to their social and economic planning, and adopt appropriate programs;
>
> That developed countries initiate or strengthen their own facilities for population studies;
>
> That international organizations extend their training of population and family-planning specialists in all relevant categories; and
>
> We * * * endorse the proposal to appoint a Commissioner for Population in the United Nations.

In support of the final recommendation, the Report observed: "As things now stand, there are both gaps and overlaps in the handling of population problems by UN agencies. Effective organization of assistance for population programs is needlessly delayed." The Report called attention to the fact that in many LDCs the incentive in the individual family toward having many children had economic validity as a form of increased productivity and social security. "In the long run, economic growth and modernization tend to make a large family a heavy economic burden rather than a source of gain and security, and thus to discourage fertility and slow population growth, but this process takes a long time if it is not deliberately accelerated."

Then the Report proposed a sixth recommendation:

> That the World Bank, in consultation with the WHO, launch immediately a wide-ranging international program for the direction, coordination, and financing of research in the field of human reproduction and fertility control.[144]

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[143] "Partners in Development," op. cit., page 20.
[144] Ibid., pages 195–199.

VII. Future Diplomatic Issues of the Food/People Equation

Rapidly advancing technology shows promise of enlarging world supplies of food to meet completely the needs of the world's burgeoning population. Technology has also demonstrated that it can be used to slow the rate of human reproduction. On a global basis, mankind need no longer be the inevitable victim of a postulated Malthusian law that condemns some fraction of the total number to starvation or semi-starvation. The question now becomes one of skill in human management: Can man so order himself and his institutions of government and administration that he can make use of the food and population technologies he has been permitted to discover?

Scientific agriculture, vigorously pursued in the United States since the 1860's, has enabled five percent of the population to feed the rest, with a surplus. By 1980, it has been estimated that there will be only about 1.9 million farms (down more than one-third from the mid-1960's) with a farm labor force of 2.5 million workers (down 1.3 million from the mid-1960's). Although one-third of all farms in 1980 will be small, their share of total farm receipts will be only 1 percent. Nearly one-third of all farms will be large, with cash receipts exceeding $20,000 per farm.[145] The presumption is that this same direction is likely to be taken by agriculture in the developing countries, as they embrace modern farm technology. Starting from an agricultural population ranging from 60 to 80 percent of the whole, the LDCs can expect the proportions of population on farms to shrink even as their total populations continue to rise. Much has been said and written about the importance of encouraging labor-intensive technology in the agriculture of these countries, and there are assurances that the Green Revolution requires not only capital but an initial increase in labor for irrigation, dam and well construction, and the like. However, the ultimate end result still seems likely to be a reduction in farm labor; man-hour productivity will rise, larger-sized farms will gain the most and expand accordingly, and farm workers will be displaced. The more rapidly the Green Revolution takes place, the more rapidly—it would seem—will agricultural workers be displaced. Only a positive and vigorous governmental effort can interrupt this process, and one of the effects of such an effort would be to diminish the incomes of the class that today provides much of the leadership in the LDCs. The alternative course—merely permitting surplus ex-farm labor to aggregate as urban unemployed—invites grave dissatisfactions, tensions, and organized insurrection. These consequences are primarily domestic, but assuredly have diplomatic aspects. It would seem prudent to recognize these early rather than late.

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[145] U.S. Department of Agriculture. "The Farm Index," (July, 1971), page 5.

In the United States, the social adjustments consequent on the shift of the population out of agriculture and into industry and services, and from rural to urban. has taken place over more than a century. The gradualness of the change has helped to ease it; even so, there have been episodes of agricultural revolt, tension, agitation, and dissent, from the Whiskey Rebellion to the Great Depression. However, the rapid pace with which the Green Revolution appears to be advancing in the LDCs suggests that adjustments will be telescoped into a decade or two.

The fruits of the Green Revolution have been spectacular. Mexican wheat yields have trebled in 15 years. Rice yields in West Pakistan have more than doubled in five years. Profits to Turkish farmers growing dwarf wheats are 2.5 times as large as those from native varieties, in Pakistan and India more than four times as large. Moreover, these achievements do not represent the ultimate, even in wheat, corn, and rice, where they have been most spectacular; further genetic improvements are still possible in these and other crops.

But paradoxically, this technological success has spawned a host of problems of such magnitude and complexity that the Green Revolution has sometimes been styled a "Pandora's box." Instead of being recognized as an opportunity for man to overcome hunger for the first time in recorded history, it is viewed with apprehension and alarm. The fact is that it is a radical development. But all technology is radical. It leads to change, to challenge, to reassessment of social mechanisms, and to readjustment of economies. In the last analysis, technology is a great regulator of the human order: It determines what is physically possible.

Politics, administration, and diplomacy are terms for the various forms of human relationship upon which technology impacts; they are also terms for the forms of human organization by which technology is put to work. These forms of human relationship determine how effectively man uses his technological opportunities.

The Politics and Diplomacy of Food for the Future

Broadly speaking, the problems set in train by the Green Revolution fall into two categories: (1) Those appearing within the LDCs themselves, as a result of the political, social, and economic effects of the new technology; and (2) the consequences for the developed nations of the world of the appearance of the new abundance of staple food commodities. The actions taken in response call for three sets of organizational entities: (1) Institutions and organizational arrangements within the LDC itself to smooth the path and ease the dislocations of the Green Revolutions; (2) bilateral arrangements, such as between the United States and an LDC; and (3) international or multilateral agreements and systems to provide global stability, unify international purposes, and ease international conflicts arising out of the changed patterns of trade.

The prospective abundance threatens to generate several kinds of problems within the LDCs. Gains in food production may be poorly distributed from one district to another, as between East and West Pakistan. They may benefit the wealthier farmers while leaving the poor farmers even less well off. Both of these effects generate tensions

within a country. The already evident flight from the farms to the cities is likely to intensify, with unemployment increasing in both poor rural areas and cities. All of these effects call for mediation and corrective action by the LDC governments, and in some cases for hard decisions on the part of political leaders. If the alternative is between governmental overthrow and outside assistance, it would seem to be important for the United States and its diplomats to know what form such assistance should appropriately take. It would seem also to be important to know in which countries such outside assistance would be likely to be effective, and where it would be merely support for a losing cause. Among the kinds of support that have been mentioned are: Improved credit resources more widely available at regional and local banking levels; more widespread and longer education of the population; encouragement of the use of labor-intensive farm equipment; assistance to small farmers in the exploitation of the new genetic forms of grain; increased opportunities for rural industry; improved arrangements for storing surplus grains and preventing losses to pests; better arrangements and facilities for the marketing of agricultural products; and above all, a strong administration of government, equipped with adequate taxing power and management skills to distribute equitably the costs and gains of the Green Revolution.

Lester R. Brown, author of "Seeds of Change," cites the international rice market as an example of the problems and opportunities of an equitable marketing of agricultural commodities. The world rice market, always sensitive, "appears to be headed for a difficult period with the amount of rice available for export at * * * reasonable price almost certain to exceed import needs." Japan, he goes on to say, is a high-income country that is a major consumer; Japan is not only self-sufficient in rice, but is subsidizing exports; yet the internal price of rice in Japan is nearly triple the current world market price. The effect of this situation is that the rice-producing LDCs are denied the Japanese rice market; consumers in Japan pay more for their staple; and the United States finds it necessary to extend dollar aid to the LDCs because they are unable to sell their product. Moreover, as the Green Revolution goes on its way, these conditions will appear in corn, wheat, and other grains.[146]

One question, from the point of view of the Department of State, is how U.S. policy should be represented in the LDCs on agricultural matters. Should historic policies of encouraging U.S. exports and prices of agricultural commodities be continued, or should there be a modification in these policies to accomplish other foreign policy objectives? A close reading of the pertinent section of the Macomber report [147] does not reveal an intention to respond to the kind of challenge raised by Lester Brown's study. Emphasis appears to be on the strengthening of the U.S. economic position in agriculture, rather than searching for a rational accommodation of international interests in stabilizing and strengthening commodity markets. The effect of such a policy would seem to be to transfer the costs of LDC development to the taxpayer, and to the consumer of protected agricultural commodities, while running the risk of creating revolu-

[146] Brown "Seeds of Change," op. cit., pages 190–194.
[147] Diplomacy for the 1970's—A Program of Management Reform in the Department of State. Op. cit., page 475.

tionary situations in the LDCs with ensuing complications for U.S. foreign policy.

There seems to be considerable support at present for achieving a resolution of the complex problems posed by the Green Revolution through the United Nations and its associated agencies, particularly FAO, WHO, and the World Bank. International programs of assistance in management skills, public administration, education, labor training, and availability of capital to exploit the Green Revolution and to provide jobs for displaced workers, all seem appropriate activities for multilateral support.

Multilateral Approaches to Problems Generated by the Green Revolution

The inherent advantage of multilateral over bilateral assistance is that the diplomatic profile of the donor is lowered. Motives of the donors are under less suspicion. Another presumed advantage is that recipients may be more likely to contribute substantively to the planning of general programs. If they are involved in the planning, they are more positively committed to the implementation of plans. Burdens of cost can be more widely distributed. Results can be better analyzed on the basis of international comparisons. Contributions to a genuinely global program can be expected to come earlier from those nations which are initially recipients. Some forms of assistance practically demand a global approach.

For example, Herman Pollack, Director of the Bureau of International Scientific and Technological Affairs, Department of State, has suggested the systematic exchange of germ plasm, a basic ingredient of agricultural development.

> Cooperative exchanges developed by the Department of Agriculture [said Pollack] have been instrumental in providing new germ plasm to widen the breeding base. For example, a variety of hard red wheat was acquired from Turkey resistant to various races of stripe rust. In Montana alone, use of this variety has prevented losses estimated at $2–$3 million annually. Similarly, a tomato variety acquired from South America provides wilt resistance to about 100 varieties grown in the United States. In Ohio alone, it is estimated that the wilt resistance gained from this acquisition has saved growers $1 million per year. A peanut variety acquired from South America was planted on 400,000 acres annually from 1962 to 1968 and is estimated to have increased production by as much as $9 million annually because of its higher yield. Following an exchange developed with the Soviet Union, United States corn breeders received an early maturing variety having good stalk quality. This germ plasm is now found in hybrids having an annual value of $500,000 for the seed alone. Many other similar examples in agriculture could be cited.[148]

Whether it would be more effective to continue the exchange of germ plasm on a low level, based on bilateral contacts, with countries at different levels of technical sophistication, or to mount a global program of germ plasm management, would seem to warrant considerable attention and analysis.

Mention has also been made in this report of the recommendation that an early warning and quick response system be developed on a

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[148] Testimony before Subcommittee on International Cooperation in Science and Space. House. Committee on Science and Astronautics, May 18, 1971. Reproduced in State Department Bulletin (June 28, 1971), pages 39–840.

global or multilateral basis for detecting and reacting to the onset of agricultural plagues or blights. In the earlier report, "The Politics of Global Health," it was suggested that such a system needed to be established by the World Health Organization for human epidemic diseases. The same logic applies, it would seem, to the protection of the plant life on which man depends. The diplomatic aspects of such a program include not only its initial design, but also the problem of overcoming resistance on the part of a country afflicted with a plant virus or blight to the measures necessary to contain and eradicate it.

Since all nations have at least some interest in further technological advances in nutrition chemistry—in particular, the development of new, perhaps synthetic, protein concentrates and additives—a substantial research program under U.N. auspices might be a logical extension. Other areas of scientific research might also be pursued on such a multilateral basis. Moreover, the statistics of agricultural production and marketing have been identified as a particularly difficult field for a developing country and could thus be an area for concerted international assistance.

In addition, there is widespread interest in the concept of stabilizing farm products and prices on a global basis. This was illustrated by the statement of the Director-General of FAO, Addeke H. Boerma, that the subject of international agricultural adjustment would be a main theme of the FAO Conference to be held in 1973. Boerma has suggested that international commodity agreements might be developed one at a time, or combined into an integrated scheme for international commodity control. This would mean, he said,

> * * * adjustment in terms of what is produced in individual countries [with] the greatest attention possible being paid to the question of comparative advantage. It is also adjustment in the rules affecting the international movement of commodities. This, of course, includes problems of access, problems relating to commodity arrangements in order to ensure reasonable and stable prices, and—assuming that surpluses are likely to continue for some time—problems as to the use of agricultural commodities in food aid.[149]

The asserted advantages of the multilateral approach to world agriculture should not obscure the evident weaknesses of present institutions to accomplish purposes generally sought. Some of the weaknesses attributed to the U.N. complex have included: Uncertain funding, varied quality of technical personnel, wavering political support, confused lines of functional organization, want of firmness in management, and absence of accepted overall authority. The desirability of a clearer mandate for specific global chores to be implemented by this system, and a general overhaul and strengthening, would appear to warrant early legislative and diplomatic consideration.

The Politics and Diplomacy of Stemming the Population Explosion

The population issue presents modern diplomacy with its most fundamental, difficult, sensitive, and universal challenge. The issue concerns the intimate human act of sex, the deep emotional values of self-perpetuation, and the spiritual forces of all religions, as well as questions of national power and prestige. The fact of the population explosion is everywhere perceived. The technology for its control is

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[149] Boerma, "Address to the Eighteenth General Conference of the International Federation of Agricultural Producers. . . .," op. cit., pages 16–17.

available. But the social and psychological obstacles to the use of this present technology in areas where the population increase is steepest are so substantial that major efforts are under way to discover more acceptable technologies. Attending these efforts is the hope that better formulas or contrivances can be found which will somehow meet the psychological, ethical, and religious, as well as the physiological, requirements of population control.

One diplomatic problem posed by this situation is that the research into potential new technologies is being sponsored by and conducted in the developed countries—subject to their standards of medical reliability and safety—while the primary need for the technology is in the LDCs whose standards might well be qualified by this greater need.

Another diplomatic problem arises from the sheer sensitivity of the issue itself; communication across international boundaries is difficult on any issue involving conflict of values or differences in national purpose, but more so when the subject matter is deeply personal as well as a concern of national policy. Regardless of the objectivity and professionalism with which bilateral aid in matters of population control is offered, the opportunity for misunderstanding of intent and suspicion of motives is likely to remain. Perhaps in this field more than others, the most hopeful route is through multilateral action.

There are many reasons to consider the need for national and global efforts to stem the rate of population increase. Population density affects the ability of human societies to preserve the quality of life, to make available adequate resources to sustain life, to maintain order, to govern, to insure the security of the individual from crime, to maintain the security of nations from tension or even insurrection, and to reduce the possibility of international conflicts. Population numbers and rate of increase have a profound bearing on all of these.

Considerable emphasis was placed, in earlier parts of this study, on the need for reliable factual information about all aspects of demography, population movement, the mathematics of human increase, behavioral differences of various geographic and social segments of population, and the like. The advantages of collecting such information in an international rather than a national agency, and of standardizing internationally the procedures and parameters used, would appear to be evident. Moreover, the relationship of numbers of population to the questions of food, urban industrialization, education and training, and public administration, is functionally important. All these matters become subjects for diplomatic discussion, related to aid to the LDCs and to the rational management of food and commerce.

A study prepared by the Office of the Foreign Secretary of the National Academy of Sciencies, announced in July 1971, offers some specific recommendations in the field of population management for adoption by multinational organizations. Said the study:

> The United Nations and its specialized agencies, particularly the UN Fund for Population Activities, the World Health Organization, and UNESCO, ought to give high priority to helping their member states learn from one another about population goals and the conduct of fertility-reducing programs * * *.
>
> The United Nations Development Program and other UN agencies and regional organizations, such as the Pan American Health Organization and the Organization of American States, are urged to greatly strengthen their staffs

and procedures to increase the effectiveness of their technical assistance for fertility reduction programs. Multilateral assistance through intergovernmental agencies will often be more acceptable than bilateral assistance to developing countries; therefore it is important to improve its quality.

A United Nations agency (such as the World Bank) should take the lead in preparing a world budget of needs during the next two decades to carry out programs of fertility and mortality reduction in all developing countries. [Such a budget would include] provision for research; training; collection and analysis of demographic data; public education and communications; contraceptive materials; services of physicians, paramedical and other personnel; transportation and other expenses; program evaluation; and welfare policies that would reduce the desired numbers of children and are feasible in different countries * * *.[150]

Political and Diplomatic Problems of the Food/People Equation

Clearly, the two global tasks of producing enough but not too much food to feed the world's population, and providing incentives and means for the world's population to hold itself within reasonable bounds, are a tremendous challenge for modern diplomacy. The rewards of success are less impressive than the terrible consequences of failure. There is a regrettable tendency on the part of mankind to respond eagerly to rewarding opportunities, but to ignore the prospect of misfortune and delay action to avert it until convinced of its reality by its actual onset.

Rationally, men can already perceive the adverse human consequences of over-population. But there is a countervailing recognition that there are also adverse consequences of a stable population. Population growth in some instances is a powerful engine of economic growth and expansion. The developed countries have not yet accepted the consequences of a steady state either in the numbers of their population or in their industrial productivity. The alternatives that face mankind today are growth or no growth, and either one presents its problems. The logic of the situation is that soon or late mankind must accept the limits of the physical world. In a finite world, infinitely continued expansion is an impossibility. The next question is whether there is at any given time an optimum size of global population. (And indeed, also, an optimum level of affluence!) If growth in numbers must stop, then when would be the best time to stop it? By what criteria is this decision to be made? Is it the same decision for all countries? Is the final result the same for all time? And, how is the decision to be reached and then given practical effect?

It is evident that the nations of the world cannot ignore each other's wishes in this matter. Population pressure in one country (for example East Pakistan) cannot help exerting pressure on its neighbors (for example India). Population differences make bad neighbors, just as affluence and poverty make bad neighbors. This dilemma must be resolved cooperatively if it is to be resolved at all. It will be resolved either rationally by agreement among nations and an orderly process of implementation; or it is likely to be resolved irrationally by war, disease, and social disorder within and among nations.

Given these somber conclusions, it would seem to be advantageous for U.S. long-range policy to search out and exploit every available opportunity to establish a solid and scientific, factual base of information about the food/population equation, for individual nations, for the

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[150] "Slowing Population Growth: Recommendations from a Special Study." News Report. National Academy of Sciences-National Academy of Engineering-National Research Council. (Vol. XXI, No. 6, June-July, 1971), page 7.

regions of the world, and worldwide. It would seem to be essential that the base of education be strengthened in all countries so that their peoples can understand the reality of the problem, and to assure that the best available technology bearing on the food/people equation is everywhere available and in the hands of people competent to use it.

There are dangers in the premature adoption of unproved technology and dangers in too prolonged testing and perfecting of technology that shows promise. Risks need to be balanced against alternative consequences, under the specific conditions of individual countries. Nor should technology be expected to provide complete answers. The "technological fix" is a chimera unless it is applied in compliance with social and political rules, unless its application makes use of social and political skills and knowledge.

Should scientists be educated to recognize that the problems of human management are far more intractable than are the technological problems associated with the food/people equation? It has been the policy of scientists to apply techniques as soon as they are validated, without subjecting them to rigorous assessment as to possible secondary effects that may ultimately prove undesirable. U.S. policy in the adoption of technology has been mixed and inconsistent: relaxed and carefree for many consumer products, fearful for some, and painfully protracted for others. The decision as to when a new technology is ready for use is an extremely difficult one, quite apart from the hazard to its users.

The great human effort involved in the mobilization of administrative and social action is more difficult than the mobilization of scientific effort. If a government is called upon to administer a grossly faulty technology, more is lost than the wasted effort and the injury resulting from the faults as the program is halted. Failure makes more difficult a subsequent mobilization of social effort when a more reliable technology becomes available. Diplomats, no less than scientists, need to be aware of this. In some areas, the Green Revolution came too early with crops ill-adapted to local conditions so that effort was wasted, harvests spoiled, and—above all—confidence impaired. Dissatisfactions also have been reported with the initial efforts to introduce the IUD, resulting in a similar toll on confidence.

The problem of the food/people equation is so complex that its solution is bound to be piecemeal and incremental, and to contain a fair element of trial and error. There is a general human tendency, moreover, to ignore possibly adverse consequences if they are remote, in order to exploit what is real, concrete, and near at hand.

Among the questions raised by the problem for which answers may have to be forthcoming are the following. Are there new techniques of diplomacy and management that can be applied to accelerate the kinds of corrective action that have been discussed in this study? Can additional new technologies further improve the corrective methods that have been described, to render them more acceptable politically, economically, and socially? Should each country bear the brunt of the burden of adjustment to achieve its own balance between food and population, or does a more effective solution lie in

regional or global balance? The answers to all of these questions relate to the effectiveness of both U.S. and multilateral efforts to balance the equation of food and population.

A heavy U.S. investment in correcting the global food/population balance would mean the shifting and reallocation of funds earmarked for other development programs, and perhaps the dropping of some, as long as U.S. foreign aid outlays remain roughly what they are now. Whether foreign aid appropriations are increased, reduced, or remain at the present level, the greatest positive impact on development might well come from putting as large as possible a percentage of foreign aid money into population-limiting activities. At present, the United States allots approximately five percent of its foreign aid to family planning work, while other large countries contribute less than one percent. Sweden, with nine percent and Norway with ten percent, appear to lead in this category.[151]

It is not known how much money would be needed to bring population growth in the LDCs to a stable condition because no comprehensive study has been made of the magnitude of the world's effort in this field. To get an accurate picture of the total need requires solid analysis of what is being done by the developed countries, the U.N. agencies, private groups, and the LDCs themselves. Such an inquiry could be launched by the Congress, either through hearings or by commissioning a study. There could also be interest in such a study at both the State Department and AID, which might want to conduct it themselves if it should turn out to be within the limits of their available resources. The United Nations might also be interested in doing a study of this kind. Indeed, President Nixon in his foreign aid message proposed that the U.N. Fund for Population Activities make a study of "world needs and possible steps to deal with them" in the population field.[152]

Regardless of the total cost of coping effectively with the onrushing tide of population, it is important that every success be as visible as possible. Thus far, the American people and the Congress have supported expenditures of public funds for this purpose. If the expenditures show no results, it is unlikely that support for this activity can be sustained in the Congress and with the U.S. public. This eventuality does not seem likely in the present climate of general concern, but given the somewhat tenuous support for foreign aid to begin with, it remains a possibility.

An even less likely development at this time, but again not impossible, would be the adoption by some developing countries of compulsory measures of population control. (Indeed, in India at one point it was proposed that compulsory sterilization be enforced upon males with three or more living children; the proposal was quickly withdrawn in the face of vigorous opposition.[153]) Should such a proposal be revived and acted upon, it would confront the United States with a

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[151] Conversation with Philander Claxton, Special Assistant to the Secretary of State for Population Matters.

[152] U.S. Agency for International Development, "Foreign Assistance for the Seventies." President Nixon's Message to the Congress. (Washington, U.S. Government Printing Office, September 30, 1970), 15 pages.

[153] Ved P. Nanda. "The Need for a Global Population Policy—Now," Denver Law Journal. Special Magazine Issue, 1971. Reproduced by Foreign Area Research Coordination Group No. 14488. Department of State, page 10.

totally new situation, inasmuch as the U.S. program is grounded, legally and morally, on the principle of free choice. Again, this eventuality is one for which the United States should not be completely unprepared.

The one conclusion to which the evidence points most insistently is that the food/people dilemma cannot be considered in isolation. It is, rather, an integral part of the total development process, and beyond that a feature of a maturing world. Even if the Green Revolution is successful in feeding a vastly increased population, development will not go forward and living standards will only decline if population growth is not effectively checked. For population is even more intractable a problem than food supply. All phases of development are retarded as long as expanding population eats into economic growth. Investment is held back or channeled into unproductive areas. Job opportunities are not created, and unemployment or underemployment spreads. Social misery continues unchecked, and populations—rural and urban—become increasingly susceptible to appeals to violence.

The final result of the international campaign to bring food and population into balance in the LDCs—in such a way that economic development can go forward, and an acceptable level of human welfare can be achieved and sustained—cannot be foreseen. Certainly the challenge is as difficult as any ever faced by man; it calls for the careful management of a complex interaction of scientific knowledge, diplomacy, and social engineering. At the beginning of the decade of the 1970s, the issue is very much in doubt. In the years ahead, the extent and character of the U.S. effort can have a crucial effect for good or ill.

Chapter 12—United States Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange

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TABLES

FIGURES

LIST OF ABBREVIATIONS

AID	Agency for International Development.
ASI (NATO)	Advanced Study Institute, sponsored by North Atlantic Treaty Organization.
BFS	Board of Foreign Scholarships.
CAO	Cultural Affairs Officer.
CIEP	Committee on the International Exchange of Persons of the Conference Board of Associated Research Councils, National Academy of Sciences.
CSCPRC	Committee on Scholarly Communication with the People's Republic of China
CU	Bureau of Educational and Cultural Affairs, Department of State
IC, FCST	International Committee of the Federal Council for Science and Technology.
LDCs	Less Developed Countries.
NAS–NRC	National Academy of Sciences-National Research Council.
NATO	North Atlantic Treaty Organization.
NSF	National Science Foundation.
OIP	Office of International Programs, National Science Foundation.
PRC	People's Republic of China.
SCI	Bureau of International Scientific and Technological Affairs, Department of State.
USIA	United States Information Agency.
USIS	United States Information Service (title for USIA overseas).

CHAPTER 12—U.S. SCIENTISTS ABROAD: AN EXAMINATION OF MAJOR PROGRAMS FOR NONGOVERNMENTAL SCIENTIFIC EXCHANGE

I. Introduction

This study describes major programs of the Federal Government which send abroad nongovernmental scientists and technical personnel to lecture, study, attend meetings, or conduct research and it highlights how these programs relate to American scientific and diplomatic goals.

During the fiscal year 1970, three-fourths of all Americans sponsored abroad by the Government were scientists, technicians, or engineers in more than half of the nations where civilian Americans were stationed. Most Federal agencies periodically send abroad scientific and technical personnel as part of the agency mission. However, two agencies have principal responsibility for programs which sponsor overseas activities of nongovernmental senior-level scientists: the National Science Foundation (NSF), and the Department of State. The National Academy of Sciences (NAS), a nongovernmental agency, also administers substantial overseas programs with funds transferred from the Foundation and the State Department.

Issues surrounding the origins, purpose, size, effectiveness, and administrative underpinning of these exchange activities illustrate several dimensions of the interaction of science with diplomacy. These include the constraints and opportunities generated by scientific factors such as the rate of scientific participation and requirements for the "unfettered" conduct of scientific research; and also diplomatic factors such as arrangements to facilitate scientific exchanges and to couple these exchange programs to foreign policy goals. For instance, the Senior Fulbright-Hays program, funded by the Department of State and administered by an agency of NAS, is designed to support educational and cultural components of the Nation's foreign policy. Programs of NSF have as their major objective the encouragement of the growth of science and of cooperative international scientific relationships. Some programs are designed, or have evolved, to support a mixture of objectives, including technical assistance to hasten the growth of science infrastructure in the developing nations. Other programs, notably the bilateral agreements with the Soviet Union and with the countries of Eastern Europe, serve both science and diplomacy by forging continuing working relationships and a degree of interdependence between the citizens of ideologically disparate states. Still other programs serve the goals of national prestige and national or international cooperative scientific inquiry.

A number of these programs were initiated in the immediate post-World War II period; some were established as a response to the Sputnik "launch" of the late fifties; but the bulk are of more recent origin, reflecting current trends toward relaxation of international tensions and broader understanding of the benefits to science and society of cooperative international science.

Note: This chapter was prepared in 1974 by Genevieve J. Knezo.

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The complexity and variety of these programs within the executive branch and the problems of oversight by congressional committees with different jurisdictions inhibit their comprehensive description and analysis. This study, categorized as a "continuing issue" in the series *Science, Technology, and American Diplomacy*, is partially intended to rectify that information gap by highlighting the origin, evolution, and status of several of these programs. The study also identifies several issues which may warrant additional consideration by the legislative and executive branches. These relate to limitations and achievements of specific agency programs with respect to scientific participation, the advance of science, and the promotion of cooperative relationships in science and technology with other nations. Also treated are issues posed by program inadequacies in light of emerging national and international scientific and political trends. Notable among these are the questions of: (1) developing conditions and programs to encourage the participation of American scientific and technical personnel in activities instituted under bilateral scientific and technical agreements, (2) improving functional coordination, Government-wide and overseas, and (3) reassessing the legislative-executive branch interface to determine program priorities.

Scope, Limitations, and Emphasis of the Study

Two basic questions underlie this study and suggest its contents and organization. They are:

> What are the major impacts of science and diplomacy on the origin and evolution of U.S. Government programs to send nongovernmental scientists abroad? and
>
> What are the impacts of these exchange activities on the Nation's scientific and diplomatic programs?

Ideally, the concept of a "world scientific community" would presuppose the free movement of scientists from one country to another to exchange information, publications, and research results. However, divided by national barriers, the community of nations does not permit such free interchange. Diplomatic arrangements between nations both sanction and proscribe activities of the world scientific community. Some of these arrangements enable scientists to obtain information for their own research projects or for Government-sponsored research; others permit the exchanges of information between scientists of different countries for national or international political purposes.

At the private nongovernmental level, scientists exchange information through the printed word, through channels increasingly provided by multinational corporations, and through personal visits and correspondence. These devices, however, encounter a number of barriers. Language differences hamper communication between scientists. National security regulations prohibit the free export of scientific information, particularly that obtained from military research. And economic and technical competition between nations, internalized and projected by scientists who are first and foremost citizens of their countries, also deters scientific exchange.

Some Government programs send abroad U.S. scientists and technicians on official missions designed to obtain or disseminate information supporting an agency's mission or objectives. These programs

serve such national objectives as defense, national security, or the maintenance of U.S. installations abroad. Some give substance to humanitarian objectives of U.S. foreign policy or foreign aid programs. Others promote internationally sanctioned cooperative research efforts.

Through other arrangements, often bilateral, the U.S. Government supports and funds overseas activities of nongovernmental scientific and technical personnel. Limitations of time and space permit consideration in this paper of programs of only three agencies:

(1) The Department of State:

The Senior Fulbright-Hays program, funded by the Bureau of Educational and Cultural Affairs and administered by the Committee on the International Exchange of Persons of the Conference Board of Associated Research Councils, National Academy of Sciences-National Research Council, under the advisory supervision of the Board of Foreign Scholarships, U.S. Advisory Commission on International Educational and Cultural Affairs, and binational commissions.

(2) National Science Foundation (NSF):

Programs administered by the Office of International Programs, including bilateral science agreements with the countries of Europe, Latin America and Asia, support of international travel and international scientific meetings, and special foreign currency projects; National Research Centers program; and awards tenable abroad under NSF's research support and educational support programs; and

(3) National Academy of Sciences-National Research Council (NAS-NRC):

Bilateral inter-Academy agreements for scientific cooperation, which are part of Cultural Relations Agreements signed by the United States with the Soviet Union and with individual countries of Eastern Europe (Poland, Hungary, Romania, Czechoslovakia, Yugoslavia, and Bulgaria), funded by the Office of International Programs, NSF, administered by the Soviet and Eastern European Exchange Staff, Office of the Foreign Secretary, NAS–NRC; and activities of the Committee on Scholarly Communication with the People's Republic of China, affiliated with the NAS–NRC.

These programs represent a sampling of U.S. Government-sponsored activities for non-governmental scientists abroad and they were selected for inclusion because they are the largest, oldest, and most publicized, and have wide geographic distribution. Their different historical origins and administrative arrangements provide a fruitful basis on which to describe interactions of science and technology with diplomacy and to compare interagency similarities and differences.

The Fulbright-Hays program differs substantially in objective from either the NSF or the NAS–NRC programs. This activity, from its beginning in 1946, was designed explicitly to promote educational exchange and cultural understanding as purposeful objectives of U.S. foreign policy. The origin and evolution of the program illustrate issues which arise in using science to serve foreign policy motivated exchange programs and in using scientific exchange in a binational cooperative program in which the concerns of science are secondary to the objectives of cooperation.

The NSF programs were designed initially to advance the Nation's domestic science base. This limited objective was gradually expanded as a result of both internal directive and legislative mandate giving the agency increasingly greater responsibility for supporting and initiating programs of international and foreign science and technology. The Foundation's programs are best described as foreign science for the sake of science. However, NSF programs seem to be fragmented administratively and to lack a well-balanced diplomatic advisory mechanism. While such factors meet the agency's need to maintain the integrity of science free from undue political interference, they also evoke questions as to whether these programs can satisfy the Foundation's increasing responsibilities for foreign and international scientific exchange programs.

The NAS–NRC exchanges with the Soviet Union and the countries of Eastern Europe illustrate a unique dimension of programs which support nongovernmental scientists abroad. These activities represent an attempt to establish fruitful scientific exchanges between ideologically disparate States which maintain mutually restrictive policies regarding the exchange of persons. These programs are the most politically sensitive of the bilateral activities discussed. Their success requires high-caliber nongovernmental scientific participation in planning and execution.

This study raises also some broader issues of the interactions and conflicts between science and diplomacy. For instance, each of these programs is subject to a number of factors common to scientific research and development in general. At the administrative level all programs have a scrupulous scientific "peer evaluation" mechanism to assist in the selection of participants. Many programs have been influenced by requirements to meet domestic geographic distribution criteria in awarding funds for science, by impacts of retrenchment in overseas research and development funding, and by implications of the need to preserve the integrity of science from undue political and governmental interference.

A number of issues common to these programs illustrate the constraints which result from conflicts between the objectives of science and foreign policy. For instance the data illustrate that many scientists are not eager to participate in overseas programs if remuneration is not satisfactory, if participation in foreign or international scientific activities is not as potentially rewarding to research and development as is participation in domestic scientific activities, if a program is designed specifically to support technical-assistance foreign policy objectives, or if a program is distinctly politically motivated and administered. Whether as a result or a cause of these problems, most programs, especially those most designed to support scientific objectives, have a weak foreign policy administrative apparatus attached to them; only a few programs require evaluation of a scientists potential for effective cultural interaction with his foreign peers; most have no language requirements nor requirements for participants to report on the special foreign conditions encountered in this work. Generally, the evidence suggests that overseas scientific programs motivated primarily by foreign policy considerations have lower-quality selection criteria than do domestic programs.

Administratively, these programs share a number of deficiencies. Most were initiated on an *ad hoc* basis in reaction to a particular opportunity or problem. In neither their origins nor their operations do they constitute part of a deliberately formulated and coherent set of policies or programs for foreign and international science and technology, or for foreign and international scientific and technical exchange. There is little public information available about the size and scope of activities conducted under them; most lack continuity; there is little intra-agency or Government-wide evaluation of their effectiveness or contribution to either science or diplomatic goals; and there is an absence of formal and informal interagency liaison arrangements, both in the United States and abroad, to coordinate programs and to share experiences in program oversight. More important, program achievements and limitations have not been adequately described to the Congress, tending to prevent appropriate legislative planning and oversight.

Scientific exchange activities are becoming increasingly important to U.S. foreign policy and to the Nation's expanding commitments in scientific cooperation, sharing of information, solving of global scientific and technological problems, and promoting the development of science infrastructure in the less developed countries. With respect to these trends the study indicates that scientific exchange activities can generate and strengthen political relations and scientific cooperation between the United States and other countries. However, it also illustrates the programmatic implications of basic conflicts between science and politics. These include the difficulties of establishing administrative arrangements to govern programs and of developing program priorities which meet expanding foreign and international scientific commitments.

In relation to these issues activities of the following units are discussed: the International Committee of the Federal Council for Science and Technology (IC, FCST), the Office of International Programs (OIP), National Science Foundation; the Bureau of International Scientific and Technological Affairs (SCI), Department of State; and the science attaché programs of the National Science Foundation and the Department of State.

Information Sources Used in the Study

Limitations of readily available data preclude detailed analysis of the programs treated in this study. However, an attempt is made to describe the salient features of each agency's programs in terms of numbers, types and location of exchanges, domestic and overseas administrative apparatus, and where available, demonstrable evidence of program achievements, especially in meeting goals of science and foreign policy.

For purposes of historical analysis, this study generally covers the period of 1960–1970. More recent data are added, if warranted, to update a program. With several exceptions treatment is given only to activities in support of sending abroad American nongovernmental scientists. The exceptions are the cases of some *quid pro quo* bilateral agreements in which the evolution and accomplishments of the program are related to activities that bring foreign scientific and technical personnel to this country.

The data base of the study consists of the following:

(1) Congressional authorization and appropriations hearings, documents and reports, 1960–1970, and Congressional reports or investigations of particular programs;

(2) In-house reports and published and unpublished materials describing program activities, accomplishments and problems;

(3) Data derived from interviews with agency personnel directly in charge of administering separate programs; [1] and

(4) Two types of information generated by a study of Government-wide exchange programs, sponsored by the Bureau of Educational and Cultural Affairs (CU) of the State Department in 1970 and 1971. The resulting computer printouts give specific data on each individual supported for exchange, by agency, during the fiscal years 1968 and 1970; and responses to a questionnaire, administered by the National Bureau of Standards,[2] providing descriptive information on how the programs support the development of "leaders," difficulties in administration, and duplication, if any, with other agency programs.[3]

The Pragmatic and Philosophical Basis of Scientific Exchange

The history of information exchanges among scientists of different countries is as old as the history of science itself. Dr. Jean-Jacques Salomon, an observer of the sociology of science and head of the Science Policy Division of the Organisation for Economic Co-operation and Development, would attribute such exchanges, in the absence of conflicting national constraints, to the inherently universal nature of scientific inquiry:

> Science is by nature universal. The truths which scientists seek to discover are not national truths; they are the same everywhere . . . . The structure as well as the nature of science is international. Research and discoveries, whatever the particular genius of individuals and peoples, constitute a common and cumulative achievement. The growth of modern science since Galileo has been closely associated with two principles which provide the foundation for all forms of cooperation in this field: collaboration between specialists and the publication of knowledge and discoveries.[4]

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[1] Conducted by the author.

[2] Interview, Mr. Walter Seelig, Office of Polar Programs, National Science Foundation, March 4, 1971.

[3] *The International Exchange Study Data Bank, 1971.* By H. E. Adams and O. G. McPherson. Prepared for Office of Policy and Plans, Bureau of Educational and Cultural Affairs, Department of State by the Research Analysis Corporation, McLean, Virginia, Draft CR, Study 230.301, April 5, 1971.

This study was prepared for the Office of Policy and Plans, Bureau of Educational and Cultural Affairs for the President's foreign policy advisor. Its general objective according to Mr. John Richardson, Assistant Secretary of State for Educational and Cultural Affairs, was: "To determine where and how [U.S. exchange activities] might be improved either in the way they are managed or in the way they are targeted so as to strengthen the overall effect of these exchanges." (U.S., Congress, House, Committee on Appropriations, *Departments of State, Justice, Commerce, The Judiciary and Related Agencies Appropriations for 1972: Hearings*, 92d Cong., 1st sess., Pt. 2, pp. 1013–1014.) The specific objective of the study was to obtain information on how U.S. exchange programs strengthen and support the development of leaders in foreign countries. (Interview with Ms. Claudia Rawles, Bureau of Educational and Cultural Affairs, 1971.)

While the data gathered are available, the study report itself is classified. According to Mr. Norman Neureiter, Office of Science and Technology, the study did not deal in depth with scientific exchanges. (Interview with Mr. Norman Neureiter, Office of Science and Technology, 1972.) The Hon. William H. Taft III, Bureau of International Scientific and Technological Affairs, Department of State, reports that what little treatment the report did give to scientific exchanges suggested that these could be improved to support the U.S. foreign policy objective of promoting the development of foreign leaders familiar with and sympathetic to U.S. national objectives. This conclusion, according to Mr. Taft, diverges from the primary objectives of many scientific exchange programs—which are to promote the development of science, to promote international cooperation in science and technology, and to assist foreign scientists in improving their skills and training to contribute better to the development of a science infrastructure in their countries. (Interview with Mr. Taft, August 1971.)

[4] Jean-Jacques Salomon, "The *Internationale* of Science, *Science Studies* 1 (1971), pp. 23–24." Excerpt from an essay translated from *Science et Politique* (Paris: Editions du Seuil, 1970.)

"Because of its objectivity," Salomon continues, "science is considered to be supracultural . . . ." Even the idea of a national scientific community would be contradictory since scientists share a ". . . single language, similar procedures, comparable experiments, [and] shared norms . . . ." Ideally the scientific community is a "spiritual collectivity, . . . and for this reason it so far transcends incompatibilities arising out of nationalism or ideology as to be completely unaware of them."

Pragmatically, the supranational momentum of scientific inquiry led early scientists to establish and maintain relations with their colleagues in other countries through exchanges of correspondence, publications, and visits. These first forms of international scientific cooperation served the same function for early scientists as they do for their twentieth-century colleagues. The American oceanographer, Dr. Roger Revelle, has described the scientific rationale for meetings between scientists:

1. Face to face meetings among scientists . . . are a most effective means for exchange of scientific information and ideas.
2. [Imagination and creativity and an ability to see relationships that have never been seen before are essential to scientific discovery.] A good deal of science cannot be communicated, much less taught, except through direct personal contact. . . . Details of experimental procedure are hard to describe in words and are rarely published; they must be seen to be believed.
3. . . . Scientific ideas are usually born in conversation, rather than in the mind of one man. . . . The fresh insights, the new association between previously unrelated phenomena, often come from the interplay of two or three minds clashing in conversation.
4. . . . In talking face to face, scientists allow themselves to state their intuitions and partly-formulated ideas, unconstrained by the caution they demand in the printed word.[5]

The Size and Variety of Overseas Activities of American Scientists

Members of the American scientific community, like their counterparts in other countries, travel a good deal. So extensive are their activities it is impossible to describe them fully. In a paper written in the early 1960's, Roger Revelle estimated that between 15 and 20 thousand U.S. scientists and engineers attend foreign scientific meetings each year.[6] However, a valid portrayal of the size and scope of U.S. overseas scientific and technical activities would have to encompass governmental and nongovernmental programs in education, field research, technical assistance, and participation in large international cooperative projects, most likely multiplying Revelle's figure severalfold.

The paucity of valid information about U.S. scientific activities abroad is matched by the lack of readily available data describing Government-sponsored overseas programs for nongovernmental scientists. An American attending an international scientific conference may have paid his own way or have received his support probably as easily from a non-profit foundation or professional association as from a Government-sponsored program. Research performed

[5] Roger Revelle, "International Cooperation and the Two Faces of Science." In: American Assembly, *Cultural Affairs and Foreign Relations* (Washington: Columbia Books, Inc., reprinted 1968), pp. 141–142.
[6] Roger Revelle, "International Cooperation and the Two Faces of Science," op. cit., p. 141.

abroad by an American may be financed by a university or foundation grant, or a Federal science education or cultural exchange program. U.S. scientists and technicians also travel abroad as members of technical assistance teams, sponsored variously by religious organizations, nonprofit foundations, international organizations, the Agency for International Development (AID), and the National Science Foundation. In addition, the American industrial sector, educational foundations, and *ad hoc* private groups send scientists, engineers, and technicians abroad for varying lengths of time on a variety of missions.

The Scope and Importance of Nongovernmental Scientific Exchange Programs

Although U.S. programs for civilian scientific and technical personnel abroad are not grounded in a deliberately formulated set of programs and policies, scientific exchange programs constitute the bulk and perhaps the most important part of Government-sponsored civilian exchange activities.

During the fiscal year 1970, Government agencies supported cultural, educational, and scientific activities of civilians abroad in 109 countries and six multistate regions. Sixty-six percent of these individuals were scientific and technical personnel.[7] More important perhaps, is the fact that scientific and technical personnel comprised 50 percent or more of the U.S. civilian exchange group in each of 75 percent of the countries in which Americans were represented, and 75 percent or more of the U.S. representation in each of more than half of the countries where Government-sponsored Americans were present. (See Table 1.)

These data, derived from the 1971 State Department Exchanges Study,[8] indicate, however, that while scientific and technical activities abroad are widespread, their scope varies with country, subject, and agency. For instance, while scientific and technical personnel were sponsored in 10 geographic areas, more than a third of all these personnel conducted their activities in Europe. The majority of scientific and technical activities were conducted in the developed countries, especially in Europe, but also in Japan, Israel, and Australia. (The majority of scientific and technical personnel sponsored by the Atomic Energy Commission, the Public Health Service, and the National Bureau of Standards, primarily agency staff, a group not studied in this report, carry out their scientific activities in Western Europe.) The developing countries, with the exception of South America, generally host more cultural and economic than scientific exchanges. Personnel sponsored by NSF and the Department of State are the most widely distributed of all agencies included in the survey.[9]

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[7] Extrapolated from *International Exchange Study Data Bank, 1971*, op. cit. The length of time spent on these visits was not considered in reaching these conclusions.

[8] *See* page 6, above.

[9] In support of this study the author gathered and graphically arrayed data from the State Department study to illustrate the following trends: duration by agency and country; number by agency and country; duration by subject and country; and number by subject and country. The agencies included are: Department of State, NSF, National Bureau of Standards, Public Health Service, Atomic Energy Commission, and Departments of Agriculture and the Interior. Subject breakdowns are: social science, physics, chemistry, biology, architecture/engineering, geology, health/medicine, agriculture, meteorology, and computer/communications. Details of this analysis are available from the author.

TABLE 1.—AMERICAN CIVILIANS SPONSORED BY THE U.S. GOVERNMENT FOR ACTIVITIES ABROAD, TOTAL, AND SCIENTIFIC AND TECHNICAL PERSONNEL, FISCAL YEAR 1970 (EXCLUSIVE OF THE PEACE CORPS AND PRIMARILY NONAGENCY PERSONNEL)

Country	Total Americans	Number, scientific and technical	Scientific and Technical: 50 percent or more	Scientific and Technical: 75 percent or more
Latin America:				
Argentina	27	12		
Bahamas	4	3	X	X
Barbados	4	4		X
Bolivia	0	0		
Brazil	54	8		
British Honduras	17	17	X	X
Chile	17	10	X	X
Colombia	24	20	X	X
Costa Rica	142	129	X	X
Dominican Republic	4	3	X	X
Ecuador	19	9	X	
El Salvador	1	1	X	X
Guatemala	5	4	X	X
Guyana	2	2	X	X
Honduras	1	1	X	X
Jamaica	2	1	X	
Mexico	73	40	X	
Panama	18	17	X	X
Peru	29	29	X	X
Trinidad and Tobago	4	4	X	X
Uruguay	12	11	X	X
Venezuela	11	9	X	X
Multicountry	56	51	X	X
Total	526	[1] 385		
Eastern Europe and Soviet Union:				
Bulgaria	5	3	X	
Czechoslovakia	87	82	X	X
Hungary	3	1		
Poland	53	24		
Romania	52	43	X	
USSR	308	91		
Yugoslavia	170	86	X	
Total	678	[2] 330		
North America:				
Bermuda	2	2	X	X
Canada	247	209	X	X
Greenland	2	2	X	X
Total	251	[3] 213		
Near East and South Asia:				
Afghanistan	4	4	X	X
Ceylon	4	4	X	X
Cyprus	1	1	X	X
Greece	72	63	X	X
India	320	52		
Iran	47	41	X	X
Israel	65	61	X	X
Jordan	1	1	X	X
Kuwait	18	17	X	X
Lebanon	4	3	X	X
Nepal	2	2	X	X
Pakistan	7	7	X	X
Saudi Arabia	23	17	X	X
Turkey	24	15	X	
UAR	43	2		
Yemen	1	1	X	X
Multicountry	24	10		
Total	600	[4] 301		
East Asia and Pacific Ocean area:				
Australia	60	55	X	X
Burma	0			
Cambodia	0			
China (Mainland)	1	2	X	
China (Taiwan)	46	25	X	
Hong Kong	5	3	X	
Indonesia	3	1		
Japan	211	152	X	
Okinawa	1	1	X	X
Korea	13	5		
Laos	2	0		
Malaysia	8	7	X	X

See footnotes at end of table.

TABLE 1.—AMERICAN CIVILIANS SPONSORED BY THE U.S. GOVERNMENT FOR ACTIVITIES ABROAD, TOTAL, AND SCIENTIFIC AND TECHNICAL PERSONNEL, FISCAL YEAR 1970 (EXCLUSIVE OF THE PEACE CORPS AND PRIMARILY NONAGENCY PERSONNEL)—Continued

Country	Total Americans	Number, scientific and technical	Scientific and Technical: 50 percent or more	Scientific and Technical: 75 percent or more
East Asia and Pacific Ocean area—Continued				
Malaya	0			
Micronesia	3	2	×	×
New Guinea	7	7	×	×
New Zealand	16	11	×	×
Philippines	8	6	×	×
Singapore	23	1		
Thailand	15	7		
Vietnam	3	1	×	
Multicountry	48	33	×	
Total	474	[4] 320		
Europe:				
Austria	39	16		
Belgium	14	10	×	×
Denmark	18	16	×	×
Finland	20	11	×	×
France	90	81	×	×
West Germany	253	60		
Iceland	6	5	×	×
Ireland	20	13	×	
Italy	113	63	×	
Netherlands	27	25	×	×
Norway	14	11	×	×
Portugal	4	2	×	
Spain	37	20	×	
Sweden	33	28	×	×
Switzerland	44	44	×	×
Trieste	16	16	×	×
United Kingdom	403	340	×	×
Multicountry	305	304	×	×
Total	1,456	[5] 1,065		
Africa:				
Algeria	20	1		
Botswana	2	1	×	
Congo (Brazzaville)	7	7	×	×
Congo (Kinshasa)	1			
Ethiopia	12	12	×	×
Ghana	30	2		
Kenya	30	27	×	×
Liberia	4	2	×	
Malawi	1	1	×	×
Mali	1	1	×	×
Mauritius	20	0		
Morocco	2	1	×	
Niger				
Nigeria	3	2	×	
Rwanda	1	1	×	×
Senegal		50		
Sierra Leone	1	1	×	×
South Africa	15	14	×	×
Tanzania	6	5	×	×
Togo				
Tunisia				
Uganda	28	0		
Zambia	4	4		
Multicountry	33	7	×	×
Total	220	[6] 139		
Antarctic and sub-Antarctic	25	[7] 25	×	×
Other multicountry	115	[8] 105	×	×
Grand total	4,350	[9] 2,903		

[1] Scientific and technical, 73 percent.
[2] Scientific and technical, 49 percent.
[3] Scientific and technical, 85 percent.
[4] Scientific and technical, 68 percent.
[5] Scientific and technical, 73 percent.
[6] Scientific and technical, 63 percent.
[7] Scientific and technical, 100 percent.
[8] Scientific and technical, 91 percent.
[9] Scientific and technical, 66 percent.

Source: Extrapolated from data contained in: H. E. Adams and O. G. McPherson, "The International Exchange Study Data Bank, 1971," prepared for the Office of Policy and Plans, Bureau of Educational and Cultural Affairs, Department of State, by the Research Analysis Corp., McLean, Va., Draft CR, Study 230.301, Apr. 5, 1971. For additional information, see footnote 3 above. If a country is not listed, no Americans other than Peace Corps personnel visited.

Significant trends also hold with respect to distribution of activity by subject in relation to geographic area. The majority of U.S. scientists and technical personnel in Europe during the fiscal year 1970 were physical, natural, chemical, and biological scientists and health personnel. The developing countries host primarily social scientists and biologists. In some of the developing areas, such as Africa, the bulk of American scientists and technical personnel typically exchanged were social scientists.[10]

The Multiple and Complex Purposes of Scientific Exchange Programs

Aggregated data of this nature provide indications of general trends of the dimension, scope, and thrust of Government-sponsored civilian science and technology activities, but leave unanswered questions regarding the specific purposes, impacts, needs, opportunities, and import of these programs.[11] For instance:

Do scientists choose to go primarily to Europe because of program limitations in other areas or because scientific activity in Europe contributes more to the pursuit of science?

How do programs differ between developed and developing countries? Do programs in the developing countries provide U.S. scientists and technicians with special research opportunities? Or are they designed to promote the growth in the host country of science and technology infrastructure and to enhance the development of indigenous educational systems?

What role does the host country play in administering these programs?

Have the scope and character of these programs varied over time?

Are international scientific meetings held more frequently in one area than another?

Are Federally supported programs for nongovernmental scientific personnel abroad increasing?

Do programs meet objectives established for them by their framers?

Which types of programs serve U.S. foreign policy goals more explicitly than scientific goals?

Do U.S. programs evenly distribute the benefits of American scientific know-how? Are there explicit goals for such programs?

There are no easy answers to such questions. These programs are governed by a variety of administrative arrangements and serve a complex set of objectives. All such programs, however, have foreign policy implications for the United States. That is, they affect or reflect U.S. political, national security, trade, foreign economic development, or humanitarian objectives. Some grew out of basically scientific motivations in the sense of sharing and exchanging information or knowledge and some serve personal goals.

Herman Pollack, Director, Bureau of International Scientific and Technological Affairs, Department of State, has described the set

[10] Idem.

[11] For an extended review of the variety, scope, purposes, and impacts of worldwide exchange programs, see: Otto Klineberg, *International Exchanges in Education, Science and Culture; Suggestions for Research* (Paris: Mouton and Co., 1966), 48 pp. (A publication of the International Social Science Council.)

of complex motives behind international scientific and technological affairs in recent testimony before the Congress:

. . . The overall objective of the U.S. Government in international cooperation in science and technology is first and foremost the advancement of our national interests and the strengthening of our international relationships. Behind all scientific cooperation . . . is the desire to advance science and to acquire and diffuse knowledge. Without this, the cooperation can have little, if any, other value. In addition, however, such cooperation is often inspired or motivated by humanitarian considerations.[12]

POLITICAL GOALS

Political goals, according to Pollack, are fundamental to all international scientific programs since they directly impact upon the initiation, conduct, and achievements of international science activities. Testifying in another hearing, Pollack noted the importance of insulating international scientific relationships from ". . . transitory political considerations . . .." But he warned that:

. . . We have not emphasized nearly enough the importance of obtaining the political agreement which will be the necessary precedent to the multilateral undertaking of major scientific and technological ventures. . . .

The advancement of national security and strengthening of international relationships, according to Pollack, should be an "operating premise by all who are interested in enlarging governmental support for international scientific cooperation." [13]

Specific political objectives of international scientific programs would include:

a. *To promote understanding and to dispel mistrust by exchange of persons and information.* The principal underlaying impetus to the enlargement of cooperative scientific relations and exchanges with the Soviet Union originated in our desire to open up a closed Soviet society, to establish mutual understanding which might lessen dangerous tensions, and to signal a move toward improved political relations;

b. *To work together in a non-controversial area to provide a basis for cooperation in more difficult fields* (e.g. the U.S. cooperative programs with Japan and France);

c. *To develop friendship and trust among a highly important segment of the population, whose role in government will become increasingly significant* (e.g. bilateral programs). Foreign relations considerations are important components of the current attempts to expand cooperative efforts with Romania and Yugoslavia. President Nixon in his recent visits has made apparent his hopes to achieve closer relations with these countries . . .

d. *To strengthen political stability of developing countries by improving economic and social conditions through science and technology* (e.g. development of Korean Institute of Science and Technology with U.S. assistance); and

e. *To reduce tensions and rivalries between countries by utilizing science and technology for common goals and mutual benefit* (e.g. U.S.-Mexico Desalination Cooperation).[14]

NATIONAL SECURITY OBJECTIVES

National security objectives also motivate some international science and technology programs. They include:

a. *To prevent developments believed inimical to national security* (e.g., cooperation in gaseous diffusion technology);

b. *To encourage actions in our long-range national interests* (e.g., post-Apollo Space Program);

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[12] Statement of Herman Pollack. In: U.S., Congress, House, Committee on Science and Astronautics-Subcommittee on International Cooperation in Science and Space *A General Review of International Cooperation in Science and Space: Hearings*, 92d Cong., 1st sess., May 1971, p. 2.

[13] U.S., Congress, House, Committee on Science and Astronautics, *Panel on Science and Technology; Twelfth Meeting; International Science Policy: Proceedings*, January 1971, p. 346.

[14] *A General Review of International Cooperation in Science and Space: Hearings*, op. cit., p. 3, 4, 71. (Emphasis added).

c. *To delay or prevent access by unfriendly nations to strategic materials or information; and*

d. *To provide for mutual security by devising reliable methods for ensuring compliance with treaty obligations* (e.g., international nuclear safeguards).

ECONOMIC OBJECTIVES

Closely related to political and national security objectives are economic objectives—to lower the costs of research, enhance opportunities for fruitful research, and open up new markets. Drawing upon a report recently completed by the International Committee of the Federal Council for Science and Technology, Pollack enumerated these specific direct and indirect economic benefits of international specific cooperation:

> . . . Instances of *direct economic benefit* [include]: sharing with other nations the costs of essential research; the incorporation into key U.S. research programs of instrumentation, techniques, and essential data generated in programs supported by other nations; and the opportunities for U.S. scientists to utilize unique research facilities—ranging from oceanographic research vessels to special collections of biological materials. . . .
>
> . . . Examples of *indirect economic benefits* [include]: the new markets for U.S.-manufactured scientific instruments . . . , the adoption by U.S. producers of economically important new technologies developed abroad and brought to our attention as a result of cooperative programs . . . [and] the ability to avoid unproductive, and expensive, directions . . . in our research planning on the basis of results coming to us through international cooperation.[15]

SCIENTIFIC AND TECHNICAL OBJECTIVES

Foreign and international science have become increasingly important in recent years—both for their intrinsic merits, and as tools of foreign policy. Dr. Edward E. David Jr., President Nixon's Science Adviser, in testimony before the Subcommittee on International Cooperation in Science and Space, House Committee on Science and Astronautics, described the President's emphasis on expanding joint research and development activities to solve global problems and to capitalize on cooperative opportunities presented by science and technology:

> The problems—and the opportunities—created by science and technology dominate an increasing share of our international activity. The problems we can no longer ignore, and can solve only through international cooperation. The opportunities we . . . can realize only through international cooperation. Taken together, these challenges constitute the new dimension of our foreign policy and of international life.[16]

President Nixon reemphasized the need for greater international scientific exchange in his March 1972 message to the Congress on "Enlarging Cooperative International Efforts in Science and Technology":

> The cause of scientific and technological progress has always been advanced when men have been able to reach across international boundaries in common pursuits. Toward this end, we must now work to facilitate the flow of people and the exchange of ideas, and to recognize that the basic problems faced in each nation are shared by every nation.
>
> . . . This Nation can benefit substantially from the experience of other countries, even as we help other countries by sharing our information and facilities and specialists with them.[17]

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[15] *International Science Policy, Proceedings*, op. cit., p. 347.

[16] *A General Review of International Cooperation in Science and Space: Hearings*, op. cit., p. 130.

[17] "Enlarging Cooperative International Efforts in Science and Technology," Message from President Nixon to the Congress (Excerpts), In *Department of State Bulletin* (April 10, 1972), p. 548. (Transmitted on March 16, White House press release; also printed as H. Doc. 92-193, 92d Cong., 2d sess.)

To meet the need, the State Department has targeted specific objectives for U.S. foreign and international scientific and technological programs. A number of programs meet the objectives of joint cooperative research to solve regional and global problems. According to Mr. Pollack, these objectives are:

a. *To advance the world's store of knowledge by free exchange of ideas and data* (e.g., International Decade of Ocean Exploration);
b. *To create a "critical mass" of intellect and/or instrumentation in attacking common problems* (e.g., Global Atmospheric Research Program);
c. *To speed the solution of critical problems by task appointment or complementary research* (e.g., safety vehicle development, U.S., Italy, Germany (CCMS));
d. *To meet the need in many studies of simultaneous or coordinated observations for many sites* (e.g., World Weather Watch);
e. *To compare the effects of geographic, climatic, cultural, etc. variables on a target system under study* (e.g., International Biological Program);
f. *To avoid unnecessary duplicatory research by information and personnel exchange* (e.g., Medlars Information exchange);
g. *To make available to scientists everywhere unique resources or experimental conditions otherwise available to only a few* (e.g., SEATO Cholera Research Laboratory, Pakistan);
h. *To develop international "banks" of scarce materials* (germ plasma, microorganisms, geological samples, etc.) for the use of all scientists (e.g., Lunar rock study program); and
i. *To concentrate the talents of many nations on a transitory phenomenon* (eclipse, volcanic eruptions, etc.) *to provide maximum scientific benefit* (e.g., International Task Force at Mexico solar eclipse.) [18]

HUMANITARIAN OBJECTIVES

Some U.S. international science activities are designed to serve humanitarian or technical-assistance goals. These include:

a. *To improve the health and welfare in developing countries by the application of advanced science and technology* (e.g., U.S.-Japan Medical Program);
b. *To develop an indigenous capability to meet their own needs through education and institution building* (e.g., AEC sister-sister relationships with laboratories in various countries);
c. *To provide assistance in catastrophes and in the prevention of catastrophes* (e.g., U.S. assistance to Iran, Turkey, Chile, etc. after earthquakes);
d. *To control hazards or undesirable conditions transcending national borders* (e.g., agricultural quarantine cooperation); and
e. *To provide networks for early warning systems* (hurricanes, tidal waves, etc. e.g., Tsunami warning system). [19]

POTENTIAL CONFLICTS AMONG SCIENTIFIC, POLITICAL, AND PERSONAL OBJECTIVES

U.S. scientists, like their counterparts in other fields and in other countries, play pivotal roles in determining both the content and mechanics of foreign and international scientific programs. In a similar manner, the objectives of these activities—the scientific goal of systematically accumulating knowledge about man and his world, and the political goal of forging closer relationships among states—necessarily vary with the way the diplomat uses science and the way the scientist views his diplomatic role.

It is difficult if not impossible to attribute clear-cut political motives to specific international scientific or scientific exchange

[18] *A General Review of International Cooperation in Science and Space, Hearings*, op. cit., pp. 71–72. (Emphasis added.)
[19] Ibid., p. 71. (Emphasis added.)

programs.[20] Salomon reports that grants and other funding are sometimes based on political motives; similarly, achievement in science is used as a legitimate currency in cultural diplomacy:

In international scientific relations, private and governmental aspects are interdependent and are often indistinguishable. Grants and subsidies made by governments to scientists to facilitate international exchanges are not without ulterior motives, and in what has been called "scientific tourism" political or military espionage cannot always be ruled out. In the conquest of Asia, the missionaries supported the settlers and, more recently, the archaeologists, the diplomats in carving up of the Middle East; in the same way, scientists are called upon to fulfill, officially or not, public functions which are connected with their technical or private preoccupations. There is also the role which they are called upon to play in the great international fairs where the conquests of science are entered into the account books as national achievements. In the framework of this "cultural diplomacy", which has been defined as the "manipulation of cultural materials and personnel for propaganda purposes", men of science are exhibited like film stars or boxing champions.[21]

In addition, Salomon seems to imply that scientists participating in ostensibly non-political international scientific activities are frequently given political missions:

The Pugwash Conferences, which bring together privately scientists of "good will" do not escape the constraints of technonature—the good will or the compliance of governments towards them is in no way absent from the calculation. In fact, a reading of the lists of participants in the Pugwash Conferences is enough to pick out the names of the scientists or political observers who are officially or unofficially linked with political decision-making bodies, whether in the East or West.[22]

These considerations undoubtedly present both scientists and policymakers with a dilemma. Thus, according to Dr. T. O. Jones, director of National and International Programs, NSF, international scientific programs based on purely political motives frequently fail:

It has been my experience in dealing with international science activities over the years, that whenever one contrives a scientific program purely for the purpose of political advantage or motivation it frequently fails, because the science is contrived and not genuine, and is not really of interest to the scientific community.[23]

A variety of personal motives have been attributed to U.S. scientists who go abroad in Government-funded exchange programs. For instance, Donald J. Shank, as executive vice-president of the Institute of International Education, which administers educational exchange programs below the senior professional level for the Department of State, reports that personal motives, travel, and cultural interests, and the desire to learn a foreign language, motivate many exchange scholars:

. . . Although many sponsors say they promote educational exchange in order to build international understanding and peace, they are usually forced to include

[20] Objective measurements might be used, for instance, to determine whether one program is more politically or diplomatically oriented than another. For example, a researcher could hypothesize that if an exchange program required its participants to meet certain characteristics it might be more politically oriented than one that did not, such as by being required to possess language capability, to undergo predeparture and post-trip debriefing by the USIA and the CIA, or to report in detail on the foreign policy aspects of their overseas activities. These questions were asked of administrators in charge of the specific programs surveyed in this study; the responses indicate that while these factors may tend to indicate that some programs directly serve political interests more than others, additional information is required to demonstrate a valid relationship. Other information, such as interviews with scientists, a task beyond the scope of this paper, would have to be utilized. However, according to Ambassador Taft, Department of State, intelligence debriefing frequently is mandatory in some programs. (Interview, August, 1971.)

[21] Salomon, "The *Internationale* of Science," op. cit., p. 32, citing F. C. Barghoorn, *The Soviet Cultural Offensive* (Princeton: Princeton University Press, 5960), p. 10.

[22] Ibid., p. 39.

[23] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *1971 National Science Foundation Authorization: Hearings*, 91st Cong., 2d sess., 1970, p. 252.

more specific objectives for participants. . . . Many Americans admit that they go abroad simply to see other countries . . . to learn something about the people and the culture of another country [and] . . . to learn a foreign language.[24]

The support of explicit professional goals, Shank continues, is only one of the motives behind such travel. "And finally," he adds, "there is a relatively small number of Americans who go abroad to teach or to help in the development of foreign institutions." [25]

This introductory section was designed to provide an overview of the exchange programs to be discussed in the study and a characterization of how these programs illustrate the many relationships and potential conflicts between the broader objectives of science and diplomacy. The four following sections describe the origins, evolution, and accomplishments of the scientific exchanges of the Fulbright-Hays program, the NSF-administered nongovernmental exchange activities, the NAS-administered exchanges with the Soviet Union and Eastern Europe, and the origins of formal scientific exchanges with the People's Republic of China. The final section presents some concluding observations.

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[24] Donald J. Shank, "The American Goes Abroad," *The Annals of the American Academy of Political and Social Science* (May 1961), pp. 99–111.
[25] Idem.

II. The Fulbright-Hays Program for Senior-Level Exchanges

At the request of Congress, the Department of Health, Education, and Welfare, in 1969, surveyed ". . . all . . . programs of the Federal Government that have to do with educational activities aimed at improved international understanding and cooperation,"[26] and found that 31 agencies of the Government administer 159 programs for two-way exchanges of scholars or for other foreign or international educational activities.[27] These programs are authorized by 42 legisative acts,[28] and cost somewhere between $400 and $800 million annually.[29]

Scope and Limitations of the Section

U.S. scholars in scientific and technical disciplines are sent abroad under a number of these programs. The oldest of these and one which supports exclusively personnel at the doctorate or post-doctorate level is the senior-level Fulbright-Hays program, directed by the Bureau of Educational and Cultural Affairs (CU), Department of State, under the statutory authority of the Mutual Educational and Cultural Exchange Act of 1961, Public Law 87–256. It includes two-way exchanges of senior-level lecturers, researchers, and scholars in all academic disciplines. (Exchanges of graduate and undergraduate students in all disciplines and exchanges of artistic, cultural, athletic, and other professionals are conducted under other parts of the Hays-Fulbright program.) American senior-level (i.e., Ph. D.) scientists and technical professionals play a large role in the program. During the last five program years an average of more than 50 percent of the senior professional lecturers and researchers recommended to be sent abroad each year were social, natural, or applied scientists; the rest were scholars or professionals in the arts, humanities, and cultural fields. (See Table 2.)

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[26] Pursuant to a provision of the Department of Health, Education and Welfare appropriations act of 1968 (P.L. 90-132), which called for: "A comprehensive study of all currently authorized programs of the . . . Government that have to do with educational activities aimed at improved international understanding and cooperation, with the objective of determining the extent of adjustment and consolidation of these programs that is desirable in order that their objectives may be more efficiently and expeditiously accomplished . . . ."

[27] The survey was conducted by means of a questionnaire sent to 44 Federal agencies; 31 responded. In addition to reporting financial and descriptive data, the agencies categorized each of their programs according to its major objectives. The resulting breakdown is: technical assistance, 56 programs; educational exchange and cooperation directed primarily to foreign nationals and countries, 14 programs; cultural exchange and presentations, 1 program; information services directed to foreign nationals, 13 programs; programs to strengthen U.S. education resources and increase manpower with international competence, 40 programs; and cooperative international activities for mutual benefit, 35 programs. (Source: U.S., Department of Health, Education, and Welfare, Office of Education, Institute of International Studies, *Inventory of Federal Programs Involving Educational Activities Concerned With Improving International Understanding and Cooperation An Inter-Agency Survey Conducted For the Congress of the United States*, June 1969, 545 pp.)

[28] U.S., Congress, House, Committee on Appropriations, *Departments of State, Justice, Commerce, The Judiciary, and Related Agencies Appropriations Bill, FY 1970: Report to Accompany H.R. 12964*, 91st Cong., 1st sess., 1969, p. 7.

[29] The House Appropriations Committee in 1969 estimated that the U.S. Government civilian exchanges programs for FY 70 would cost $377,419,000. This figure is based on materials supplied by the Department of State. The $800 million figure is taken from James M. Davis, "The U.S. Government and International Education: A Doomed Program?," *Phi Delta Kappan* (January 1970), p. 238. Davis based his total on computations using materials presented in *Inventory of Federal Programs Involving Educational Activities Concerned with Improving International Understanding and Cooperation. . .*, op. cit. The HEW study did not present any annual totals for Government-wide costs for international education activities.

TABLE 2.—SUBJECT DISTRIBUTION OF RECOMMENDED CANDIDATES, PROGRAMS ADMINISTERED BY THE COMMITTEE ON THE INTERNATIONAL EXCHANGE OF PERSONS, 1961–62 AND 1966–70

Program year	Number of awards in all fields	Number of awards in natural and applied sciences	Number of awards in social sciences	Percentage of all awards for natural, applied, and social sciences
1961 to 1962	967	312	193	52
1966 to 1967	1,159	344	288	54
1967 to 1968	1,229	355	309	78
1968 to 1969	1,132	318	277	52
1969 to 1970	705	228	170	56
1970 to 1971	360	127	83	58

Source: This information was compiled from unpublished data supplied by the Committee on the International Exchange of Persons, Conference Board of Associated Research Councils, "Annual Report to the Board of Foreign Scholarships." Data for 1970–71 from Annual Report . . ., July 1, 1969 to June 30, 1970 (1970), p. 42; for 1969–70 from Annual Report, July 1, 1968 to June 30, 1969 (1969), Table III; for 1968–69 from Annual Report, July 1, 1967 to June 30, 1968 (1969), Table III; data for 1967–68 from Annual Report, July 1, 1966 to June 30, 1967 (1967), Table III; and date for 1966 to 1967 from Annual Report July 1, 1965 to June 30, 1966 (1966), Table III.

CIEP data should be considered the most reliable for this study since they include only senior research scholars and lecturers sent abroad in professional scholarly fields. The percentage of scientists to total American program exchanges is lower when figured on the basis of data for total senior mutual educational and cultural exchanges as published in annual Department of State appropriations hearings. These sources include information on exchanges sent on some programs other than those handled by the CIEP, and are not as valid for longitudinal comparative purposes since the time periods upon which they are based are not the same and repeats occur. Department of State data, extrapolated from appropriations hearings, yield lower percentages:

Time period	Total number of grantees	Total number of science grantees	Percent of science grantees to total
Academic years:			
1966 to 1967	900	318	35
1967 to 1968	724	329	45
1968 to 1969	672	294	44
Program year:			
1969	416	146	35
1970	507	215	42

The scientific exchanges conducted under the Fulbright-Hays program have not been described in detail in documents available to the public or to the Congress. The purpose here is to identify and assess the major diplomatic, administrative, and substantive considerations which impact upon them. The study describes the initiation and evolution of these international educational and cultural activities, and summarizes legislative and executive branch efforts to insulate program operations from undue political pressures. For instance, to attract superior grantees, the Congress gave responsibility for domestic day-to-day selection and program operations to several nongovernmental groups, funded and supervised by CU in the Department of State. Similarly, binational exchange commissions and other arrangements were initiated to encourage bilateral cooperation in selecting grantees and in determining the scope and content of country programs. However, these programs are part of overseas educational and cultural activities; thus overseas field administrative responsibilities were given to Cultural Affairs Officers attached to the United States Information Agency (USIA), thereby imparting to these programs a distinctly political and informational character. These divisions of responsibility may seem warranted in view of the administrative mechanics of U.S. official representation abroad and the need to maintain the integrity of educational and cultural exchanges. But they have raised questions as to the impact of such arrangements on the quality and effectiveness of the program's coordination and evaluation mechanisms.

Moreover, the quality and quantity of scientific participation overseas appears to be affected by changes in diplomatic objectives. In contrast with the situation in the early days of the program, participation of scientific personnel with the highest reputation among peers appears to have decreased as the program evolved from one designed primarily to support the "unfettered" international exchange of research scholars and lecturers to a program designed to serve information, political, and technical assistance objectives. Scholarly requirements for participation in the scientific and technical aspects of the Fulbright-Hays program are met in exchanges conducted with the developed countries. However, in the case of the developing countries the data appear to point to a discrepancy between the scientific, technical, and political objectives of the Fulbright-Hays program and the requirements and capabilities of scientific and technical scholars.

The Foreign Policy Objectives of Educational and Cultural Exchange Programs

International educational exchanges tend to be initiated, justified, and programmed in terms of strengthening foreign political, cultural, and economic objectives rather than of strengthening a particular branch of knowledge. U.S. programs are no different in these objectives from those of its political allies, nor those of the Soviet Union.[30] Since their inception, U.S. educational and cultural exchange programs have been the subject of a persistent controversy: that is, how independent of foreign policy should these exchange programs be? The legislative and administrative history of U.S. educational and cultural exchange programs indicates that they are a working compromise between the position of those who advocate complete independence and the view that such programs should be closely responsive to foreign policy. Many of the difficulties encountered, especially in the scientific exchanges in the Fulbright-Hays program, arise from this ambivalence.

Early Exchange Programs

Before World War II, official educational exchange programs were small and confined primarily to Latin America.[31] During World War II, educational and cultural exchange programs were replaced by informational and propaganda efforts devoted to winning the war. Mixed educational, cultural, and informational motives continued to characterize U.S. exchange and assistance programs in the immediate post-war period. In 1945, large-scale educational, cultural, and informational activities became part of the occupation program in Germany, Austria, and Japan. In 1947 the technical assistance features of the Marshall Plan had important educational and scientific aspects.

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[30] Documentation on this point is supplied by Frederick C. Barghoorn, *The Soviet Cultural Offensive; The Role of Cultural Diplomacy in Soviet Foreign Policy* (Princeton: Princeton University Press, 1960). For a description and review of the exchange programs, see also: Oliver J. Caldwell (Asst. Commissioner or International Education, U.S. Office of Education), "What Others are Doing, The Rising Demand for International Education," *Annals of the American Academy of Political and Social Science* (May 1961), pp. 112–21.

[31] Cummins E. Speakman, Jr., *International Exchange in Education* (New York: The Center for Applied Research in Education, Inc., 1966), pp. 31–32 and U.S. Congress, House, Committee on Education and Labor, *Federal Educational Policies, Programs, and Proposals: A Survey and Handbook, Part II: Survey of Federal Educational Activities.* Prepared in the Legislative Reference Service, Library of Congress, 90th Cong., 2d sess., 1968, p. 8 (House Document No. 398).

The Point IV Program, initiated in 1950, brought "American technical know-how" to the developing countries.[32]

The Fulbright Program of Overseas Fellowships

The Nation's first large-scale legislative program for international educational and cultural exchange began in 1964 when Senator William Fulbright sponsored an amendment to the Surplus Property Act of 1944 to authorize a mutual exchange of scholars with 22 countries, financed by foreign currencies derived from the sale of surplus U.S. war materials abroad.

The Fulbright program differed significantly from previous overseas scholarship activities. These factors continue to characterize it today. First, the program was conceived so as to minimize involvement with propaganda and "cultural imperialism", and to insure bilateral cooperation, by (a) requiring that the United States and each participating country sign formal exchange agreements to authorize the program, and (b) by establishing binational foundations or commissions, composed equally of U.S. citizens (including the U.S. Ambassador) and foreign nationals, who would assist in local program selection and administration. Second, architects of the program sought to establish an administrative framework neither too dependent nor too independent of foreign policy by (a) placing overall administrative responsibility for the program in the Department of State, but also by (b) establishing a Board of Foreign Scholarships (BFS) charged with selecting all participants and with general supervision of the program. Responsibility for administration and execution of the program was given to the Bureau of Educational and Cultural Affairs (CU) in the Department of State, which also administers other U.S. exchange-of-persons programs. CU, acting under broad policy outlines set by the Board, provides administrative staff and secretariat for the program, negotiates agreements covering educational interchange with foreign governments, maintains liaison with U.S. embassies and consulates overseas, and in Washington cooperates with other U.S. Government and private agencies on particular aspects of the program.[33] According to one historian of this era:

> The Fulbright program . . . fitted perfectly the spirit of the times. International-minded academic and civic groups saw in it an appealing and practical means to promote world understanding. As hundreds of scholars began criss-crossing the ocean the very name Fulbright became a world-wide symbol of mutual understanding.[34]

However, after several years of operation the Fulbright program came under increasing criticism. First, some critics felt it was too limited:

> . . . For all its virtues, the Fulbright program had limitations. . . . It was restricted to academic exchanges and it could operate only in countries where the U.S. Government happened to own "excess foreign currencies," which excluded a good many countries. It could cover only the transportation costs of foreign

[32] For a review of the evolution of American technical assistance programs, especially the Point IV program, see: "Chapter Four: The Point IV Program: Technological Transfer As the Basis of Aid to Developing Countries.," *In* U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research and Development, *Technical Information for Congress: Report*, Prepared by the Science Policy Research Division, Congressional Research Service, Library of Congress, 92d Cong., 1st sess., April 25, 1969, pp. 61–96.

[33] U.S., Board of Foreign Scholarships, *Continuing the Commitment . . . a report on Academic Exchanges: Eighth Annual Report* (October 1970), p. 19.

[34] Philip H. Coombs, *The Fourth Dimension of Foreign Policy: Educational and Cultural Affairs* (Published for the Council on Foreign Relations, Harper and Row, 1964), p. 30.

students, not their dollar costs in the United States, which had to be raised from private sources. And eventually its reserves of foreign currencies would be exhausted.[35]

Second, many Members of Congress, responding to the growing intensity of the Cold War, wanted either to abolish the program or link it more closely to foreign propaganda and promotional activities:

Many Congressmen had gone overseas in 1946 and 1947, and most came home shocked and angered by the calculated misrepresentations of the United States they had encountered and [were] deeply concerned by the evident lack of understanding of American society and motives, even among good friends.[36]

THE SMITH-MUNDT ACT OF 1948

After a long and heated debate on the relationship of educational exchange to foreign policy, the Congress amended the existing legislation by passing the United States Information and Education (Smith-Mundt) Act of 1948, P.L. 80–402. The provisions of this Act reflected a desire to maintain a relative independence of educational and cultural affairs from foreign policy. The foreign policy purpose was served by establishing an information service separate from educational activities. The Fulbright program was strengthened by:

(1) authorizing some educational exchange in countries other than those whose governments had signed educational exchange agreements;

(2) enabling Fulbright scholars to receive some supplementary dollar support;

(3) requiring the State Department to use private organizations wherever possible in carrying out the operations and objectives of the program;

(4) authorizing the inclusion of technical assistance activities under the concept of educational interchange of persons, knowledge, and skills authorized by the program; and

(5) further expanding the concept of educational exchange by authorizing the Secretary of State to support the exchange of educational materials, and to extend grants to American-sponsored schools, libraries, private universities, and other organizations to further the aims of the educational and cultural exchange programs.

The act also created the presidentially-appointed U.S. Advisory Commission on Educational Exchange to appraise the effectiveness of the educational exchange program semiannually and recommend legislative improvement.[37]

As noted, the Congress had authorized the Fulbright program to utilize foreign currencies derived from the sale of surplus war materials. By 1954 this source of funding began to dry up and Senator Fulbright, foreseeing the need for a new source of revenue, proposed an amendment to the Agricultural Trade Development and Assistance Act of 1954. The Congress passed this amendment (P.L. 83-480) thereby authorizing U.S.-owned foreign currencies derived from any source, including the sale of U.S. agricultural commodities abroad, to be used for educational exchange.

[35] Idem., p. 30.
[36] Ibid., p. 31.
[37] Created by section 603 of P.L. 80–402, (62 Stat. 6).

During the early part of the 1950's the Fulbright program became increasingly subjected to the vagaries of international politics. According to Philip Coombs, a former director of the cultural exchange programs of the Department of State: "In this new cold war context, the educational exchange program was soon outranked by the information program and increasingly became its handmaiden." [38]

He continues:

> Emphasis shifted to grants and exchanges which could have a "quick impact." A State Department reorganization—aimed at giving the information program greater freedom from the Department's hobbling bureaucratic constraints—classified exchange of persons programs . . . as "media services," in the same category as radio, press, and motion pictures.[39]

According to Coombs, one of the most severe threats to the independence of educational and information activities came in 1953 ". . . when all overseas information activities were transferred from the State Department to a new semi-independent United States Information Agency." In the process, he continues, "the educational exchange programs were all but forgotten. Only by the intervention of an influential group, headed by Senator Fulbright and including Senators Mundt and Hickenlooper, were they kept from being placed under the new information agency." [40]

Although the educational programs were not placed under the U.S. Information Agency (USIA),[41] its establishment brought about the beginning of a division of responsibilities which lends a possible political connotation to overseas administration of the program since the staff of the USIA handle overseas day-to-day administration of U.S. educational and cultural exchange programs.[42] The USIA Cultural Affairs Office (CAO), who as part of the United States Information Service (USIS) team handles these programs overseas, reports directly both to the USIA and to the Department of State. Thus, according to Speakman, the program "has two masters in Washington." [43]

Origins of the Fulbright-Hays Act: The Need To Improve Existing Programs To Meet Political and Practical Objectives

In 1961 the Congress passed the Mutual Educational and Cultural Exchange Act, Public Law 87–256, approved September 21, 1961. This statute, commonly known as the Fulbright-Hays Act, is the original authorizing legislation for current educational and cultural exchange programs. The Act had wide support in the Congress; it passed by a vote of 79 to 5 in the Senate and 378 to 32 in the House.

The Fulbright-Hays Act revised existing legislation by repealing and gathering under its authority the previously enacted statutes on educational and cultural exchange: the Finnish Educational Exchange Act, the International Cultural Exchange and Trade Fair

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[38] Coombs, *The Fourth Dimension of Foreign Policy*, op. cit., p. 33.
[39] Idem.
[40] Idem.
[41] Called "United States Information Service" overseas.
[42] Binational commissions establish annual and long-range program plans and generally have final authority in selecting grantees. This theme is developed below on pages 34 and 35.
[43] Speakman, *International Exchange in Education*, op. cit., pp. 35–6, citing an authoritative study on USIA and administration of the program: Charles Frankel, *The Neglected Aspect of Foreign Affairs* (Washington, D.C.: Brookings Institution, 1965) 156 pp.

Participation Act, and the educational provisions of the Smith-Mundt Act.[44] The new legislation also:

—made financial arrangements more flexible to support long-range binational planning and financing by permitting reservation of foreign currencies in advance, dollar financing, interagency transfer of funds for programs, and the extension of support to individuals as well as to institutions;

—authorized private sector evaluation research on educational and cultural exchange;

—expanded the program to include U.S. and foreign participation in international educational and scientific meetings and created additional centers of technical and cultural interchange, such as the East-West Center in Hawaii; and

—refined and strengthened binational program planning and the role of private advisory groups in administering the program.[45]

The provisions of the Fulbright-Hays Act were designed also to rectify program deficiencies described in several advisory group reports presented to the Congress and the President in 1960 and 1961.[46] These reports indicated basic difficulties with the existing legislation.

One difficulty, according to Thomson and Laves, was the need to coordinate a "mass of often unrelated acts [and] to codify and amplify the existing mass of legislation." [47] A second, according to Coombs, was:

> . . . that the diverse educational and cultural activities were a vitally important aspect of U.S. foreign policy and should be accorded higher priority, greater support, and stronger leadership.[48]

"The reports," he said, "stressed the need for clearer policy direction, better coordination, more adequate budgets, consolidation of legislation, stronger federal-private cooperation, and better collaboration . . ." [49]

The new Act also had distinct political objectives. By 1961 bipolarization of the world into "the Communist camp" and "the free World" had peaked; ideological conflict between the two groups of nations was reinforced by the tactics of "Cold War diplomacy." Concurrently, the emergence of the "third world" created a different set of diplomatic problems as the former colonial territories became "developing nations" and sought economic and political ties compatible with their strong nationalism and their need for technical assistance and a favorable trading position. To effectively meet its new inter-

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[44] Informational exchange provisions of the Smith-Mundt Act had previously been subsumed under the authority of the United States Information Agency, created in 1953.

[45] U.S., Congress, House, Committee on Foreign Affairs, Subcommittee on State Department Organization and Foreign Operations, *Mutual Educational and Cultural Exchange Act of 1961: Hearings on H.R. 5203 and H.R. 5204*, 87th Cong., 1st sess., 1961, 343 pp.; U.S., Congress, House, Committee on Foreign Affairs, *Mutual Educational and Cultural Exchange Act of 1961: Report No. 1094*, 87th Cong., 1st sess., August 31, 1961, 42 pp.; U.S., Congress, Senate, Committee on Foreign Relations, *Mutual Educational and Cultural Exchange Act: Hearings on S. 1154*, 87th Cong., 1st sess., March and April 1961, 241 pp.; U.S. Congress, Senate, Committee on Foreign Relations, *Mutual Educational and Cultural Exchange Act of 1961: Report on S. 1154*, 87th Cong., 1st sess., June 14, 1961, 44 pp.

A comprehensive legislative and administrative history and review of accomplishments and limitations of the Fulbright-Hays programs may be found in: Walter Johnson and Francis J. Colligan, *The Fulbright Program: A History* (Chicago: The University of Chicago Press, 1965), 380 pp. The summary appearing in the text above was taken primarily from Johnson and Colligan, pp. 305–309.

[46] "Final Report of the Twenty-second American Assembly on Cultural Affairs and Foreign Relations," *In* The American Assembly, Columbia University, *Cultural Affairs and Foreign Relations* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), pp. 172–177.

[47] Charles A. Thomson and Walter H. C. Laves, "United States Cultural Relations Activities," *In* David G. Scanlon and James J. Shields, eds., *Problems and Prospects in International Education* (New York: Columbia University Teachers College Press, 1968), p. 215.

[48] Coombs, *The Fourth Dimension of Foreign Policy*, op. cit., pp. 44–5.

[49] Idem.

national political burdens, the United States sought to broaden and intensify its presence abroad; both educational and cultural exchange, and informational activities were given important roles to play. Reflecting this diplomatic goal, the statement of purpose of the Fulbright-Hays Act reads:

> . . . to enable the Government . . . to increase mutual understanding between the people of the United States and the people of other countries by means of educational and cultural exchange; to strengthen the ties which unite us with other nations by demonstrating the educational and cultural interests, developments, and achievements of the people of the United States and other nations, and the contributions being made toward a peaceful and more fruitful life for people throughout the world; to promote international cooperation for educational and cultural advancement; and thus to assist in the development of friendly sympathetic and peaceful relations . . . .[50]

Senator Fulbright once described its purposes: "High academic standards are important . . . but the purpose of the program is not the advancement of science nor the promotion of scholarship. These are by-products of a program whose primary aim is international understanding."[51] Recent testimony from the Department of State has amplified this theme as the prime function of the Mutual Educational and Cultural Program:

> The development of lasting relationships between key leaders—leaders of opinion, leaders of organizations, social and political decisionmakers—characterized by mutual confidence, trust, empathy, knowledge, and respect. . . . The total program emphasis is still exchange of persons, but restructured toward better prospects of high leverage, high multiplier, multi-dimensional impact on significant attitudes, relationships and communication processes.[52]

Specific political objectives for the fiscal year 1972 were targeted for geographic areas served by the Fulbright-Hays program. For instance:

> *Near East and South Asia.*—A major objective . . . will be to help Arab leaders and opinion molders understand how U.S. Foreign policies seek to contribute to international political, social, and economic progress and to the maintenance of international amity in the Middle East;
>
> *Africa.*—More extensive emphasis will be placed on emerging leaders among the lower and middle organizational professional levels. Increased programming effort will also be devoted to African news media specialists;
>
> *American Republics.*—Emphasis, as in other areas, will be placed on young professionals and university students who have leadership potential. Continued support will be given to strengthening university-to-university relationships. These programs have developed strong personal institutional ties among influential academic leaders in the United States and Latin America. We are focusing on the need to overcome a variety of different and often difficult cultural and psychological barriers to good relations.[53]

HOW THE FULBRIGHT-HAYS PROGRAM OPERATES

In brief, the Fulbright-Hays program is administered as follows: The binational commissions in each of the 48 countries with which the United States has educational exchange agreements determine the number and types of scholars to be exchanged each year. The Bureau of Educational and Cultural Affairs transmits this information to its

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[50] Statement of purpose (sec. 101) of the Mutual Educational and Cultural Exchange Act of 1961, as amended, Public Law 87-256, 75 Stat. 527, approved September 21, 1961, as amended by Public Law 87-565, 76 Stat. 255, approved August 5, 1962, Public Law 87-793, 76 Stat. 832, approved October 11, 1962, and Public Law 89-698, Stat. 1006, approved October 29, 1966.

[51] As quoted by Robert M. Rosenzweig, "Foreign Policy and Education: A Confusion of Purpose," *Journal of Higher Education* 37 (May 1966), p. 278, as cited by Steven E. Deutsch, *International Education and Exchange: A Sociological Analysis* (Cleveland: Case Western Reserve University Press, 1970), p. 77.

[52] U.S., Congress, House, Committee on Appropriations, *Departments of State, Justice, and Commerce, the Judiciary and Related Agencies Appropriations for 1972: Hearings, Pt. 2*, 92d Cong., 1st sess., 1971, pp. 871-872.

[53] Idem.

program and selection agents, the Board of Foreign Scholarships,[54] and to its operating agency, the Committee on the International Exchange of Persons (CIEP) of the Conference Board of Associated Research Councils in the National Academy of Sciences.[55] The CIEP publishes lists of available openings and circulates them to schools and universities. Applicants forward credentials to the CIEP which, with the assistance of regional and subject-area review committees (composed of distinguished Americans throughout the country), submits an approved list of candidates to the Board of Foreign Scholarships (BFS). If the CIEP has not found suitable candidates for outstanding vacancies, it recruits personnel. Upon completion of the year's competition, the BFS and the Department of State submit names of acceptable candidates to a binational commission in the host country which makes the final choice of Fulbright scholars.[56]

ASSISTANCE PROVIDED BY PUBLIC ADVISORY BODIES

Six public bodies, whose establishment was authorized by statute, advise the Department of State in formulating policies for the mutual educational and cultural exchange programs. Five of these provide advice on the content of specific programs relating respectively to the arts, athletics, UNESCO, book and library programs, and the Center for Cultural and Technical Interchange Between East and West. There is no public advisory body to assist explicitly in scientific and technical exchanges. One of these bodies, the Advisory Commission on International Educational and Cultural Affairs, is charged with advising the Department on all aspects of the exchange program.[57]

U.S. Advisory Commission on International Educational and Cultural Affairs.—The U.S. Advisory Commission on International Educational and Cultural Affairs was established under authority of the Fulbright-Hays Act of 1962 during President John F. Kennedy's administration. It replaced the U.S. Advisory Commission on Educational Exchange, created in 1948 under the authority of the Smith-Mundt Act. It is authorized to serve, in effect, as a board of trustees for the educational exchange programs.

The Commission consists of nine, nonpartisan, presidential appointees, primarily drawn from the academic world. They serve a three-year term and require Senate approval. Secretariat for the Commis-

[54] The Board is composed of 12 members appointed by the President from academic and cultural institutions and government agencies. It evaluates, nominates, and selects grantees; sets policies and procedures for administration; and supervises the conduct of the program. "The intent of Congress," according to the Board, "was to establish an impartial and nonofficial body which would assure the respect and cooperation of the academic world for the educational exchange program . . . ." (*Continuing the Commitment*, op. cit., p. 17.)

[55] The CIEP was created in 1964. Its parent organization, the Conference Board of Associated Research Councils, is the coordinating body for four major professional organizations of the American scholarly world: the National Research Council, the American Council of Learned Societies, the Social Science Research Council, and the American Council on Education. The CIEP administers its own exchange programs, and acting under contract between the National Academy of Sciences and the Department of State assists in selection of American lecturers and research scholar candidates and in the day-to-day operation, administration, and supervision of the exchange program for research scholars and lecturers from abroad. Day-to-day activities are executed by the National Academy of Sciences' Office of Science Scientific Personnel, an independent office in the Academy-Research Council structure. Dr. Francis A. Young was staff director of CIEP from its inception to June 1, 1969. He was succeeded by Dr. John L. Landgraf, current director.

[56] *International Educational Exchange; The Opening Decades, 1946 to 1966, A Report of the Board of Foreign Scholarships to the Department of State*, 1967, p. 15.

[57] U.S., Department of State, Bureau of Educational and Cultural Affairs, Policy Review and Coordination Staff, *A Guide to U.S. Government Agencies Involved in International Educational and Cultural Activities*, September 1968, pp. 11-12.

sion is provided by the Department of State. The principal functions of the Commission are to:

—formulate and recommend to the President policies for international education;

—appraise the effectiveness of Government programs in educational exchange;

—submit annual reports to the Congress and the public on the programs; and

—assist in developing better public understanding of and support for programs authorized by the legislation.

Scope and Limitations of Scientific Exchanges in the Fulbright-Hays Program

Throughout its history the Fulbright-Hays program has lacked both appropriate data collection and evaluation procedures,[58] consequently there has been insufficient attention to systematic improvement of planning and program operations.[59] Scientific exchanges, constituting

[58] With the exception of a detailed review the Congress gave to operations and activities of mutual educational and cultural exchange programs when it was considering the Fulbright-Hays legislation in 1961, congressional consideration of these programs has been limited essentially to annual appropriations committee review of the State Department's Mutual Educational and Cultural Exchange Program. A search of Congressional hearings and literature 1960 to 1970 reveals no special attention to the Fulbright-Hays program.

Each year the Bureau of Educational and Cultural Affairs inserts into House Appropriations Committee hearings raw data printouts on senior level American exchanges conducted during the year. These data typically include name and address of U.S. grantee, subject field, foreign location, funding, and program duration. However, it is difficult to obtain from this material a clear picture of exchanges carried out. The Bureau does not categorize these data or present tabular or statistical summaries showing trends in exchanges. Sometimes the Bureau reports on the basis of a program year and other times on the basis of a fiscal year, precluding valid comparative longitudinal analyses.

In their published annual reports, both the Board of Foreign Scholarships and CU typically report only gross statistical data which do not provide a good basis for evaluation of program activities by country or subject. (For instance, see Table 2, pages 46–7 in U.S., Department of State, Bureau of Educational and Cultural Affairs, *International Exchange, 1967:* Report, 1968.

Inadequacies in the availability of data have been widely criticized. Typical, for instance, is the following exchange between Representative John Rooney, chairman of the House Appropriations Subcommittee for the Departments of State, Justice, Commerce, and the Judiciary, and Mr. John Richardson, the Assistant Secretary of State for Educational and Cultural Affairs:

"There are so many U.S. Government civilian exchange activities that you cannot keep up with them all." To which the Assistant Secretary replied: ". . . There is much in what you say. . . . We have a number of other agencies whose purposes and missions vary somewhat from ours. . . . There are many different activities here under agencies with varying missions. It is really difficult to add them up and to conclude one thing or another about them . . . ." (U.S. Congress, House. Committee on Appropriations. Part 2, Department of State, 92nd Cong, 1st sess. (Washington: U.S. Government Printing Office, 1971): p. 1013.)

Typical of the consistently repeated recommendations for improving the gathering and dissemination of information on educational exchanges is a statement in the 1971 report of the U.S. Advisory Commission on International Educational and Cultural Affairs. It found that there was a need for "a central inventory of all programs . . . in international educational and cultural affairs, both public and private. Information was available and should be collected regularly in one place either within the Bureau of Educational and Cultural Affairs, or the Department's library." (*Eighth Annual Report* (1971), p. 5.)

See also similar recommendations In: Task Force on Management Reform for the Department of State, *Diplomacy for the 1970's: A Program of Management Reform for the Department of State, 1970.* pp. 480–481; and U.S., Congress, House. Committee on Foreign Affairs, and Senate, Committee on Foreign Relations, *Required Reports to the Congress in the Foreign Affairs Field,* 1973, pp. 65–71. (Joint Committee Print.)

[59] The need for a research capability to assess the effectiveness and impacts of the Fulbright-Hays program has been recommended repeatedly. According to the program's first advisory commission: "We still know too little about the processes of communication between cultures, of attitude formation, of educational development in relation to other aspects of national development."

"Continuous research and evaluation concerning these processes and methods," the group recommended, "are needed as guides to intelligent long-term planning of Government programs." (U.S., Advisory Commission on Educational Exchange in 1961, *Toward a National Effort in International Educational and Cultural Affairs,* p. 75). Throughout its history, the successor to this group, the U.S. Advisory Commission on International Educational and Cultural Affairs, has also called for development of a research capability in the Bureau of Educational and Cultural Affairs. (See its reports: *Third Annual Report* (1965), p. 5; its *Sixth Annual Report* (1969), pp. 28, 30). In 1970 in its Seventh Annual Report, *A Multitude of Counselors,* the Commission reiterated its recommendations: ". . . We believe that the development of a social science research capability in the Bureau is a fundamental and urgent management requirement. . . . Institutionalizing the evaluation and research function . . . would give it the staying power which 'contracting out' lacks. It would also provide the daily evaluation and research continuity which operators of the program cannot themselves provide" (pp. 8–9).

The Bureau did maintain a small evaluation staff for a few years after passage of the Fulbright-Hays Act; in 1964 the staff was abolished when funds which previously were available for contract Research and Development purposes were cut, causing "restrictive personnel policies which delayed establishment of a permanent research and development evaluation staff." (*A Multitude of Counselors,* op. cit., p. 8.) Recent actions indicate that the Bureau, most likely under pressure from Congress as expressed in Public Law 90–132, op. cit., will place greater emphasis on research and development. In fiscal year 1970 the Bureau spent $13,971 on research and evaluation. In fiscal year 1971 $114,000 was allocated for this purpose; the Bureau sought $214,000 for research and evaluation functions for fiscal year 1972. (See: U.S., Congress, House, Committee on Appropriations, *Department of State: Hearings, Pt. 2.,* 92d Cong., 1st sess., 1971, p. 921.)

more than half of the Fulbright-Hays program apparently have not received in-depth evaluation by agencies administering the program. As a result, there are almost no appropriate measures of the impacts of scientific exchanges, that is, accomplishments of grantees with respect to both the advance of science and the promotion of scientific and political cooperation between the United States and the Fulbright-Hays host country. What little information that is available consists of unpublished reports prepared by the CIEP and annual reports prepared for the Congress by the Advisory Commission on International Educational and Cultural Affairs.[60]

These reports do indicate, however, that the quality, quantity, and impacts of scientific exchange are influenced by two factors: (1) general considerations of educational and cultural exchange programs which address intellectual, diplomatic, and administrative issues; and (2) considerations unique to scientific research and teaching abroad.

Statistical and descriptive data in these reports indicate that a majority of Americans recommended to be sent abroad annually under the senior Fulbright-Hays program have been scientific and technical personnel. Forty-seven countries are served by the program; 38 percent of the countries served are in Europe.[61] In relation to the total number of countries served by the program, a disproportionately higher number of total exchanges are recommended annually for the European countries, where high-quality applicants have always outnumbered available lectureship and research scholar vacancies. In contrast, scientific and technical exchanges are disproportionately fewer in number in the developing countries. In addition, participants in developing countries are not as well qualified academically, and frequently vacancies must be filled by recruitment. Specifically:

—under the Fulbright-Hays program, Americans are awarded grants for lectureship or study in five geographic areas; on the average, about half of the Americans who are recommended for awards each year are recommended for service in Europe; and

[60] The annual reports of the Board of Foreign Scholarships typically contain superficial comment on the quality of programs, lists of members, references to meetings, data on cost sharing agreements, and general information describing exchange by state, and tenure abroad. The Annual Reports of CU, *International Exchange*, contain: information on cooperating private agencies and their activities; examples of notable exchange activities; statistical profiles of longitudinal and other characteristics of exchange (for all programs without differentiation by type of program); and separate tables on exchange by country and exchange by subject category of grantee, both foreign and American.

The U.S. Advisory Commission on International Educational and Cultural Affairs has produced reports treating problems in organization, administration, policy guidance, and steps needed to improve the quality of American as well as foreign grantees. These are printed as Congressional documents:

A Beacon of Hope—The Exchange of Persons Programs, 1963 (first report of the U.S. Advisory Commission on International Educational and Cultural Affairs); *American Studies Abroad*, 1963; *A Sequel to a Beacon of Hope*, 1964, (second report); *A Report on the Strategic Importance of Western Europe*, 1964; *Third Annual Report of the U.S. Advisory Commission on International Educational and Cultural Affairs*, 1965; *Fourth Annual Report of the U.S. Advisory Commission on International Educational and Cultural Affairs*, 1966; *Open Hearts, Open Minds: How America Welcomes Foreign Visitors*, 1966; *Foreign Students in the United States—A National Survey*, 1966; *Fifth Annual Report of the U.S. Advisory Commission on International Educational and Cultural Affairs*, 1968; *The Use of U.S. Owned Excess Foreign Currencies*, 1967; *Government, The Universities and International Affairs: A Crisis in Identity*, 1967; *Is Anyone Listening*, 1968 (sixth annual report): *A Multitude of Counselors*, 1970 (seventh annual report); *Eighth Annual Report*, 1971.

The CIEP has done little in-depth research, but its evaluations of the day-to-day funding, selection, and operational problems usefully point out major areas which need to be improved. The Committee's evaluations are included in its annual reports, submitted to the Board of Foreign Scholarships; reports are not presented to Congress, nor published, but they are available for public review.

[61] Binational commissions for the program are located in: *Africa:* Ethiopia, Ghana, Liberia, Tunisia; *South America:* Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay; *Asia:* Afghanistan, Australia, Ceylon, Republic of China, India, Japan, Korea, Malaysia, New Zealand, Nepal, Pakistan, Philippines, Thailand; *Europe:* Austria, Belgium, Luxenbourg, Denmark, Finland, France, Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, Yugoslavia; *Middle East:* Cyprus, Iran, Israel, Turkey, United Arab Republic. (Source: "Binational Educational Foundations and Commissions: Executive Secretaries and Addresses," issued by CU/Board of Foreign Scholarships, September 1970.)

on the average approximately 50 percent of the exchanges conducted annually are with European nations;

—in the last several years a majority of the Americans recommended for Fulbright-Hays grants have been in the fields of either social sciences or natural and applied sciences; average annual figures indicate that approximately 50 percent of the grantees in these fields plan to serve in Europe.

With respect to scientific and technical exchanges in the developing countries the data indicate that:

—it is difficult to find qualified Americans to apply for Fulbright-Hays awards for openings in the less developed countries (LDCs); much recruiting is done to find social, natural, and applied scientific and technical personnel to serve in these countries;

—political considerations which underpin the technology transfer aspects of the program deter scientific participation; the changing emphasis from research and unfettered scholarship to technical assistance and lecturing, accompanied by a cut in salary and travel funds, makes it less attractive for scientists and technical personnel to serve in the LDCs; and

—diplomatic considerations support the program's foreign policy and international cooperation objectives, specifically its binationalism, but at the same time limit scientific participation because the scope and content of scientific activities abroad are predetermined by foreign hosts who prefer exchanges of scientific and technical personnel with requisite language skills to provide technical assistance.

Available program evaluations also indicate that senior Fulbright-Hays grantees judged most effective abroad are those who can interact culturally with foreign hosts and that scholars judged most prestigious and professionally competent by their peers may be less effective overseas than those judged less professionally competent. Scientists fall under these categories. These trends will be described next.

DIFFICULTIES OF FINDING QUALIFIED SCIENTIFIC CANDIDATES TO SERVE IN THE DEVELOPING COUNTRIES

During the period 1966 to 1970, the CIEP recommended lecture and research awards in four subject categories, tenable in five geographic areas of the world. Between 53 and 60 percent of the recommended awards were for the social sciences and the natural and applied sciences. During this five-year period, about 42 percent of the recommended awards in these two science areas were for Americans for service in Europe. A continuous decrease has taken place in research awards for these two science categories but the bulk of cuts for research awards in the social and in the natural and applied sciences since 1966 has been in the developing countries. (See Tables 3 and 4.)

TABLE 3.—DISTRIBUTION OF RECOMMENDED CANDIDATES BY DISCIPLINE, COMMITTEE ON THE INTERNATIONAL EXCHANGE OF PERSONS

	Arts		Humanities and education		Social sciences		Natural and applied sciences		
	Lecturers	Research scholars	Lecturers	Research scholars	Lecturers	Research scholars	Lecturers	Research scholars	Total
1970–71 program:[1]									
Africa			11		9		4		
Latin America			20		17		37		
East Asia			17	6	14	1	14	5	
Europe		5	62	13	23	9	29	25	
Near East/Asia	3		12	1	10		13		
Total	3	5	122	20	73	10	97	30	360
Total, lecturers									295
Total, research scholars									65
1969–70 program:[2]									
Africa			15		9		6		
Latin America	2		20		16	1	35		
East Asia	5		44	13	26	16	30	22	
Europe	3	10	132	24	50	22	44	55	
Near East-Asia	7	1	29	2	25	5	31	5	
Total	17	11	240	39	126	44	146	82	705
Total, lecturers									529
Total, research scholars									176
1968–69 program:[3]									
Africa			31		11	1	14	1	
Latin America	4		53		45	1	52	3	
East Asia	4	1	73	16	38	9	50	14	
Europe	10	33	143	77	73	51	56	86	
Near East/Asia	5	2	61	24	39	9	35	7	
Total	23	36	361	117	206	71	207	111	1,132
Total, lecturers									797
Total, research scholars									335
1967–68 program:[4]									
Africa			23		12		9	2	
Latin America	2		44	2	37	3	64	3	
Far East	2	2	70	14	50	14	41	28	
Europe	7	29	135	116	79	45	46	90	
Near East/Asia	8	4	72	35	50	19	60	12	
Total	19	35	344	167	228	81	220	135	1,229
Total, lecturers									811
Total, research scholars									418
1966–67 program:[5]									
Africa	1		21		9		9	1	
Latin America		2	50	2	33	2	59	2	
Far East	3	5	74	18	52	11	40	33	
Europe	15	20	135	74	83	37	41	81	
Near East/Asia	2	4	90	11	50	11	67	11	
Total	21	31	370	105	227	61	216	128	1,159
Total, lecturers									834
Totol, research scholars									325

[1] Data for 1970–71 from: Committee on International Exchange of Persons, Conference Board of Associated Research Councils, "Annual Report to the Board of Foreign Scholarships, July 1, 1969 to June 30, 1970" (1970), p. 342.
[2] Data for 1969–70 from: ———, "Annual Report, July 1, 1968 to June 30, 1969" (1969), table III.
[3] Data for 1968–69 from: ———, "Annual Report, July 1, 1967 to June 30, 1968" (1968), table III.
[4] Data for 1967–68 from: ———, "Annual Report, July 1, 1966 to June 30, 1967" (1967), table III.
[5] Data for 1966–67 from: ———, "Annual Report, July 1, 1965 to June 30, 1966" (1966), table III.

TABLE 4.—PERCENTAGE OF AWARDS BY SUBJECT AND AREA, CANDIDATES RECOMMENDED BY THE COMMITTEE ON THE INTERNATIONAL EXCHANGE OF PERSONS

Year	A		B	
	Number of awards in social sciences lecturing and research	Percent of Col. A for Europe	Number of awards in natural and applied sciences lecturing and research	Percent of col. B for Europe
1970 to 1971	83	32	127	43
1969 to 1970	120	60	228	43
1968 to 1969	277	45	318	45
1967 to 1968	309	40	355	38
1966 to 1967	288	42	344	31

Source: Data figured from table 3 above.

CIEP annual reports have consistently noted the overwhelming American interest in filling vacancies for awards in Europe, and conversely, the disinterest Americans show for serving in other areas, especially the developing countries. Excerpts of narrative descriptions of this problem, 1962 to the present, indicate that their disinterest is motivated by lack of foreign language skills; insufficient reimbursement; differences between host countries' and scientists' expectations about services to be performed; absence of funds for research; and unwillingness of U.S. scientists to participate in technology-assistance-oriented Fulbright-Hays activities. To overcome these problems, the CIEP has found it necessary to recruit American scientific and technical personnel, but these efforts are not always successful. A few illustrations of these problems, taken from CIEP reports, follow:

1962:

[The decline in applicants for Latin America] may be in part attributed to the fact that a large percentage of the awards . . . are in the physical and natural sciences, fields in which few Spanish speaking specialists are available, [and the Congressional elimination of travel funds for dependents. CIEP added to its staff a consultant, Dr. S. S. Steinberg, Dean, College of Engineering, University of Maryland, especially to recruit in the scientific fields.][62]

[One of the year's worst problems was in recruiting for the social and physical sciences.] The situation is nearly acute. [It is necessary to increase publicity or to insist that binational commissions lower expectations for science and technology.][63]

There is a dearth of applicants in social sciences and natural sciences for Africa.[64]

1967:

[It is difficult to fill vacancies in the social sciences in South America. CIEP is considering giving additional language training. They are also considering establishing an Advisory Committee for Science.][65]

1970:

In Africa recruitment . . . for lecturers . . . has long been necessary. . . . Late requests language requirements, and insufficient compensation . . . contribute to the difficulty . . . . A particularly unfortunate aspect of the Africa program . . . is the absence of research awards.[66]

. . . The Indian program does not attract . . . social scientists [who] are likely to apply for . . . lectureships unless the host university is in a center

[62] Data obtained from following report of the CIEP to the Board of Foreign Scholarships: 1/1/62 to 6/30/62, pp. 1–11.

[63] Data obtained from following report of the CIEP to the Board of Foreign Scholarships: 6/30/62 to 12/31/62, pp. 7–9.

[64] Data obtained from following report of the CIEP to the Board of Foreign Scholarships: 6/30/63 to 12/63, p. 17.

[65] Data obtained from following report of the CIEP to the Board of Foreign Scholarships: 7/1/66 to 6/30/67.

[66] Data obtained from following report of the CIEP to the Board of Foreign Scholarships: Report for 1970, p. 14.

from which they can conduct . . . studies, and the absence of research awards . . . reduces . . . applications. The absence of grants in the sciences [is a problem].[67]

After several years of trying to conduct a "package" program for American lecturers in the sciences, the Foundation in Taipei is shifting to a more open program, . . . because U.S. matching parts of the "packages" have proved virtually impossible to find.[68]

Openings in Argentina . . . require candidates able to lecture fluently in Spanish. This requirement . . . has caused the Committee often to recommend candidates who have held previous grants either in Argentina or in other countries of Latin America.[69]

The Discrepancy Between Foreign Policy and the Nature of Scientific Inquiry.—A number of factors explain the low rate of U.S. scientific and technical participation in Fulbright-Hays educational exchange programs in the developing countries. One of the more important is the discrepancy between the foreign policy objectives of the program and the nature of scientific inquiry. Foreign policy factors have influenced not only the thrust of the program, but also its content, funds available to support it, attitudes of participating scientists, and the activities of grantees while abroad.

Francis Young, director of the CIEP since its inception to 1970, explains that participation rates ebb and flow in relation to the political connotation of the program. When the program was first established it supported free scholarship and educational exchange, thereby attracting an eager group of candidates:

[The program] initially [emphasized] free scholarship, intellectual ability, and an open competition. [It was] a product of the immediate post-war American idealism. . . . There were . . . at the beginning no political burdens . . . to carry. The "cold war" was still in its early stages, and what appealed . . . was the idea of converting swords into ploughshares by means of a world-wide educational exchange program in which the government and the academic community worked as partners.[70]

Then, beginning in 1953, with intensification of the Cold War, the program became increasingly involved with overt foreign policy goals. Scholarly research and educational activities were subordinated to the achievement of national objectives overseas, resulting in a program—

. . . oriented more toward the interest of the United States and the other participating countries, as defined by their governments and their representatives . . . and less toward the interest of individual scholars . . . .[71]

Educational exchanges thereafter took on a new role "over and beyond the traditional one of personal development and the advancement of scholarship." Research and educational exchange were subordinated as the program began rapidly to take on "characteristics of an international extension service." [72] The individualism of the program, its attractiveness for noted scholars, and its status and effectiveness abroad, rapidly declined as the program became more

[67] Ibid., p. 32.
[68] Ibid., p. 15.
[69] Ibid., p. 16.
[70] Francis A. Young, "The Conference Board of Associated Research Councils in the United States: A Brief Historical Account with Special Reference to National and International Manpower Problems," *Social Science Information* (June 1965), p. 121.
[71] Ibid., p. 122.
[72] Ibid., p. 123.

closely linked to foreign policy considerations. Constraints imposed by these considerations, says Young, continue to characterize the program today. He cites:

> . . . a feeling that a program based upon the limited and transient interest of individual scholars lacked continuity of purpose and impact; an increase in cold war tensions and extension of the East-West conflict to the cultural and educational area; [the subordination of] private interests to national needs; . . . the influence of the Point IV concept of "technical aid;" and the need of justifying to a reluctant Congress steadily increasing expenditures on educational exchanges.[73]

Thereafter, "the effect of all these factors was to swing the pendulum over to the side of more explicit program objectives, more centralized planning, and more bureaucratic control."

ADMINISTRATIVE OBSTACLES TO FRUITFUL SCIENTIFIC EXCHANGE

Philip H. Coombs, first Assistant Secretary of State for Educational and Cultural Affairs, appointed during President Kennedy's administration said the 1950's, when most of these programs were initiated, ". . . were a period of unplanned proliferation of international educational and cultural activities on all sides, and while this constituted progress it also created a heritage of problems." [74] An important ramification of this unplanned growth is that international education activities are not governed by the Government department concerned with education, but by an agency charged with designing and implementing foreign policy.[75] Coombs has described the cause and effect of this choice:

> . . . Educational and cultural affairs had not yet come to be regarded . . . as having a vital bearing on our foreign relations. They were "good things to do" but not in the same class as political, economic, and military affairs which dealt with the "practical realities" and "serious business" of foreign policy.[76]

As a result, "the exchange program was an orphan in the State Department." [77]

Other critics of this arrangement contend that international educational programs are unrealistically expected to contribute to foreign policy goals. For instance, Miriam Rooney, research professor of law stated in 1967, after returning from a year at the University of Saigon as a Fulbright professor: "We have unfortunately had to tie our cultural program to military power and might, in the interest of defense. This has affected unfavorably our cultural and intellectual impact upon the rest of the civilized world." [78] Another scholar reports that ". . . cultural activities [are] regarded as nice but inconsequential, from the unreasonable expectation that they are capable of solving immediate political problems." This leads, he said, "either to naive

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[73] Ibid., pp. 122, 166.

[74] Philip H. Coombs, "The Past and Future in Perspective." American Assembly. *Cultural Affairs and Foreign Relations* (Washington: Columbia Books, 1968). p. 151.

[75] The Department of Health, Education, and Welfare was given increased responsibility under the International Education Act of 1966 to coordinate these activities and established the Institute of International Studies to carry out the purposes of the Act. However, the act was never funded, constricting the Department's ability to implement it.

[76] *The Past and Future in Perspective*, op. cit., p. 151.

[77] Idem.

[78] Statement of Miriam Rooney. In Allan A. Michie, ed., *Diversity and Interdependence through International Education:* A report of a symposium marking the Twentieth Anniversary of the International Educational Exchange (Fulbright) Program, sponsored by the Board of Foreign Scholarships and co-sponsored by the Edward W. Hazen Foundation, The Johnson Foundation and Education and World Affairs (Education and World Affairs, 1967), p. 127.

prescriptions . . . or recriminations because of the inability of cultural activities to solve problems or prevent unfavorable situations which are in fact due to other causes." [79]

Still others charge that international educational and cultural programs fail to meet the needs of the developing countries. "In these lands, mutual understanding is very low on their list of priorities: freedom, power, and the benefits of industrialization are very high." [80]

RECOMMENDATIONS TO ELEVATE THE STATUS OF EDUCATIONAL AND CULTURAL AFFAIRS IN THE STATE DEPARTMENT

Constraints are imposed also by the configuration of the administrative apparatus which governs these programs. For instance there have been repeated recommendations that educational and cultural exchange programs would be improved if a post of Under Secretary of State for Educational and Cultural Affairs were created to provide leadership under a clearer and more forceful mandate. Coombs suggests that:

> The new undersecretary would be charged with developing a unified set of policies to guide all international educational activities of the government . . . and ensuring their proper coordination. He would include within his purview, among other things, the present confusing clutter of international scientific activities of the federal government, which today tend to be treated separately from [but should be] an integral part of our educational and cultural affairs.[81]

The Advisory Commission on International Educational and Cultural Affairs commented in its Fourth report: ". . . There are undersecretaries in the economic and political spheres. . . . Educational and cultural matters can come into their symbolic place in the multiplicity of overseas activities . . . only if the person in charge of them is at the level of Under Secretary." [82]

RECOMMENDATIONS FOR OVERSEAS EDUCATIONAL AFFAIRS OFFICERS

A cultural affairs officer of the United States Information Service is a member of the local binational commission and "administers the educational and cultural exchange activities of the Department of State abroad." [83] Additionally, in countries where there is no commission, these cultural officers, as representatives of the Department of State, handle the local end of the educational exchange program, help process grant applications from students and other academic candidates, and give orientation and local supervision to American grantees coming to that country.[84] This link between Fulbright

[79] Robert Blum, "The Flow of People and Ideas," *In* American Assembly, Columbia University, *Cultural Affairs and Foreign Relations* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963), p. 4.

[80] Richard A. Humphrey, "Cultural Communication and the New Imperative," *Annuals of the American Academy and Socibl Science* (May 1961), p. 145.

[81] *The Fourth Dimension of Foreign Policy*, op. cit., pp. 123–4.

[82] *Fourth Annual Report*, 1967, op. cit., p. 2.

[83] *A Guide to U.S. Government Agencies Involved in International Education and Cultural Activities*, op. cit. p. 13.

[84] *Continuing the Commitment* ,op. cit., p. 19.

field operations and the USIA has been cited as another limitation of the program.[85]

Shortly after leaving his post as Assistant Secretary of State for Educational and Cultural Affairs, Coombs wrote an evaluation of the Mutual Educational and Cultural Exchange activities which he had directed. Describing the incompatibilities which arise between USIA "informational activities" and CU's educational and cultural exchange activities, Coombs said:

> USIA . . . is first and foremost an information agency, managed by people skilled in journalism, schooled in the psychological approach. . . . The first claim on USIA's budget and top managers is the latest crisis and each day's news. . . . At the same time USIA must . . . handle educational and cultural affairs overseas . . . through a cultural affairs officer who is often torn between two Washington bosses with apparently conflicting approaches, and who is subordinate to a public affairs officer whose first concern must be with USIA's information mission.
>
> . . . The "informational approach" is essentially a one-way process, legitimately preoccupied with developing sympathetic foreign attitudes. . . . Day by day it endeavors to explain these policies and actions and to put them in the best light that truth affords. It is also a competitive process, daily occupied with exposing and criticizing policies and propaganda that are hostile to the United States. The 'educational and cultural approach' is . . . also concerned with developing honest and sympathetic understanding, but it is a two way process calculated to foster mutual understanding and to benefit both parties.[86]

Field administration of overseas educational and cultural affairs, according to the U.S. Advisory Commission, should be handled by an Educational Affairs Officer who "represents the current dynamic movements of the U.S. educational system [and who] can ". . . deal with [American and foreign] educators on their own terms." [87]

THE AMBIGUOUS IMPACTS OF THE BINATIONAL COMMISSION

Fulbright-Hays binational educational commissions have been established in 47 countries. One of their major functions is to insulate educational exchange from politics and to encourage the international and binational cooperative emphasis of the program. However, paradoxically, they have had deleterious effects on rates of scientific and technical participation in the senior Fulbright-Hays program.

Commissions are composed of distinguished national educators and cultural leaders from the host country and the resident American

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[85] Possible CIA involvement has also been criticized. During the period 1964–1970, the Advisory Commission on International Educational and Cultural Affairs complained vociferously in its reports to the Congress about the need to insulate educational exchanges from politics and from the interference of CIA intelligence gathering activities which had impacted on these programs. (See *A Beacon of Hope*, Second Annual Report, 1964, p. 9.) Two special reports the Commission distributed in the mid-sixties, *Research, Appraisals and Reports* (1964) and *Government, the Universities and International Affairs: A Crisis in Identity* (1967), 18 pages, described a serious problem about USIA informational and covert CIA intelligence gathering involvement in international educational programs administered by the Department of State. "Chief among [its] concerns," the Commission reported "is the maintenance of the integrity of the educational and cultural exchange programs of the U.S. Government. The Commission feels strongly that the effectiveness of international educational and cultural relationships . . . depends upon free and open exchange. . . . Like most of the educational community [the Commission] was shocked by the revelation of involvement of the Central Intelligence Agency in exchange activities. . . . Government assistance to these organizations could and should have been given overtly." (*Fifth Annual Report*, 1968, pp. 25–6.)

[86] *The Fourth Dimension of Foreign Policy*, op. cit., pp. 122–3.

[87] U.S. Advisory Commission on International Educational and Cultural Affairs, *Fifth Annual Report*, op. cit., pp. 27–8.

community. Typically the U.S. Ambassador serves as honorary chairman; the USIA cultural affairs officer (CAO) or public affairs officer is almost always a member and sometimes executive secretary.[88]

Annual and long-range plans are formulated according to guidelines expressed by the BFS in its handbook, *The Policy Statements of the Board of Foreign Scholarships*.[89] Program plans address: the needs and interests of the respective countries; the needs and interests developed by students, teachers, professors, and research scholars desiring to study or teach in the respective countries; and the opportunities and resources offered by the respective countries. These plans are to be coordinated with related activities of other U.S. Government and private programs in relation to the contributions that can be made to overall country program objectives.[90]

In effect, this means that each commission determines and recommends the number of awards to be filled for that country, and specifies the subject specialization required (such as a consultant to assess research and development of freezing facilities of the meat industry), location of the visit (such as at a university or research institute), duration of visit, and foreign language competence required.

As these activities became more binational and designed to meet the science, education, and science infrastructure needs of the host country, Fulbright-Hays openings were linked more closely to total long-range country planning projects, departing from the early emphasis on educational exchange in specific academic or research areas compatible with the American exchangee's requirements. This arrangement, according to Young, forces scientific and technical personnel to accept predetermined assignments, encourages host country requirements for scholars in short supply in the United States, results in vacancies which are professionally unchallenging to U.S. personnel, and generally discourages scientific and technical participation since scientists are more eager to conduct research programs to serve U.S. science than to provide technical assistance and training. As a consequence, CIEP has to engage in active recruiting for candidates to fill vacancies, a practice which results at times in the nomination of individuals who may be unsuited for the program:

Specializations in high demand in the less developed countries—such as medicine, the natural sciences, and developmental economics—turned out to be in

[88] *Continuing the Commitment*, op. cit., p. 19

[89] Binational commissions also provide orientation and counseling to American grantees while abroad, and prepare terminal reports on grantee activities and annual reports to the Board of Foreign Scholarships.

[90] U.S. Department of State, Board of Foreign Scholarships, *The Policy Statements of the Board of Foreign Scholarships*, July 1, 1964, section 111.21 "Determination of Fields of Activity," revised 8/18/69:

short supply in the United States and conversely fields in which the United States has a surplus of scholars interested in teaching abroad—such as English Literature, the arts and psychology—were in low demand. . . . If the many American scholars who applied for Europe would have been willing to serve alternatively in the less developed countries and if the less developed countries would have been willing to accept highly qualified American scholars in specializations in good supply there would have been, and would be now, no problem of staffing the Fulbright Program. Unfortunately it did not, and still does not, work out that way.[91]

RETRENCHMENT IN FUNDING

During the last few years, American programs for the support of nongovernmental scientists abroad, like mutual educational and cultural exchange programs generally, have been subject to funding fluctuations and retrenchment, caused by budget and balance-of-payments problems. For instance, total funds obligated for exchange of persons programs for fiscal year 1963 amounted to $56 million.[92] During fiscal years 1965 and 1966 approximately $40 million was allocated to support these exchange programs; total funds obligated for the fiscal year 1970 amounted to only $28 million. (See Table 5.) Data available specifically for support of Fulbright-Hays lecturer and research scholar awards show that whereas approximately $6.6 million was spent on Americans abroad in these categories during 1967–1968, only $3 million was spent for support of professionals in these categories during the 1969–1970 program. (See Table 5.)

The most important effect of these cuts is a decrease in the number of Americans sent abroad. CIEP data illustrate this decline. For example, during the years 1966–1967 and 1967–1968, the senior Fulbright-Hays program reached a high point when 650 and 962 grants, respectively, were made. During the program years 1969–1970 and 1970–1971, only 297 and 381 grants, respectively, were offered. These figures are considerably lower even than the number of grants awarded during 1955–1956, when 411 grants were made. (See Table 5.)

Research awards typically are the first area to suffer from budget cuts. In the program year 1968–1969, 140 awards were offered for research; in 1969–1970, only 44 research scholar awards were offered.[93] (See Table 5.) And while research awards in the social and natural sciences have decreased in all areas of the world, the first areas to suffer are countries other than Europe, which generally is recommended to receive about 75 percent of the annual research awards in these areas. (See Table 6.)

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[91] Young, op. cit., p. 124.
[92] U.S. Advisory Commission on International Educational and Cultural Affairs, *Sixth Annual Report, 1969*, op. cit., pp. 20–26.
[93] "Annual Report of CIEP to BFS, July 1, 1968 to June 30, 1969," op. cit., p. 3.

TABLE 5.—LECTURE AND RESEARCH AWARDS AND FUNDS, SENIOR FULBRIGHT-HAYS PROGRAMS, 1964–71

	Awards			Funds		
	Lecture	Research	Total	Support to U.S. lecturers	Support to U.S. researchers	Total funds obligated, exchange-of-persons program
1970–71 program:						
Africa	28		28			
Latin America	80		80			
Near East	39	1	40			
Far East	47	12	59			
Europe	122	52	174			
Total	316	65	381			$27,965,114
1969–70 program:						
Africa	17		17			
Latin America	55		55			
Near East	34	1	35			
Far East	43	16	59			
Europe	104	27	131			
Total	253	44	297	$2,807,485	$297,196	24,414,131
1968–69 program:						
Africa			30			
Latin America			114			
Near East/Asia			91			
Far East			97			
Europe		140	258			
Total		140	590	5,044,051	1,038,238	23,858,721
1967–68 program:						
Africa			24			
Latin America			100			
Near East/Asia			123			
Far East			104			
Europe			611			
Total			962	5,643,413	1,025,003	33,722,523
1966–67 program:						
Africa			20			
Latin America			93			
Near East/Asia			134			
Far East			142			
Europe			261			
Total			650	6,442,492	1,301,787	35,678,597
1965–66 program: Total						40,709,095
1964–65 program				5,612,287	1,076,810	40,098,836

Note: If no entry appears, the data were unavailable.

Sources: Awards Data for 1970–71 from: Committee on International Exchange of Persons, Conference Board of Associated Research Councils, "Annual Report to the Board of Foreign Scholarships, July 1, 1969 to June 30, 1970" (1970), table II; data for 1969–70 from: ——, "Annual Report to the Board of Foreign Scholarships, July 1, 1968 to June 30, 1969 (1969), table II; data for 1968–69 from: ——, "Annual Report to the Board of Foreign Scholarships, July 1, 1967 to June 30, 1968" (1968), table II; data for 1967–68 from: ——, "Annual Report to the Board of Foreign Scholarships "July 1, 1966 to June 30, 1967" (1967), table I; data for 1966–67 from: ——, "Annual Report to the Board of Foreign Scholarships, July 1 1965 to June 30, 1966" (1966), table II; data for 1965–66 from: ——, "Semi-Annual Progress Report to the Board of Foreign Scholarships, January 1, 1965 to June 30, 1965" (1965), table I.

Funding data: Data on lecture and research scholar funding from: Annual reports of the Board of Foreign scholarships: "Exchange Scholars: A New Dimension in International Understanding," 3d annual report, October 1965; "Educational Exchanges: New Approaches to International Understanding," 5th annual report, October 1967; Toward Mutual Understanding: A report on Academic Exchanges," 16th annual report, October 1968; "Reviewing the Commitment . . . A Report on Academic Exchanges," 7th annual report, October 1969; and "Continuing the Commitment . . . A Report on Academic Exchanges," 8th annual report, October 1970. Total funds obligated include all exchange of persons programs, both ways, specifically including: exchanges with 127 countries and territories; assistance to high school exchanges; special programs for nongrant students; and volunteers to America. It excludes aid to American sponsored schools abroad; cultural presentations; multilateral organizations activities; program services costs; and administrative expense. Data for 1965 to 1969 from: U.S. Department of State, Bureau of Educational And Cultural Affairs, "International Exchange 1969," p. 27. Data for 1970 from: U.S. Department of State, Bureau of Educational and Cultural Affairs, "A Statistical Profile of the U.S. Exchange Program, 1971," table 8.

TABLE 6.—RECOMMENDED RESEARCH AWARDS, SOCIAL SCIENCES AND NATURAL AND APPLIED SCIENCES, EUROPE AND OTHER AREAS, SENIOR FULBRIGHT-HAYS PROGRAM

Year	Total number of awards in social sciences	Total number of awards in social sciences for Europe	Total number of awards in natural and applied sciences	Total number of awards in natural and applied sciences for Europe
1970 to 1971	10	9	30	25
1969 to 1970	44	22	82	55
1968 to 1969	71	51	111	86
1967 to 1968	81	45	135	90
1966 to 1967	61	37	128	81

Source: Figures taken from table 3 above.

The U.S. Advisory Commission on International Educational and Cultural Affairs has repeatedly expressed concern about the adverse impacts of retrenchment on educational and cultural exchange and the Fulbright-Hays program. A detailed review of the Commission's reactions to these cuts was included in its Sixth Annual Report to the Congress (1969). " . . . The program [according to the Commission] has been . . . tremendously successful and is an important and significant element of American foreign relations. [However] throughout [our] studies . . . the theme of fiscal starvation recurs." [94] These cuts in the program, according to the Commission, have been unwarranted. Specifically:

> [There is] a 67 percent cut in the number of American grantees going overseas. This cut appears to have been made on the false premise that somehow the Fulbright-Hays programs and the sending of American scholars, professors, teachers, students, and specialists overseas . . . contributes to the serious balance-of-payments problem facing the United States. . . . Such considerations should not have entered into the budget . . . . No travel restrictions . . . on the U.S. citizen, nor any travel tax eventuated from [deliberations on the balance of payments problem].[95]

In addition, cuts in these programs weaken the binationalism underpinning the concepts and objectives of the Fulbright-Hays program:

> . . . One more particular cause for worry . . . has to do with the blow to . . . binationalism which has characterized the academic exchange programs since 1946. That many governments have so believed in the program that they have entered into cost-sharing agreements with this Government in order to keep the program going as our supply of foreign currencies decreases is evidence of a faith in educational exchanges which we must not betray by eliminating even some of them unilaterally.[96]

Another of the more immediate impacts of retrenchment is the adverse effect of the cut on compensation for grantees. Young explains the problem in these terms:

> The changes in the purposes and roles of the Fulbright exchanges were not accompanied . . . by commensurate changes in the terms and conditions of the grants. In the early days of the program, if a Fulbright stipend failed to cover all the grantee's necessary expenses, it was nevertheless welcomed by a scholar eager to increase his professional skills and research production. As the awards came to offer less in the way of a professional opportunity and to require more in the way of a professional service, both the limited stipends and the predetermined assignments became less attractive to well-qualified scholars.[97]

[94] *Sixth Annual Report*, op. cit., pp. 20–66.
[95] Idem.
[96] Idem.
[97] Young, op. cit., p. 123.

Accordingly, the CIEP has recommended increases in the funds available to support the program and specifically to make awards more financially adequate, especially for service in the LDCs:

. . . It should be possible for a scholar to accept a Fulbright award for lecturing in the less developed countries without financial loss. . . . Dollar supplementation [should be increased]. To be effective, this increase should be substantial—perhaps $1000 for a nine or ten months' award. Fringe benefits to the grantees should also be increased wherever possible by such means as including in the award a foreign-currency allowance for the grantee travel in the host country and surrounding region.[98]

THE NEED TO MAINTAIN THE QUALITY OF AMERICAN GRANTEES

Difficulties in securing candidates for LDCs have been accompanied by another equally significant and persistent problem—that of maintaining the high quality of American grantees sent to the developing countries. The CIEP explained the problem in these terms:

During the first few years of the Fulbright program, its prestige was high and there was a general feeling that the quality of the grantees was good. The large number of awards offered for research and lecturing in Europe . . . dominated the early program and attracted many distinguished scholars. But as the number of awards offered in the less developed countries increased and finally exceeded those in Europe, more persons of modest qualifications were drawn into the program and concern began to be expressed over the quality of the American representation.[99]

CIEP has taken systematic steps toward achieving better standards and improving the quality of grantees sent abroad. First, several in-house and extramural studies were performed on the question of quality. The first of these studies, completed in the spring of 1963, compared the quality of American grantees sent abroad during the period 1957–58 with the quality of those sent abroad during 1962–63. This study revealed that the quality of the program had decreased significantly from 1957 to 1963. In the words of the CIEP: "The program simply grew faster than the manpower resources available to it, which meant that the program had to reach down to lower levels of qualifications in order to meet its requirements." [100] The second and third studies in this series assessed the merits of procedures used by CIEP evaluation teams in predicting overseas effectiveness of applicants with actual performance in the field.[101] Until the mid-sixties CIEP evaluation teams relied on the following credentials: the professional record of the applicant, the judgments of his colleagues as contained in the four required letters of reference, and evaluations of application materials. The evaluation research on these procedures revealed that the criteria of professional and scholarly competence, the factor given greatest weight by evaluation teams, had low predictive value for effective performance abroad. According to CIEP:

There was another weakness in the traditional procedure [for evaluating applicants]. It equated quality with the candidate's scholarly reputation at home rather than with his probable effectiveness abroad. Were there a close correlation between productive scholarship at home and effectiveness as a Fulbright grantee abroad, this would not matter. But experience has shown that the correlation is not very close; on the contrary, many highly regarded scholars of modest reputation turn in surprisingly fine performances in their overseas assignments.[102]

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[98] "Annual Report, CIEP to BFS, 1966–1967," op. cit., pp. 27, 38–9.
[99] "Annual Report, CIEP to BFS, July 1, 1966 to June 30, 1967," op. cit., p. 30.
[100] Ibid., pages 31–32.
[101] The second study, published in June 1964, was prepared by Leonard Goodwin, a research associate of CIEP. Titled "American Professors in Asia," the study focused on predictions of effectiveness and actual effectiveness of American grantees in Asia. The third study was performed in-house. (Ibid., pp. 33–4).
[102] "Annual Report, CIEP to BFS, July 1, 1967 to June 30, 1968", op. cit., p. 2.

Parenthetically the Committee added: "Perhaps this means that many Fulbright assignments, especially in the less developed third countries, are better filled by scholars on the second or third rather than the first level of academic distinction in the United States." [103]

Addressing the findings of these studies, CIEP instituted new procedures to elicit more information about the candidate and his overseas assignment:

> . . . the screening committees were asked . . . to give the Fulbright applicant two ratings: (1) a professional rating reflecting professional standing in the United States, that is a traditional quality rating; and (2) an 'assignment' rating, in which a prediction is made of the candidate's probable success in carrying out his assignment abroad.[104]

Nevertheless, the Committee still reports difficulties in implementing these new procedures, relating especially to vagueness in defining the criteria of personal suitability, and to problems of "invasion of privacy," stemming from the need for reviewers to assess personal qualifications of grantees.[105]

CIEP has developed an "up-to-date register [to] relieve one of the major . . . problems of the program. This is recruiting—the filling of overseas openings which for one reason or another have not been responded to by qualified . . . applicants." [106] But CIEP continues to report that recruitment may not be effective after all, since ". . . there are strong indications that in some fields the springs of supply are beginning to run dry." As an example:

> This became apparent when the Conference Board, in cooperation with the American Economic Association, recently sent a 'saturation' mailing to Spanish-speaking economists . . . advertising openings in Latin America. It was probable that virtually the entire manpower potential in this field in the country was contacted. A few inquiries, but no applications were obtained from this effort.[107]

"The existence of a large data bank of specific names of individuals in many classifications," CIEP reports, "will aid such searches, but not obviate them." [108]

OTHER RECOMMENDATIONS

Better Program Planning.—During the last several years CIEP has made a number of other recommendations to overcome problems of filling vacancies. "To make the awards more meaningful educationally and more challenging professionally . . . ," the Committee recommended that binational commissions should undertake better program planning:

> This should include the appointment of additional long-range planning teams of American and foreign scholars to advise on programs with the less-developed countries . . .; inter-agency meetings [should be held] to discuss their implications and to consider ways of implementing them. Planning without follow-up . . . is a waste of time, money and hopes. The overseas Commissions also need a greater capacity to refine and carry out long-range plans, a need which could be . . . reduced by setting up local committees of specialists . . . to advise the Commissions on interim planning and by strengthening Commission staffs . . . .[109]

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[103] "Annual Report, CIEP to BFS, 1966–1967", op. cit., p. 34.
[104] "Annual Report, CIEP to BFS, July 1, 1967 to June 30, 1968", op. cit., p. 3.
[105] Idem. pp. 4–5.
[106] Young, op. cit., p. 124.
[107] Young, op. cit., p. 124.
[108] "CIEP Annual Report, FY 1970," op. cit., p. 4.
[109] "Annual Report, CIEP to BFS, 1966–1967," op. cit., pp. 37–8.

Better Information About Openings.—Binational commissions should also provide U.S. candidates with better information about the openings:

. . . The Committee receives some requests for lecturers which do little more than identify the subject and the host institution. [Commissions should] give a clear picture of the status of the subject in the host university, the significance of the assignment, the reasons for requesting a foreign lecturer, or the opportunities for research or other forms of professional growth.[110]

CIEP recommended to the BFS that the binational commissions should require that:

Requests for lecturers . . . originate within the faculty of the host institutions and be described by the faculty member concerned . . .;
Assignment descriptions . . . be written or reviewed by subject specialists and should emphasize the professional aspects which are meaningful and challenging to scholars;
Assignments . . . encompass a wide diversity of grantee roles in addition to classroom teaching such as participation in faculty seminars, consulting on problems of educational development, advising on long-range program development, and preparing teaching materials;
Lectureship . . . include a research component, . . . opportunity to give a research seminar, or extension of the award period to provide additional research opportunities; and
Requests . . . be submitted in ample time to permit extensive publicity and recruitment. . . .[111]

Tenure.—Frequently an American professor who goes abroad for foreign service jeopardizes his career because his university discriminates against overseas service in evaluating promotion applications.[112] To meet this problem, the CIEP has recommended that:

Experiments . . . be tried . . . using Fulbright awards to support interinstitutional exchange programs and inviting colleges and universities to accept responsibility for recruiting for certain continuing lectureships in the less developed countries. [More] use [should be made] of short term awards. . . . The awards offered in the less developed countries must be distributed more evenly over the various principal disciplines so as to bring the overseas demand for American professors into closer relation to the domestic supply.[113]

Science and Technology Exchange Apparatus.—The CIEP has made no special recommendations for improving arrangements for exchanges of scientific and technical personnel. Special arrangements were made to secure scientific applicants for a cooperative science education project in the United Arab Republic in 1960. The mechanism established for this program might serve as a guide to improve recruitment in the LDC's. In brief, this program incorporated the following elements: (paraphrase)

—provision for a maintenance allowance and a dollar supplement to attract scientists and a supplement to attract scientists in the higher income brackets;

—travel for at least one dependent;

—provision for compilation of detailed background information on the state of science in the UAR, from a specially undertaken survey;

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[110] "Annual Report, CIEP to BFS, 1967–1968", op. cit., p. 7.
[111] "Annual Report, CIEP to BFS, 1965–1967", op. cit., pp. 7–8 and p. 38.
[112] See C. Easton Rothwell, "Education, Foreign Policy, and International Relations," In American Assembly, *Cultural Affairs and Foreign Relations* (Washington, D.C.: Columbia Books, Publishers, 1968) p. 124, and Coombs, *The Past and Future in Perspective*, op. cit., pp. 160–161.
[113] "Annual Report, CIEP to BFS, 1966–1967," op. cit., pp. 27, 38–39.

—detailed description of duties scientists would have to perform; and

—temporary increase in CIEP staff to provide a special scientific recruitment officer.[114]

Conclusion

The Nation's first post-WWII program to send U.S. senior scientific personnel abroad to research and lecture was the Fulbright program, inaugurated in 1946. Its basic purpose is political—to promote international cooperation by familiarizing scholars of other countries with American achievements in science, education, and culture. U.S. scientific and technical professionals are exchanged under the provisions of the senior Fulbright-Hays program, which provides grants, travel funds, and stipends for Americans to lecture, teach, and conduct research abroad. The American scientific community has played a significant role in this program. During the last few years, scientific and technical personnel have been recommended for more than 50 percent of the lectureship and research scholar openings.

The descriptive and factual history of the program illustrates several interactions between scientific exchange and diplomacy. In support of initiating and promoting exchanges, this program, like others which followed it, has profited from State Department efforts to remove foreign administrative and diplomatic obstacles to the movement of scientists, scientific information, and equipment. As the program evolved, its cooperative aspects were expanded. Provision was made for the signing of bilateral executive agreements and joint funding; and more important, the program sought to insure bilateral cooperation by establishing overseas binational commissions to plan the content and scope of exchange. Also, in an effort to maintain the integrity of educational exchange, the Congress and the State Department delegated responsibility for day-to-day selection, evaluation, and program operations to several quasi-governmental groups composed of eminent scholars.

When the program was first inaugurated, U.S. scientific and technical personnel were eager to participate. But as the program evolved, expanding into the developing countries, and as it became more binational, the quality of scientific participation decreased, especially for service in the developing countries. The program history indicates that little difficulty has arisen in filling quotas for scientific exchange in Europe, which typically receives a majority of exchanges, a majority of research awards, and a disproportionate number of all scientific and technological exchanges per year. By contrast, the quotas for scientific exchanges in other parts of the world must be filled by recruitment, in many cases with individuals whose qualifications do not match those of scholars exchanged with Europe.

Difficulties in securing scientific participation for the developing countries include:

—binational planning which supports cooperation, but imposes a variety of constraints on the conduct of scientific activity, including requests for highly trained scientific specialists, sometimes in short supply in the United States, and for exchanges to support technical assistance, an unattractive field for scientific scholars anxious to profit from high-quality educational interchange or research;

[114] "Semi-annual report, CIEP to BFS," January 1, 1960 to June 30, 1960, op. cit., pp. 5–7.

—retrenchment in program funding, causing: (1) a decrease in the availability of research scholar openings, especially in the developing countries, limiting scientific participation to teaching, an endeavor incompatible with scholarly and peer expectations; and (2) inadequate remuneration; and

—possibly unfavorable political connotations deriving from USIA field administration.

It was observed also that effective performance of the grantee is often more a function of his ability to get along in the overseas situation than of his professional standing as determined by his peers at home.

The data raise the following issues:

Would the quality and effectiveness of scientific participation in the program be improved if: (1) a science advisory apparatus were established in the Bureau of Educational and Cultural Affairs or in the Committee on the Exchange of Persons to provide for better coordination between the requirements of scientific scholarship and diplomatic objectives? (2) the Bureau of Educational and Cultural Affairs undertook more comprehensive information-gathering on the program, and sponsored more research and evaluation to improve program operations, continuity, and long-range in-country planning? and (3) field responsibilities were shifted from the cultural affairs officer to an official more familiar with the requirements of educational and scientific exchange, such as an educational officer or science attaché? [115]

Another issue, more broadly associated with the general relationship between scientific exchange and diplomacy, emerges from the data:

In view of the difficulties encountered in finding scientific and technical personnel to serve in the developing countries, would the objectives of the Fulbright-Hays program in these areas be better served if special inducements were made to obtain qualified personnel willing to serve in technical assistance capacities; or if foreign government expectations for technical assistance were satisfied through other U.S. Government programs?

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[115] A review of congressional committee hearings on the program, FY 1960–FY 1970, reveals that the Congress has not been provided with complete information on difficulties the State Department encounters in conducting the senior Fulbright-Hays program. (See annual hearings of the House Committee on Appropriations on Dept. of State Appropriations.) After the draft of this study was completed, Development Alternatives, Inc. completed a study for CU on *The Senior-Fulbright Program and Its U.S. Domestic Impact.* Many of the recommendations made in that study parallel those made here. For instance, with respect to research awards the report recommended: "that each grant given have both a clearly defined research component and teaching or seminar responsibilities which will bring the professor into close contact with the faculty and graduate students of the host institution," and "that some joint research projects with a problem-solving orientation be initiated." Also among the recommendations were the following: (paraphrase) that recipients be made aware of cultural constraints in adapting to a foreign culture; that travel funds be made available for families; that language be made a requirement for many countries; that more grants of longer tenure be awarded; that professors make pre-departure arrangements with foreign host institutions; that the role of the Binational Commissions and of the Cultural Affairs Officer be reassessed "in light of possible alternatives or methods for improving the effectiveness of planning: that more attention be given by Binational Commissions to the availability of candidates in the United States; that institution-to-institution ties be developed; that the level of stipends be reassessed to account for the increased cost of living in many countries; that better pre-departure country orientation programs be initiated; and that grantees be given longer predeparture lead time. (Development Alternatives, Inc. *The Senior Fulbright Program and Its U.S. Domestic Impact.* A study prepared for CU, under contract No. 1069–387022. Project director, Charles F. Sweet. Washington, D.C.: January 1973), pp. 53–57.)

III. National Science Foundation Programs for Americans Abroad

National Science Foundation (NSF) programs in support of Americans to research, teach, or participate in other scientific activities abroad have grown in both number and importance since the Foundation was established in 1950. These programs are almost ubiquitous and undoubtedly the most active of all Federal programs sponsoring U.S. senior level nongovernmental scientific and technical personnel in foreign countries. During the fiscal year 1970, 886 recipients of Foundation awards carried out activities in 75 countries for a total of 3,214 man-days. State Department programs sent 293 nongovernmental scientists and technicians to 64 countries for only 1,871 man-days. (See Table 7.) Americans are supported abroad under several different NSF programs which now include: (a) the administration or funding of a variety of bilateral science agreements with 17 countries, (b) support of American nongovernmental scientific participation in international scientific meetings and organizations, (c) travel abroad in large-scale cooperative research programs as part of the mission of NSF-funded national centers and major research programs, (d) travel under research grants supported by the Research Directorate, and (e) educational grants supported by the Division of Graduate Education.

TABLE 7.—AMERICAN SENIOR-LEVEL NONGOVERNMENTAL SCIENTIFIC AND TECHNICAL PERSONNEL ABROAD, NSF AND DEPARTMENT OF STATE, FISCAL YEAR 1970

Area	Number of countries		Number of persons		Number of man-days	
	NSF	State Department	NSF	State Department	NSF	State Department
South and Latin America	19	13	274	55	656	244
Eastern Europe/U.S.S.R.	6	4	80	21	313	62
North America	3	1	24	1	80	9
Far East and Australia	10	10	135	66	464	412
Mideast and India	10	11	49	35	106	230
Africa	13	9	81	13	300	82
Western Europe	14	16	243	102	1,295	832
Total	75	64	886	293	3,214	1,871

Source: Extrapolated by author from data included in "The International Exchange Study Data Bank, 1971," op. cit.

Overview of NSF International Programs

The bulk of NSF activities for Americans abroad are funded with regular dollar appropriations, and some with special foreign currency funds. In the fiscal year 1974, the Foundation's international-related expenditures totaled approximately $118 million.[116] Much of this outlay has supported international exchange.

[116] Including approximately $2.5 million in funds transferred from the Agency for International Development and the State Department. (See page 96 below.)

When the NSF was established in 1950 it was given limited authority for international scientific activities, but only to support the growth of the domestic science mission. The bulk of the Foundation's international activities was initiated before 1968, when the agency's authority was expanded to support "international science policies" on their own merits (P.L. 90–407). As a result of this delay, program operations, administrative arrangements, and policies for governing international programs were shaped not by clear-cut and explicit legislative goals or Agency objectives, either scientific or political, but by the pace of events: such as international and foreign political opportunities and initiatives, Presidential directives, recommendations of the Bureau of the Budget, and the Federal Council for Science and Technology, and internal program developments.

The Foundation created an office for international activities in 1955; but even today this office administers only about 5 percent of NSF's international science related activities. The rest of the Foundation's programs in this area, many of which involve exchanges of nongovernmental personnel, are scattered throughout the Agency. Consistently categorized annual data on these programs are scarce, obscuring a comprehensive description of their evolution and impact. There appears to be little intra-agency coordination and liaison of these activities, a situation which evokes questions as to the effectiveness of steps the agency is taking to develop "international science policies."

A second issue is that exchange activities are shaped to meet criteria imposed by the Foundation's tradition of maintaining the integrity of science, insulating it from undue political or governmental interference. While obliged to report on scientific aspects of NSF-funded programs, grantees are rarely required to report on the special conditions of conducting foreign and international research and travel. Nor are they uniformly required to meet language or cultural criteria. While the Agency's programs meet exacting scientific criteria, there seems to be little attempt to evaluate systematically their impacts on foreign policy. Annual reports are required of some programs, but not others; some programs are coordinated closely with the Department of State, others are not. The growing size and scope of the Foundation's international science programs raises the issue of whether NSF organization and administration, as now constituted for international science and scientific exchange activities, effectively meet these increasing mission responsibilities.

The importance of this issue was underscored when, on July 1, 1973, President Nixon, in accordance with Reorganization Plan No. 1 of 1973, designated the Director of the NSF as his Science Adviser. In this capacity the Director was given responsibility for "international and scientific and technical activities [previously] performed by the Office of Science and Technology." The Director's chief "support for carrying out this responsibility will come from the Assistant Director for National and International Programs," [117] under whose jurisdiction fall many of the programs discussed in this chapter.

The next section of this chapter deals with the evolution of NSF's authority and programs for international science and the impacts of this history on the organization of programs for scientific exchange.

[117] Letter included in Statement of H. Guyford Stever, Director, NSF, before the Committee on Science and Astronautics, House of Representatives, July 17, 1973. Additional information on precise duties and support comes from: U.S., National Science Foundation, "Staff Memorandum, Subject: Responsibility for International Scientific and Technical Activities Performed by OST," O/D 73-22, June 30, 1973.

Succeeding sections describe the activities and status of the Foundation's programs to send scientific and technical personnel abroad. Summary observations are included in the concluding section.

Slow Growth in NSF Authority for International Science

As noted the Foundation's authority to support international science activities was not clearly defined until 1968, when the Congress expanded and revised the NSF enabling legislation. From 1950 to 1968, the Foundation's support of international science, including sponsorship of Americans to travel, research and study abroad, was based on broad interpretation of two provisions of the original legislation which limited the agency's support primarily to basic scientific research designed to strengthen domestic science [118] and to foster the interchange of scientific information between foreign and U.S. scientists.[119] Under this statute the Foundation was permitted to award science education grants tenable abroad; [120] to award basic research grants tenable abroad; [121] to support defense related research; [122] to cooperate in international scientific activities at the approval of the Secretary of State; [123] and to support the attendance of Americans at international scientific meetings, with the approval of the National Science Board.[124] The Foundation also had authority, under the Economy Act of 1932, as amended, to accept funds by transfer from other departments or agencies and to use them for the purposes for which they were originally appropriated.[125]

The Agency's mandate to support international science was broadened somewhat in 1959, following launching of the Soviet Sputnik, when the Congress amended section 13 of the enabling legislation substituting "international scientific activities" for the original phrase "international scientific research activities." [126] At the same time, the Congress expanded the Foundation's authorization to support education and training of foreign scientists in this country. Authority "to foster the interchange of scientific information among scientists of the United States and foreign countries," was broadened also following passage of the National Defense Education Act of 1958.[127] With these actions support for the program category "international scientific activities" rapidly increased, starting in 1959, and has consistently enlarged since that time. See Table 8.

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[118] Sec. 3 (a) (2), P.L. 81-507.
[119] Sec. 3(a)(5).
[120] Sec. 10.
[121] Sec. 11(c).
[122] Sec. 11(c).
[123] Sec. 13(a).
[124] Sec. 13(a).
[125] 31 USC 686. History discussed in: U.S., Congress, House, Committee on Government Operations, Subcommittee on Research and Technical Programs, *Federal Foreign Research Spending and the Dollar Drain: Hearings*, 89th Cong., 2d sess., February 10 and 24, 1966, pp. 33-34.
[126] Public Law 86-232, September 9, 1959.
[127] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research and Development, *The Participation of Federal Agencies In International Scientific Programs: Report*. Prepared by the Science Policy Research and Foreign Affairs Divisions, Legislative Reference Service, Library of Congress, 90th Cong., 1st sess., 1967, pp. 79-80 (which gives a history of the expansion of the Foundation's authority).

TABLE 8.—NSF, INTERNATIONAL SCIENTIFIC INFORMATION EXCHANGE OR INTERNATIONAL COOPERATIVE ACTIVITIES, OBLIGATIONS

Fiscal year	Amount	Fiscal year	Amount
1953	$33,565	1964 estimate	$700,000
1954	53,058	1965 estimate	800,000
1955	77,054	1966 estimate	700,000
1956	46,054	1967 actual	700,000
1957	122,069	1969 actual	1,427,120
1958	119,900	1970 actual	1,712,426
1959	331,528	1971 actual	2,179,996
1960	768,078	1972 actual	4,244,812
1961	473,302	1973 estimate	4,700,000
1962	703,069	1974 request	6,200,000
1963	749,358		

Source: Data for fiscal years 1953–65 from: U.S. Congress, House, Committee on Science and Astronautics, "The National Science Foundation: A General Review of Its First 15 Years: Report," 1965, p. 185. Data for fiscal years 1966–73 from annual reports and authorization hearings.

During the mid-1960's both the Congress and the Foundation gave critical attention to further expansion of the agency's mandate. Three areas received major concern: social science research, applied research, and international science. Three major issues were addressed with respect to international science:

First, fragmentation of administration, support, and governance. John T. Wilson, a deputy director of the NSF, described this fragmentation in testimony before the Research and Technical Programs Subcommittee, House Committee on Government Operations, in 1966:

> Almost all units of the Foundation are to some extent involved in international activities, [which] include research support for individual scientists in foreign institutions, support of international cooperative research programs, support to U.S. institutions and individuals for foreign related science activities (research, science education . . . , international meetings and foreign travel, studies of foreign science resources, etc.); support of scientific information activities abroad, and support of science education projects in developing countries . . .[128]

Second, the need for NSF to free justification for international science from its support of the domestic science mission. For example, in a special study prepared in 1965 evaluating issues relating to the Foundation's support of international science, the National Science Board, the policy advisory group of the NSF, described the Agency's limited mandate and mission as follows:

> The basic intent underlying the stated purpose of the NSF Act is to promote and strengthen science and science education in the United States. International activities carried out with funds appropriated to NSF must therefore be justified by their contribution toward strengthening science in the United States, or as efforts to determine what should be recommended as national policy to promote basic research and education in the sciences.[129]

Justification of these activities in terms of strengthening domestic science was no longer sufficient in a world increasingly transformed and challenged by science and technology.[130] "A review of past and current international activities and interests," the report continued, "points up the need for the Foundation to focus more clearly on policy issues central to the current and future role of NSF in international matters." [131]

[128] *Federal Foreign Research Spending and the Dollar Drain: Hearings*, op. cit., p. 35.
[129] U.S., National Science Foundation, International Science, "Activities and Policy Issues," typed in-house report (May 1965), p. 1.
[130] Ibid., pp. 4–5.
[131] Ibid., p. 5.

Dr. Leland Haworth, Director of the NSF, described the scope of international science activities in testimony before the Subcommittee on Science, Research, and Development of the House Committee on Science and Astronautics in 1965. According to Dr. Haworth, the Foundation's programs could be subsumed under four general headings:

1. Cooperative programs like IGY, International Year of the Quiet Sun, International Indian Ocean Expedition, and the Antarctic Program.
2. Support of research that can be done better in a particular foreign country or that can take advantage of certain geographical and environmental aspects of that area.
3. Support of science and science education in the developing countries which are in support of foreign policy objectives. The activity is normally carried out on behalf of the Agency for International Development.
4. The "gray area" where support of foreign scientific activities falls in between a normal extension of the Foundation's mission and the obvious support of foreign policy objectives.[132]

Each of these areas, the Director continued, must be considered on its own merits in terms of whether or not it should be properly a Foundation activity and if so, what the extent of the involvement should be.[133]

Third: The broadening of NSF responsibility for formulating international science policies and for taking joint initiative with the State Department in designing programs to exploit foreign and international cooperative opportunities presented by science and technology. Testifying on this point before the Subcommittee on Science, Research, and Development, Herman Pollack, Director, Bureau of International Scientific and Technological Affairs, Department of State, noted that proposed legislation—

. . . reflects [the committee's interest in clarifying] a more active role for the NSF in international affairs and support of international scientific activities. The Department of State welcomes this intent and would welcome a more active role for NSF in the international field.[134]

Pollack suggested that the Foundation should be authorized to engage in international scientific activities for their own sake and "for reasons other than whether [they] promote . . . science or science education in the United States . . . ." An expansion of authority would enable the Foundation and the State Department to:

. . . seize opportunities in the so-called gray areas which thus far have proven difficult to act upon. Thus it should make possible the inauguration of new bilateral and multilateral scientific relationships which could prove to be of overriding advantage to the Unites States.[135]

Summarizing its 1965 investigations of the Foundation's international scientific activities and responsibilities, the House Subcommittee reported:

National foreign policy recognizes the Nation's scientific activities as an important element in foreign relations. Yet the role of the NSF is still to be crystallized.[136]

Expansion of NSF Authority for International Exchange Programs

Subsequently, Rep. Emilio Q. Daddario, Chairman of the Subcommittee on Science, Research and Development, introduced

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[132] U.S., Congress, House, Committee on Science and Astronautics, *Government and Science: Review of the National Science Foundation: Hearings*, 89th Cong., 1st sess., Pt. 1, 1965, p. 787.

[133] U.S. Congress, House, Committee on Science and Astronautics, *The National Science Foundation, Its Present and Future: Report*, 89th Cong., 2d sess., 1966, p. 93.

[134] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *A Bill to Amend the National Science Foundation Act of 1950: Hearings*, 89th Cong., 2d sess., April 1966, p. 27.

[135] Ibid., pp. 33–34.

[136] *The NSF: Its Present and Future*, op. cit., p. 92.

legislation to solve these problems. His proposal, enacted in 1968, expanded the Foundation's mandate to "initiate and support specific scientific activities in connection with matters relating to international cooperation," and to support these activities on their own merits rather than on their need to support the growth of domestic science.[137]

The expansion of the Foundation's mandate is reflected in its 1973 description of the "International Cooperative Scientific Activities" Program:

> (1) gain access to ideas, expertise, facilities, and methodology in other countries for application to American scientific problems and to increase the productive capability of American scientists and institutions; (2) share expenses and talent on global problems confronting advanced nations that are amenable to scientific solutions; (3) permit U.S. ideas, plans, and programs to be presented to appropriate international scientific meetings and bodies; and (4) support the President's announced "United States Foreign Policy for the 1970's," in which he stated that, "It is settled U.S. policy to encourage international cooperation in basic science."[138]

The Implications of Limited Authority

As noted above, the bulk of the Foundation's international activities, and specifically those which send abroad nongovernmental scientists, began long before the Foundation was given a fully articulated mandate to govern and implement them. The evolution and character of NSF programs for the support of nongovernmental scientists abroad reflect many of the difficulties which resulted from the slow evolutionary growth of the Foundation's authority. Although the Agency's overseas activities have increased considerably since 1968, NSF has not established a central organizational focus to provide for general coordination of the science and foreign policy aspects of the bulk of its foreign and international support activities. Programs which send Americans abroad are planned, funded, and administered by several different NSF divisions and offices. The Assistant Director for the Directorate of National and International Programs does not have jurisdiction for implementing all of these activities. The Office of International Programs, OIP, which is under the jurisdiction of the Directorate, funds only about 5 percent of the Foundation's international-related activities. The OIP appears to provide some assessment, coordination, and planning of the science and foreign policy aspects of its own nongovernmental support programs. However, it is not evident that the Office of the Assistant Director for National and International Programs provides effective evaluation, synthesis, and priority setting for other international-related activities supported by the Directorate or by other sections of the NSF.

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[137] Statement of NSF in 1972 House NSF Authorization, Hearings, op. cit.: p. 344. The relevant provisions of the legislation are:

". . . to initiate and support specific [and unclassified] scientific activities in connection with matters relating to international cooperation or national security by making contracts or other arrangements . . . [Sec. 3 (b)];

"to [enter into arrangements] for the carrying on, by . . . the United States and foreign countries, including other government agencies of the United States and foreign countries, of such . . . activities . . . necessary to carry out the purposes of the Act, and at the request of the Secretary of State or . . . Defense, specific activities in connection with matters relating to international cooperation . . ." [Sec. 13 (a)];

" . . . to cooperate in any international scientific activities consistent with the purposes of this act . . . , to defray the expenses of representatives of Government agencies, and other organizations and of individual scientists . . . ; to undertake programs . . . with foreign nationals for scientific study . . . ," [Sec. 9 (3)];

"to enter into . . . arrangements . . . in foreign countries . . . to cooperate in international scientific activities . . . with the approval of the Secretary of State . . . ," [Sec. 13 (b) (1)];

to consult with the Secretary of State in negotiations on scientific matters with other countries, [Sec. 13 (b) (2)].

[138] U.S., National Science Foundation, *Justification of Estimates of Appropriations to the Congress, FY 1973*, 1972, p. H-1.

To the extent that this omission exists, it would seem to preclude systematic evaluation, planning and priority setting of activities most relevant to U.S. scientific and foreign policy interests. As described throughout this study, American nongovernmental scientists abroad frequently are perceived as representatives of the American governmental or scientific community. However, because of the Foundation's tradition of insulating science from politics, most NSF grantees are not given intensive orientation to the cultural, social, and political factors which may impact upon their overseas performance. Similarly, many cannot understand the language of the nation they are visiting. And the absence of an NSF-wide international activities coordination mechanism probably contributes to the absence of accurate, systematically gathered and maintained information describing the scope and impact of these activities. Generally, interpretation of the data presented evokes questions as to whether these programs might better serve their science and foreign policy objectives if they were more tightly organized and administered. The importance of this observation is underscored by the Foundation's increasing programmatic responsibilities for foreign and international science.

THE OFFICE OF INTERNATIONAL PROGRAMS

One of the most important consequences of the slow growth of the Foundation's authority for international science is the absence of a centralized locus for planning, governing, and supporting international science activities. The origin of the Office of International Programs dates to 1955. During that year the Foundation established the Office for the International Geophysical Year to administer U.S. participation in this international cooperative science program.[139] In 1959, the name of the Office was changed to the Office of Special International Programs to reflect the expansion of the Agency's programs following launch of the 1959 amendments and emphasis on support of science following the Soviet Sputnik.[140] This office was given early responsibility for directly administering some international programs, for assisting in others, and for providing some liaison to the Department of State.

During 1961 the Foundation redesignated its foreign programs office, as the "Office of International Science Activities." In the late 1960's, the name was changed again, to the "Office of International Programs" (OIP). The OIP is responsible for administering programs under the current program category, "International Cooperative Scientific Activities." It is the only Foundation office which regularly reports to the Department of State on foreign scientific activities.[141] In addition, staff members provide liaison with professional associations, the Office of the Foreign Secretary of the National Academy of Sciences, and the Bureau of International Scientific and Technological Affairs (SCI), Department of State. However, staff members of other divisions also perform these functions, from time to time if their responsibilities warrant it.[142] See figure 1.

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[139] U.S., National Science Foundation, *Annual Report, FY 1960* 1961, p. 130.
[140] National Science Foundation. *Annual Report, FY 1959*, 1960, p. 126.
[141] Interview, Dr. Raphael Ronkin, NSF, February 26, 1971.
[142] Interview with Mrs. Bertha Rubinstein, Division of Social Sciences, NSF, in which she said that the Division of Social Sciences checks with the State Department before awarding funds for a potentially sensitive social science research project in foreign countries even though the Foundation is exempt from Government-wide guidelines to report to the Foreign Affairs Research Council before undertaking sponsorship of foreign area research.

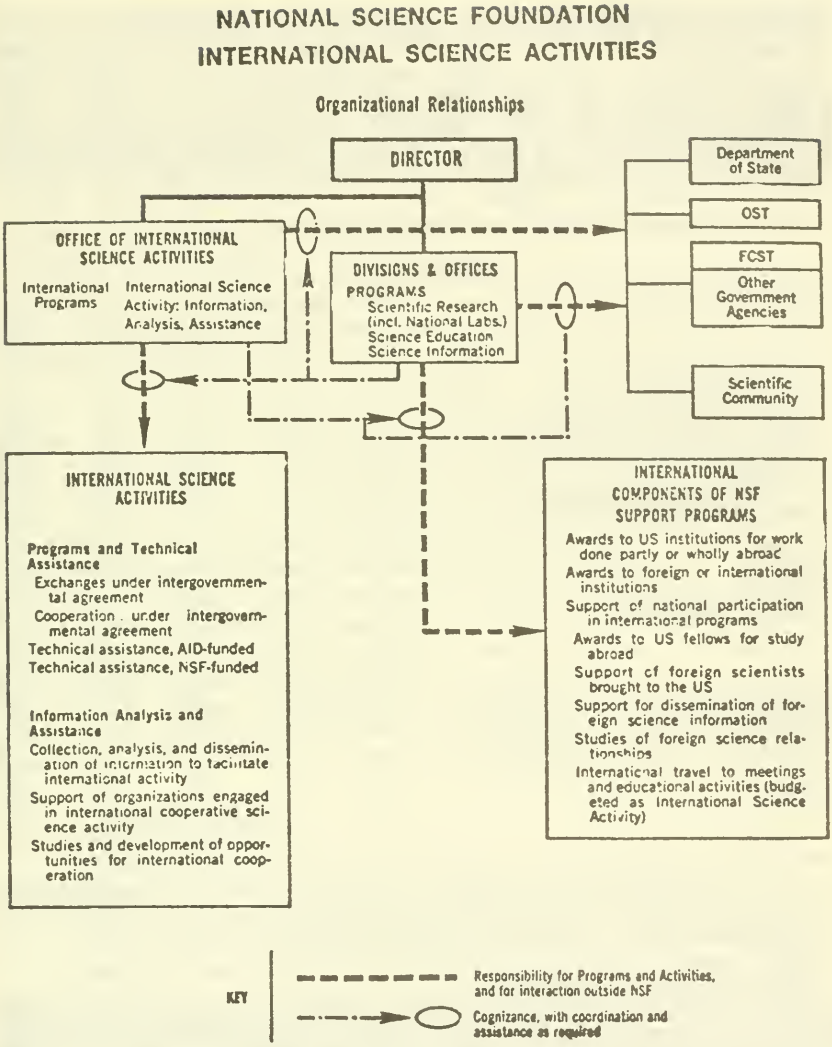

FIGURE 1

Source: U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *1970 National Science Foundation Authorization: Hearings, Vol. II*, 91st Cong. 1st sess., 1969, p. 566.

The Office of International Programs is responsible for only a very small percentage of the Foundation's international and foreign science activities. For instance in fiscal year 1968, OIP funded about 7 percent of programs with international components:

During fiscal year 1968, a total of $20 million was obligated for activities that had international components, of which $1.4 million was obligated directly through the [Office of International Programs].[143]

[143] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *1970 National Science Foundation Authorization: Hearings*, 91st Cong., 1st sess., Vol. II, 1969, p. 53.

Although NSF obligations for international science activities have increased since that time (from $20 million in 1968 to $118 million in the fiscal year 1974), OIP's responsibilities for supporting these activities have decreased, relative to total expenditures, since 1968. During the fiscal year 1974, the OIP will support activities totaling $6.2 million, which is 5.2 percent of the Foundation's reported obligations for programs with international implications. (See Table 9.)

TABLE 9.—NSF PROGRAMS WITH INTERNATIONAL IMPLICATIONS, FUNDING[1]

[In millions of dollars]

	Fiscal year—				
	1970	1971	1972	1973	1974
National and special programs:					
International biological program	4.0	7.0	9.4	9.5	9.5
Global atmospheric research program	1.5	2.0	2.4	3.0	4.0
International decade of ocean exploration	0	15.0	19.7	17.5	17.0
Ocean sediment coring program	6.5	7.2	9.3	9.0	11.0
Polar programs	7.4	9.5	(30.5)	(29.5)	(29.0)
Arctic research program			3.5	4.0	4.0
U.S. Antarctic research program			27.0	25.5	25.0
1973 solar eclipse	0	0	.1	.6	.1
Subtotal	19.4	40.7	71.4	69.1	70.6
Facilities:					
Cerro Tololo	1.9	2.2	2.5	2.7	2.6
Other national laboratories	.6	.75	1.1	1.2	1.2
Subtotal	2.5	2.95	3.6	3.9	3.8
Education	3.5	2.0	.2	.1	.1
Science information	1.5	1.0	.4	.3	.3
Basic research programs	[2] 19.0	25.0	[2] 25.0	[2] 26.0	[2] 27.0
Research—RANN			[3] 2.4	[3] 2.7	[3] 2.7
International programs [4] (Office of International Programs)	[5] 1.7	2.2	4.2	4.7	6.2
Public Law 480	2.0	2.0	3.0	5.0	5.0
Aid transfer [6]	.6	.6	.4	.4	.2
DOS transfer [6]			1.2	2.5	2.5
Total	50.2	76.45	111.8	114.7	118.4

[1] Data for total international activities, fiscal years 1970 and 1971 are from: U.S. Congress, House, Committee on Science and Astronautics, Subcommittee on International Cooperation in Science and Space, "A General Review of International Cooperation in Science and Space: Hearings," 92d Cong., 1st sess., May 1971, p. 128. Data for 1972, 1973, and 1974 are from information supplied by Dr. E. Sohns, Office of International Programs, NSF, Jan. 17, 1973.

[2] Estimated.

[3] Weather modification project.

[4] May generally be considered as supporting OIP.

[5] Fiscal year 1970 data from: U.S. Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, "1972 National Science Foundation Authorization: Hearings," 92d Cong., 1st sess., 1971, passim; fiscal year 1971 estimated data: NSF, "Justification of Estimates of Appropriations fiscal year 1972 to the Congress," 1971, p. I-1; fiscal year 1972, 1973 and 1974 data from: NSF, "Justification of Estimates of Appropriations fiscal year 1974 to the Congress," 1973, p. G-1.

[6] These sums are for funds transferred to the Foundation by the Agency for International Development and the State Department, for respectively the Indian and educational programs and the Spanish Agreement.

INCONSISTENT REPORTING HISTORY

The fragmentation of the Foundation's international science activities poses a significant problem for researchers: viz., unsystematic and inconsistent reporting of funding. Throughout its history, the Agency has not reported as "international" all of its international scientific activities. These discrepancies appear in both congressional budget hearings and in *Annual Reports of Grants and Awards*. Furthermore, the Foundation has included some programs under different.

program categories from one year to another making it difficult for the researchers to compile a valid history of how these programs evolved.[144]

The NSF amendments of 1968 expanded the jurisdiction of the Subcommittee on Science, Research, and Development, House Committee on Science and Astronautics, to authorize appropriations for the NSF. In 1971 the Committee requested that the Foundation present the Congress with a line item budget.[145] In response to this request the Foundation began to use a consistent format for reporting international scientific activities.[146]

Since the fiscal year 1971 all specifically labelled international scientific activities have been included in one section of the report and are differentiated by program titles corresponding to budget presentation categories. Although these changes improve the Foundation's reporting, several major problems still remain. First, its support of cooperative science projects and international travel fall under two budget categories: International Activities and Special Foreign Currency Program. No attempt is made to explain whether activities under one category also fall under the other. Second, more than 90 percent of the Foundation's international activities are administered by divisions other than the Office of International Programs. The revised budget category, "International Cooperative Scientific Activities," reports only those programs administered by the OIP. The Foundation does not report to Congress totals of other grants (such as in research grants, national research centers, and education) that involve foreign or international activities carried on abroad. In 1970 the Foundation began an experimental program requiring program directors to indicate on a proposal form those grants with international implications. These categories were further subdivided into:

foreign travel;
foreign citizens;
operations or projects at a foreign site including cooperative projects;
foreign procurement of goods or service;
liaison with or support of international organizations; and
participation in an international program.

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[144] For example the agency's programs in international science were first justified in terms of supporting the growth of domestic science, thus early programs were included under either one of two program categories: "Dissemination of Scientific Information: international information exchanges;" or "Science Education, international." Thus, early in the Foundation's history, travel programs and exchange programs with the USSR and Eastern Europe were included under the category of international information exchanges, which included also translations and support for obtaining foreign science information. Sometimes the category of foreign science information also included the subcategory of participation in "international science information activities." Different figures have been given to report actual expenditures for a particular program. At times the Foundation has distinguished among participation in meetings, international travel grants, and the USSR-EE program, but not always. Similarly the U.S.-Japan Cooperative program, which like the Soviet and Eastern European program, includes exchange of personnel, was not included under the category of international information exchanges, like the Soviet program but under the support category of "Scientific Research," which included also national and international research programs. Thus annual reports of grants and awards sometimes categorized the USSR-EE program as an international cooperative activity, and other times as international information exchange. In addition, the science education category has been used to report international activities which involved more than education, further compounding difficulties in tracing the history of programs.

[145] "There are numerous reasons for instituting a line item budget for NSF at this time. The sheer size of the NSF budget, together with its expected increases in the future, warrant closer congressional control and overview." U.S., Congress, House, Committee on Science and Astronautics, *Authorizing Appropriations to the National Science Foundation [FY 1972]: Report No. 92-204*, 92d Cong., 1st sess., May 17, 1971, p. 63.

[146] Under this new format, the category of "International Information Exchanges" is no longer used. USSR and Eastern European exchange programs are no longer listed under travel programs, they are subsumed under the category of "Cooperative Science Programs," which includes reporting for all the bilaterals the Foundation administers.

The 1970 experiment resulted in a computer printout. No attempt was made to indicate how much of the funds in the particular grant were used for international activities. Total funds awarded which had international implications amounted to $56,976,783.[147]

It may be fruitful for the Foundation to continue to experiment with this reporting system and to obtain additional information on the exact nature of international implications of a particular award.

ABSENCE OF REQUIREMENTS FOR REPORTS FROM GRANTEES

Fragmentation also poses significant problems in the Foundation's development of internal policies and programs to govern these activities. Consistent with its tradition of insulating scientific support from governmental interference, NSF does not require grantees, with the exception of the travel grants program and some programs administered by OIP, to report on special foreign conditions or considerations impacting on scientific activities carried out under their grant. Grantees with funds tenable abroad, as data in the sections below indicate, typically are not required to meet language qualifications for service in a foreign country; nor do they usually receive a predeparture briefing on the conditions of research and other factors which might relate to their work. Similarly, while abroad, they are not required to maintain contact with representatives of either science or foreign policy agencies. These factors raise questions relating to:

program continuity;

effectiveness of planning programs for specific countries or specific areas of science;

understanding of the requirements for performance of NSF grantees abroad; and

evaluation of whether foreign and international scientific activities effectively meet their scientific and diplomatic objectives.

PROBLEMS RELATING TO NSF OVERSEAS SCIENCE OFFICES

Another important consideration governing the evolution and administration of NSF programs in support of Americans overseas is the NSF science attaché program. In 1961 the Foundation established an overseas office in Tokyo, as part of the American Embassy, in Japan to coordinate NSF aspects of the U.S.-Japan Cooperative Science Program.[148] In fiscal year 1962 the Foundation established overseas offices in Paris and Rio de Janeiro. These were discontinued in 1964.[149] During 1965, the Foundation added a science officer in San Jose, Costa Rica, wholly funded by the Agency for International Development (A.I.D.), to administer and coordinate the AID-funded program for the regional development of the universities of Central America. Currently, NSF sponsors a staff member in Christchurch, New Zealand, from October to March to serve as liaison with the NSF-sponsored research teams engaged in Antarctic research. The Foundation also has a science office in New Delhi to assist in the administration of the U.S.-Indian program for science education and retains the Tokyo office.

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[147] Interviews, Dr. Ernest Sohns and Dr. Walter Thompson, Office of International Programs, NSF, February 1971.

[148] U.S., National Science Foundation, *Annual Report, FY 1961*, 1962.

[149] U.S., National Science Foundation, *Annual Report, FY 1965*, 1966, p. 148.

The NSF science attaché program, according to the Foundation, has promoted the success of NSF cooperative activities. For instance, in 1969 the Foundation reported:

> One factor which has made certain . . . cooperative activities . . . successful is the Foundation liaison staff . . . . As the Foundation's international programs increase in size and scope, and as the needs of this country's scientific community to know about foreign activities grow, the Foundation will need further representation abroad.[150]

Although the Foundation views the overseas offices as essential to the administration of some programs, it has not expanded these for several reasons. One of the most important is NSF's response in 1968 to a recommendation made by the Research and Technical Programs Subcommittee, House Committee on Government Operations, for Federal agencies to cut back on their overseas research and science representation in an effort to assist in solving the balance-of-payments problem.[151] A second reason is the Foundation's apparent adherence to a set of recommendations made jointly by the Federal Council for Science and Technology and the State Department, in December 1964, which recommended that all official overseas science representation should be a part of the science attaché's office in the U.S. embassy.[152]

However, the House Committee on Science and Astronautics, which oversees the NSF authorization, has consistently recommended that the agency strengthen its science attaché program. In 1966 the Committe reported:

> The international nature of science together with the high repute of the NSF abroad . . . suggest the possibility that the Foundation should have a greater role in representing American science within the community of nations.

The Committee recommended that

> The Foundation's responsibilities [in] international science can be served considerably better through the expanded use of science attachés closely identified with the State Department, selected, funded by the Foundation and directly linked to its science information activities.[153]

No action was taken in response to these recommendations. Furthermore, while both the Committee and the Foundation agree that the Department of State science attaché does not serve the functions of NSF representation abroad,[154] they have not reached agreement on a desirable configuration of expanded NSF representation. In its report on the 1971 NSF authorization, the House Committee reported that

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[150] *1970 NSF Authorization : Hearings, Vol. II*, op. cit., p. 571.

[151] The issue of the balance of payments has significantly impacted on several major programs in support of sending abroad American nongovernmental scientists. The Research and Technical Programs Subcommittee, House Committee on Government Operations has looked into this question first in 1966. In 1968 the Committee recommended cuts in overseas science officers: "[In its 1966 report, the Committee observed that] to administer dollar-financed foreign research, the five agencies maintained 15 science offices employing 212 people in eight cities outside the U.S. at a cost in fiscal 1965 of $3,033,000. . . . Federal expenditures for foreign research and overseas science offices are a part of [total dollar drain] and reductions in them can contribute significantly to the intensified Government-wide drive to achieve payments economies." (U.S., Congress, House Committee on Government Operations, *Foreign Research Dollar Drain: 20th Report*, 90th Cong., 2d sess., House Report No. 1578, 1968, pp. 2, 6.

[152] "Appendix XII, Department of State, Office of International Scientific Affairs, statement relating to U.S. agency scientific and technical representation overseas," *In Federal Foreign Research Spending and the Dollar Drain: Hearings*, op. cit., pp. 209–210.

[153] *The National Science Foundation: Its Present and Future* op. cit., p. 95. See also U.S. Congress, House, Committee on Science and Astronautics, *Amending the National Science Foundation Act of 1950 To Make Improvements in the Organization and Operation of the Foundation:* Report No. 1650, 89th Cong., 2d sess., 1966, p. 18.

[154] For example Dr. Arthur Roe, then Head of the Office of International Programs testified in 1969: 'The [Department of State] scientific attachés are now scientific politicians. They are doing an admirable job for their embassies, for their ambassadors, and for the State Department. And they are so busy with chores of a scientific-political nature that they don't really have much time to do the sort of thing that we would want an NSF man to do." (U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *1970 National Science Foundation Authorization: Hearings: vol. I* 91st Cong. 1st sess., 1969, p. 465.

". . . the Science Foundation and its personnel can make a valuable contribution to the existing science attaché program." It recommended that:

> . . . NSF staff members might function as staff members of individual embassies [because] such a program, properly implemented, would further the progress of American science, and also contribute to the technical knowledge and reasoned judgments necessary to an increasing proportion of foreign policy decisions.[155]

The Foundation, on the other hand, apparently seeks establishment of regional NSF science attaché offices, similar to the model of the London branch of the Office of Naval Research.[156]

TERMINATION OF SPECIAL ADVISORY COMMITTEE ON INTERNATIONAL SCIENCE ACTIVITIES

In 1961 the Foundation created a Special Advisory Committee on International Science Activities, composed of industrial and academic scientists, to assist the agency in governing and developing international science programs.[157] Apparently this Committee lapsed in 1965[158] and it is not listed among the Foundation's Advisory Committees in the Agency's 1971 Annual Report.[159]

Programs Administered by the Office of International Programs

The Office of International Programs (OIP) administers programs budgeted under "International Cooperative Scientific Activities." They include: bilateral agreements, some programs for the support of travel to international scientific meetings, the special foreign currency program, and support for the International Institute for Applied Systems Analysis, a new East-West research center in Vienna. All of these programs involve the foreign travel of nongovernmental scientific personnel. For a graphic illustration of OIP activities, see figure 2.

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[155] U.S. Congress, House, Committee on Science and Astronautics, *Authorizing Appropriations to the National Science Foundation: Report No. 91-991*, 91st Cong., 2d sess., April 9, 1970, p. 60.
[156] *1970 NSF Authorization, Hearings, Vol. II*, op. cit., p. 571.
[157] U.S., National Science Foundation, *Annual Report, FY 1971*, 1972, p. 164.
[158] Not listed in NSF *Annual Report, FY 1965.*, op. cit.
[159] NSF, *Annual Report FY 1971*, op. cit., Appendix A.

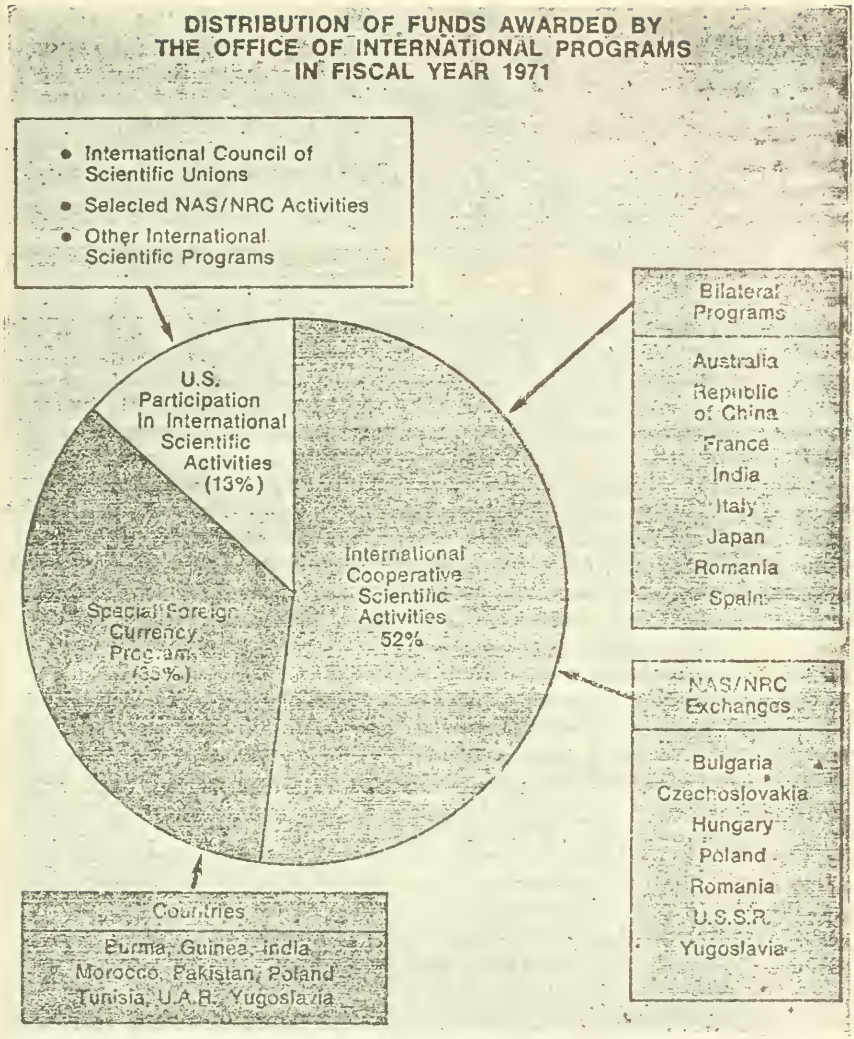

FIGURE 2.

Source: U.S., National Science Foundation, *Annual Report, FY 1971*, 1972, p. 54.

COOPERATIVE SCIENCE PROGRAM

The Office of International Programs (as of 1972) administered the Cooperative Science Program, which involves bilateral agreements with Australia, the Republic of China (Taiwan, France, India, Italy, Japan, Romania, Spain, Iran, Brazil, and Argentina. The Foundation also funds the U.S.-Soviet Eastern European bilateral agreements for scientific cooperation through grants awarded to the National Academy of Sciences—National Research Council, which directly administers the program. In addition, the OIP began in 1972 to administer directly some bilateral programs with countries of Eastern Europe.

Bilateral science agreements consist mainly of activities to exchange personnel. U.S. and foreign scientists exchanged abroad to conduct joint research, attend and chair seminars, attend meetings, and engage in other forms of information exchange. The Foundation's activities as implementing agency generally consist of funding; coordinating funding and programmatic elements contributed by other U.S. Agencies; and, in the case of agreements it directly administers, binational formulation of annual programs and selection and monitoring of U.S. scientific participation.

The purposes of these agreements, according to the Foundation, are to:

> (1) encourage and support U.S. scientific participation in international science programs and activities that promise maximum benefits to the United States from the funds invested; (2) produce new scientific knowledge through the support of U.S. participation in cooperative efforts with foreign scientists; (3) promote shared use of unique scientific facilities in cooperating countries; and (4) strengthen national prestige and contribute to the achievement of U.S. foreign policy objectives.[160]

Bilateral science agreements vary considerably in their origins and scope and in their scientific and diplomatic underpinning. It is generally acknowledged that most of these agreements are politically motivated.[161] Most of them were agreed upon soon after visits between political leaders and were intended to strengthen international relations between States. However, to develop fruitful scientific programs, the agreements provide that details for cooperation are to be worked out in joint scientific/diplomatic negotiations.

The agreements between the United States and the Soviet Union, and the countries of Eastern Europe, administered by the National Academy of Sciences, support scientific exchanges which could not occur in the absence of mutually agreed upon terms of reference. They support exchanges only on a *quid pro quo* basis and thus differ substantially from the less formal agreements the Foundation administers directly. Most NSF-implemented agreements are designed to complement or supplement other previous governmental and nongovernmental scientific exchanges between the signatories. However, political and scientific purposes differ from one agreement to another. For instance, the bilaterals with Japan and France are based on the need to induce Americans to conduct activities in countries where they had been disinclined to go. Australian and Italian bilaterals are designed primarily to assist the foreign scientific community by providing them with a centralized research and development funding source and additional justification for conducting scientific activities in the United States. Bilaterals with the developing countries, those recently signed with Latin American States, and the agreement entered into under provisions of the expanded defense treaty with Spain, are for technical assistance.

The number of bilaterals to which the United States is a signatory has been increasing significantly in recent years. The increasing

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[160] U.S., National Science Foundation, *Justification of Estimates of Appropriations, to the Congress, Fiscal Year 1974*, 1973, p. G-1.

[161] See the sections below on bilaterals administered by the NSF and the NAS. Cf. also the following comment by the State Department: " . . . The newer [bilateral] agreements . . . have been stimulated by political events and for political considerations . . . ". ("U.S. Scientific and Technological Agreements with Other Countries", *International Science Notes*, Published by Bureau of International Scientific and Technological Affairs, Department of State, 25 (September 1970), p. 2.)

frequency of such arrangements and the nature of their origins indicate that they are becoming an important tool of foreign relations.[162]

The Foundation has encountered difficulties in administering some of these agreements. While the agency is charged with implementing the agreements, it neither funds nor plans all activities sanctioned by them. Other Federal Agencies which fund and administer some of these agreements do not consistently report to the Foundation on their activities. The resulting inadequacy of information on such activities tends to constrain development of long-range programs. Most of the bilaterals, reflecting the absence of NSF requirements for reporting on foreign activities, lack continuity and frequently have poorly structured scientific underpinning. While all bilaterals are based on principles of mutuality, some are designed more to support development of foreign science than to contribute to scientific endeavors of mutual benefit. These characteristics undermine the quality of some bilaterals and to discourage scientific participation. As in the case of some of the Fulbright-Hays activities, some of these bilaterals are oriented to technical assistance; others, as evidenced by low rates of U.S. scientific participation, appear to provide inadequate opportunities for fruitful research and development; and most require language qualifications. The Foundation does not appear to have made a comprehensive effort to assess the utility of these arrangements for either science or diplomacy.

The United States-Japan Cooperative Science Program.—The United States-Japan Cooperative Science Program was established in 1961. It is one of the oldest, most cooperative, and best organized of the U.S. bilateral science programs. The Foundation views this program as ". . . eminently successful in promoting the interaction between the U.S. and the Japanese scientific communities."[163] Since the program history illustrates some of the major difficulties the Foundation encounters in planning and administering bilateral science programs, it will be described in detail.

Origin of the United States-Japan cooperative science program.—A joint communique by Japanese Prime Minister Hayato Ikeda and President John F. Kennedy in June 1961 expressed ". . . their concern over the unstable aspects of the situation in Asia and agreed to hold close consultation . . . to discover . . . the ways and means in which stability and well-being might be achieved in that area." They announced the establishment of three joint committees to strengthen the partnership: (1) the Joint United States-Japan Committee on Trade and Economic Affairs, established at the cabinet level ". . . to assist in achieving the objectives of . . . the Treaty of Mutual Cooperation and Security"; (2) the Joint United States-Japan Committee on

[162] The Foundation reported to the Congress, during Fiscal year 1974 authorization hearings, that it served as executive agency for bilateral agreements with 14 countries (Argentina, Australia, Brazil, Bulgaria, Czechoslovakia, the Republic of China, France, Hungary, India, Italy, Japan, Mexico, Romania, and Yugoslavia.) (It serves also as executive agency for cooperative science and technology programs with Spain and Iran.) It also supplies funds for NAS-administered agreements with the academies of the Soviet Union and 6 Eastern European countries. (U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research and Development *1974 National Science Foundation Authorization: Hearings*, 92d Cong. 2d Sess., 1973, pp. 315. 318. The Foundation reported in 1969 that it served as executive agency for agreements with 6 countries: Japan, Italy, Australia, Romania, the Republic of China, and India. It also supported NAS-administered exchanges with the academies of the Soviet Union and 4 Eastern European countries. (*1970 NSF Authorization: Hearings, vol. II*, op. cit., pp. 575–579.) The Foundation also provides primary government support for programs with Israel and the People's Republic of China.

[163] *A General Review of International Cooperation in Science and Space*, op. cit., p. 102.

Expansion of Cultural and Educational Cooperation; and (3) the Joint United States-Japan Committee to Strengthen Scientific Cooperation.[164]

Pursuant to this communique the Secretary of State named a U.S. delegation of scientists and diplomats to the Joint Committee. U.S. members receive their instructions from the State Department and "are responsible to the Department for review and evaluation of scientific programs undertaken for recommendation of new areas of scientific cooperation, and for the provisions of related scientific advice." [165] The Committee held the first of its regular annual meetings in Tokyo in 1961; subsequent meetings have been held alternatively in the United States and Japan.

At the first meeting, the Committee reviewed and analyzed the status of scientific cooperation between the two countries and discussed fields appropriate for closer collaboration. Economic, political, and scientific considerations influenced their deliberations. Apparently, Japanese and American diplomats and scientists decided that a strengthening of cooperation in science would inject a civilian character into a primarily strategic relationship, based on economic and military ties. And like its European allies, Japan wanted to benefit from the scientific and technological eminence of the United States. These motivations are underscored in a statement from the Joint Committee:

> The United States has cooperated extensively with the nations of Europe in matters of mutual interest in the Atlantic area. . . . The Pacific area is no less important and the sharing of Japanese and American scientific knowledge and technical competence is a giant step forward in the understanding and mastery of the environment.[166]

At the first meeting the Joint Committee adopted the following principles:

—all cooperative activities must be of high quality and beneficial to the advancement of science;

—all cooperative efforts should contribute to the promotion of international understanding and peace;

—each cooperative activity should be significant from a scientific point of view as a project for bilateral cooperation;

—all cooperation should be performed on a basis of mutuality and equality;

—at least one qualified scientist from each country . . . should participate in each cooperative project; and

—scientists of each country should take part in their capacities as individuals.[167]

Administration of the program.—At the request of the Secretary of State and the Bureau of the Budget, NSF assumed responsibility on March 20, 1962, for coordination of the scientific interests of the United States in the program. As implementing agency, the Foundation "is responsible for: (1) organization and support of specialized scientific panels to advise the NSF and the Joint Committee, and (2)

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[164] "Joint Communique Issued by the President and Prime Minister Hayato Ikeda of Japan, following discussions held in Washington, D.C., June 20–21, 1961," (Press Secretary, The White House, June 22, 1961).

[165] U.S., National Science Foundation, In-house limited distribution annual report of the Office of International Programs on "United States-Japan Cooperative Science Programs, FY 1963," p. 6.

[166] An annual report is issued on the status of the U.S.-Japan Committee on Scientific Cooperation. It is prepared by the country which hosted the annual meeting. This statement is taken from a report prepared by the Japanese delegation to the Joint Committee and approved by the U.S. delegation: *The United States—Japan Committee on Scientific Cooperation: The First Five Years, 1961–1966*, available from NSF, p.1.

[167] "Status of the U.S.-Japan Cooperative Science Program . . . As of March 31, 1970," p. 5. (Available from OIP, NSF.)

administration, coordination, and financial support of U.S. participation in joint scientific activities."[168] The Office of International Scientific Affairs (now OIP) was given operating functions. This office "effects coordination with other components of the Foundation and with other agencies to ensure that scientific projects undertaken are of the highest quality and of benefit to U.S. science."[169] In September 1961, NSF supplemented its already existing science liaison office in the American Embassy in Tokyo, to assist in administering the U.S. segment of the program. In 1961 the Tokyo office had a staff of three Americans and three Japanese.[170]

Two organizations were named as implementing agencies for Japan: the Japan Society for the Promotion of Science, (JSPS), and the Science and Technology Agency. As the program developed, JSPS, under the auspices of the Ministry of Education, became the primary agency, since its authority encompassed the major portion of the overall program activity.[171]

To assist in promoting joint activities the implementing agencies appointed joint advisory panels of scientists, one panel in each country for each program area. These panels and their constituent subpanels met at irregular intervals as required. In 1962 there were panels concerned with exchange of scholars, exchange of scientific information, earth sciences of the Pacific area, biological sciences, and medical sciences. In 1963, panels were added for education in the sciences and hurricane and typhoon research, and in 1966, a panel on pesticides research.[172]

According to the Joint Committee, "In the early years of the Program, these panels played a vital role in identifying specific projects falling under their general area, informing other scientists about the program and encouraging their participation, and in some cases, serving as the communication link between American and Japanese scientists."[173] In 1968, the panel system was abandoned as the program gathered its own momentum and expanded into mutual areas of interest:

> The panel system was particularly useful to the Japanese implementing agencies since their organizations were unlike that of the NSF, where scientific staffing and review panels already existed. . . . As the program . . . grew and brought more U.S. and Japanese scientists together, new cooperative projects and seminars were generated by the scientists themselves, as the catalytic action of the panels was no longer critical. At its eighth meeting . . . the . . . Committee recommended that . . . cooperation . . . be expanded to include all the natural sciences, broadly interpreted to include mathematical and engineering sciences as well as those areas of the social sciences that can be studied with the methods of natural sciences. Acting on this recommendation NSF and JSPS dissolved the panels.[174]

At the same time, the Committee created eight categories for administration of an expanded program and recommended that the

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[168] "U.S.-Japan Cooperative Science Programs, FY 1963," op. cit., p. 6.

[169] Idem.

[170] Establishment and Operations of the NSF-Tokyo Office, *In NSF, Eleventh Annual Report, 1961*, op. cit., pp. 138–139.

[171] "Status of the U.S.-Japan Cooperative Science Program . . . as of March 31, 1970," op. cit.: p. 6.

[172] *U.S.-Japan Committee on Scientific Cooperative: The First Five Years*, op. cit., pp. 23–29.

[173] "Status of the U.S.-Japan Cooperative Science Program . . . as of March 31, 1970," op. cit., pp. 7–8. The chairmen of some of the early panels were: Exchange of Scholars: Dr. Dael Wolfle, Dr. Detlev W. Bronk, Dr. Allan H. Brown, and Dr. Thomas Fontaine; Exchange of Scientific Information and Materials: Dr. Edwin H. Land, Dr. Emanuel R. Piore, Dr. Henry Birnbaum, Dr. Allen V. Astin; Earth Sciences of the Pacific Area: Dr. Geoffrey Keller, Dr. Roger Revelle, Dr. William W. Rubey, Dr. Thomas O. Jones; Biological Sciences: Dr. Harve J. Carlson, Dr. Ernst Mayr, Dr. G. E. Hilbert, Dr. Caryl Haskins, Dr. Harold J. Coolidge, Dr. David Keck; Medical Sciences: Dr. H. W. Magonu Magoun, Dr. Kenneth Endicott, Dr. Alfred Gellhorn; Education in the Sciences: Dr. Mark H. Ingraham; Hurricane and Typhoon Research: Dr. Francis Reichelderfer; Pesticides Research: Dr. Robert Metcalf. (*U.S.-Japan Committee on Scientific Cooperation: The First Five Years: 1961–1966*, op. cit., pp. 23–9.)

[174] Ibid., p. 8.

implementing agencies appoint liaison members, one from each country for each of the eight categories, to serve as an adviser to the Committee.[175] The current program encompasses visiting scientists, seminars, and cooperative research projects.

Seminars.—Seminars may be held on any academic subject, but topics must "be compatible with the general purposes" of the program. According to NSF, this statement means that topics must be of particular regional interest or when "sufficient competence in the research areas exists in both countries to make a meeting mutually beneficial." [176] A seminar chairman proposes a topic; five to ten participants from each country are nominated. The Foundation encourages all participants to present papers; it also encourages geographic distribution of participants and recommends that younger men be nominated. The cooperative aspects of the program must be followed:

> A proposal should be developed jointly with a Japanese scientist and both countries must approve the topic and participants. A written report or abstract must be submitted to a professional journal: "Thus the widest possible audience will be informed of what is going on in Japan in a specific field." [177]

Table 10 shows the expansion of seminar activities from 2 in 1962 to 24 in 1969:

TABLE 10.—UNITED STATES-JAPAN COOPERATIVE SCIENCE PROGRAM, EXPANSION OF SEMINAR ACTIVITIES 1962–69

	Held in United States	Participants		Held in Japan	Participants		Total participants	
		United States	Japan		United States	Japan	United States	Japan
1962	0	0	0	2	11	58	11	58
1963	1	7	2	6	45	63	52	65
1964	12	93	69	11	97	132	190	201
1965	6	60.	50	22	185	267	245	317
1966	7	71	68	19	147	207	218	275
1967	14	147	120	11	82	142	229	262
1968	13	127	101	10	83	113	210	214
1969	11	118	101	13	101	158	219	259
Total	64	623	511	94	751	1,140	1,374	1,651

Source: "Summary Record, Joint Staff Meeting, United States-Japan Cooperative Science Program," Washington, D.C., September 1969, p. 17.

Visiting scientist program.—The visiting scientist program, usually exclusively funded by OIP, provides grants to U.S. scientists to research or train in a Japanese laboratory. The rationale, according to the Joint Committee, ". . . has been that Japan has long sent large numbers of research scientists to the United States for study, whereas American scientists seldom elected Japan as a site for extended research activity." [178]

A scientist in any field is eligible; a doctoral degree is required; preference is given to young postdoctorates; the visit should last from

[175] Ibid., p. 9. Liaison members, as of March 31, 1970, are: Exchange of scientists: Edward Tatum, The Rockefeller University; Education in the Sciences, Harry Kelly, Provost, North Carolina State University; Scientific and Technical Communication: Allen Astin, Former Director, NBS; Earth, Planetary and Astronomical Sciences: Walter Orr Roberts, President, University Corporation of Atmospheric Research; Biological, Agricultural and Medical Sciences: Stanley Bennett, Professor, University of North Carolina; Mathematical, Physical and Chemical Sciences: Robert E. Marshak, Professor, University of Rochester; Engineering Sciences; John Ide, Division Director for Engineering, NSF; and Special Problems Related to the Natural Sciences: John Wilson, Vice President, The University of Chicago. (Ibid., pp. 103–104.)

[176] U.S., National Science Foundation, "U.S. Japan Cooperative Science Program: Guidelines for Submitting Seminar Proposals," September 17, 1969.

[177] Ibid.

[178] "Status of U.S.-Japan Cooperative Science Program . . . as of March 31, 1970," op. cit., p. 9.

six months to a year. The formal proposal must "fully describe the project, including: description of proposed work, the value of the visit to the investigator and to U.S. science, length and dates of visit, host institution, manner or report, curriculum vitae, and list of publications." A proposal should show that the applicant has been in touch with Japanese scientists with whom he wishes to work; copies of correspondence should be attached. If a U.S. scientist wishes to work in Japan and has no contacts, the OIP will assist him. Both Japan and the United States must approve the proposal. If it is approved "the visiting scientist must write a report on his visit to Japan. In addition to an account of his research activity in Japan, the report should note with whom he worked, institutions visited, travel in Japan and general comments. Publication of research results in an appropriate journal is encouraged." [179]

Only a small number of U.S. scientists have participated in the visiting scientist program since its inception: 87 for both short- and long-term visits during the period 1963–1970. Forty-six of these spent six months or longer working in a Japanese laboratory; the remaining 41 made shorter visits.[180] Although there are some inconsistencies in information reported for each year, available annual data indicate that American enthusiasm for the program may be waning. U.S. visiting scientists sent to Japan, by years from 1963 to 1969, numbered 2, 13, 32, 27, 15, 14, and 18. During fiscal year 1973, 6 Americans went to Japan under the long-term visiting scientist segment of the program, and 6–8 for short-term visits.[181]

Cooperative research.—Although the OIP implements cooperative research activities, under the U.S.-Japan program, it does not usually provide primary support for the American portion of the program. Other NSF divisions and other Government agencies and nongovernmental organizations also fund such research. Proposals for visiting scientists and seminars are accepted in any scientific area; however, proposals for joint research projects were limited initially to the specific scientific areas of earth and atmospheric sciences of the Pacific, animal and plant geography and ecology of the Pacific area, and cancer research. In 1962, the somewhat limited areas of support in biology and medicine were enlarged; hurricane and typhoon research, and education in the sciences were added as new areas. In 1965, research on pesticides was recommended as a new area for cooperative research.[182]

According to NSF, "162 cooperative investigations, with counterpart projects in each country, have been supported in the lifetime of the agreement." Some specific projects have been described:

> Noteworthy scientific advances have been achieved in geophysical studies on earthquakes, volcanoes, and in meterology, in the study of hurricanes, typhoons and cyclones. For example, U.S. and Japanese meterologists were able to track simultaneously the mesocyclone. Data collected by Japanese land-based radar were combined with American meteorological satellite data to produce a . . . synoptic chart of the cyclone. Combined study and surveillance of potentially destructive storms benefit both countries by providing early warning to international shipping and air lanes as well as to populations on land areas situated in the probable path of the storm.[183]

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[179] "Guidelines for Submitting a Proposal to the NSF for a Visiting Scientist Grant," August 1969.

[180] "Summary Record, Joint Staff Meeting, U.S.-Japan Cooperative Science Program, Washington, D.C., September 1969," p. 13. These data are taken from a report prepared to correspond with the Japanese fiscal year which is different from the U.S. fiscal year. NSF figures, based on the U.S. fiscal year, are incomplete; this figure is an adequate representation of the number of U.S. scientists visiting Japan under the program.

[181] *1974 National Science Foundation Authorization: Hearings*, op. cit., p. 315.

[182] "Status of United States-Japan Cooperative Science program . . . as of March 31, 1970," op. cit., p. 7.

[183] *A General Review of International Cooperation in Science and Space*, op. cit., pp. 102–105.

Difficulties with the program.—The current NSF contribution to the program averages approximately $500,000, down from a high of approximately $700,000 when the program first started. See Table 11, which also illustrates lack of consistency in reporting on the program. According to the Foundation, "some problems have arisen in the administration of the . . . program from language difficulties, different fiscal years, and different internal organizations for support of science. There has also been opposition to the program in Japan by some scientists for political rather than scientific reasons." [184] The Joint Committee has consistently criticized the low rate of American participation:

> At each annual meeting the . . . Committee has urged that more American scholars and students, especially young scientists and engineers, should participate . . ., [especially] for meetings and . . . the visiting scientists [program.] [185]

The Committee also notes that the program has suffered because American scholars who come to Japan generally want to study the social sciences or humanities, topics not of special benefit or interest to Japanese science:

[184] *1970 NSF authorization, Hearings*, op., cit., p. 575.
[185] *The United States-Japan Committee on Scientific Cooperation: The First Five Years, 1961–1966*, op. cit., p. 7.

TABLE 11.—UNITED STATES-JAPAN COOPERATIVE SCIENCE PROGRAM—FUNDING AND ACTIVITIES UNDER SEGMENTS OF THE PROGRAM

Fiscal year	Total U.S. funds [1]	Total NSF grant obligations for the program	Total Japanese funding	NSF grants for cooperative research	Number of projects	NSF support for long-term grants to Japan	Number	Number of meetings held in United States or Japan	Number of scientists
1962	25,000							15	80 Japan.
1963	717,460	717,460		657,460	(11)				80 United States.
1964	708,000	708,000		448,000	(22)			17	120 Japan. 101 United States.
1965	722,332	725,245		622,595	(19)	102,650	(10)	26	233 Japan. 220 United States.
1966	708,846	701,700		413,150	(23)	88,550 [4] 200,000	(8)	30	
1967	503,024	505,146	530,800	298,500	(16)	39,300 [4] 150,100	(4)	9	25.
1968	449,279	507,129	542,333	325,716	(18)	62,327	(8)	30	318 Japan. 266 United States.
1969	[2] 500,000	497,368	541,689	219,100	(10)	147,268	(14)	27	270 Japan. 240 United States.
1970	[3] 500,000	421,315	555,555	127,565	(9)	138,450	(13)	26	206 Japan. 224 United States.

[1] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, "1970 National Science Foundation Authorization: Hearings, vol. II," 91st Cong., 1st sess., 1969, p. 572.

[2] Estimate.

[3] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, "1970 National Science Foundation Authorization: Hearings, vol. I," 91st Cong., 1st sess., 1969, p. 453.

[4] Data illustrate discrepancies in reports.

Source: All data except noted exceptions taken from reports on the program.

The majority of Japanese faculty members coming to the United States are interested in the physical, biological, or engineering sciences, though the majority of Japanese graduate and undergraduate students in the United States are studying . . . the humanities or social sciences . . . . More than half of the American faculty members in Japan are engaged in the humanities and social sciences, with further emphasis on Japanese language and literature. During the period 1957–1966, the disparity has grown; the number of American scientists going to Japan has barely doubled, while the increase of Japanese scientists coming to the United States has been nearly tenfold.[186]

Summing up the results of the program in 1969 the Foundation reports:

As originally conceived, this program was to be a catalyst to increase cooperation between scientists of the two countries, and when things were well established it was planned that the formal program would disappear. Now, however, the foreign affairs agencies of both countries wish it continued for political as well as scientific reasons.[187]

United States-Italy Cooperative Program in Science.—The Japanese program was the first of a series of bilaterals in which the NSF was committed to administer various kinds of scientific cooperation with individual nations. The other programs described below are all different in origin, purpose, scope, and administration and accordingly warrant separate brief treatment.

The United States-Italy Cooperative Program in Science was initiated on June 19, 1967.[188] It was the second bilateral science agreement for which the Foundation became the implementing agency. The program resulted from informal initiatives made by the National Research Council of Italy, the Consiglio Nazionale delle Ricerche, to NSF and subsequent consultations on diplomatic and scientific levels.[189] The agreement provides for cooperation between mission-oriented as well as basic science support agencies; each government bears its own costs of the program; its original duration was for five years, subject to annual program planning. The agreement provides for cooperative research, seminars, and exchange of scientists.[190] It was renewed in 1972 for three years.

According to an NSF official formerly in charge of the U.S.-Italy Cooperative Science Program, Italy did not have a mechanism nor special funds to support Italian-American cooperative research before inception of this agreement. One of its purposes, similar to that of the U.S.-Australian agreements, was to institutionalize a way to encourage Italian and American scientists to work together.[191] Another was to encourage the allocation of funds by the Italian Government for such cooperation.

Information is scarce about the number, subjects, and activities of the scientific exchanges which have been carried out under this program. Exchanges usually take place only in connection with cooperative research projects, the majority of which are funded by other agencies. While the NSF must approve projects included under

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[186] Ibid., p. 7.

[187] *1970 NSF Authorization: Hearings, Vol II.* op. cit., p. 575.

[188] Historical data taken from: Letter, Secretary of State Rusk to Dr. Haworth, Director, NSF, June 11, 1967; Letter Wilson, OIP to Rusk, June 13, 1967; and "U.S. Italy Cooperative-Science Program, program announcement, 1970," NSF 70–15. The agreement is formalized as TIAS 6280, 18 UST 1268.

[189] Memorandum to members of the international committee of the Federal Council for Science and Technology, "Subject: Executive Agency Guidelines for U.S.-Italy Program," by Robert Fleischer, Acting head, Office of International Science Activity, April 5, 1967, including "Guidelines for the Executive Agency for the U.S.-Italy program."

[190] "United States-Italy Cooperative Science Program," op. cit., NSF 70-15.

[191] Interview with Dr. Raphael Ronkin, February 26, 1971.

the program, the Foundation does not require reports from scientists supported by other agencies who might have traveled to Italy in connection with their research.[192]

Available NSF funding history indicates that the Foundation's role as well as the program itself may be waning. For instance in fiscal year 1967, the year the program began, the Foundation awarded grants totaling $551,000. During fiscal year 1971, the Foundation contributed $8,500 for one award for a mathematics seminar in Italy. See Table 12.

In describing the progress of the program in 1969, the Foundation reported:

> The program is progressing smoothly, the difficulties during the first year being such minor administrative ones as developing effective communication between the Foundation and CNR and making certain that grants issued by both agencies had roughly the same starting dates and durations. So far, at the request of the Italians, only cooperative research projects are being considered under the program. They prefer to postpone consideration of visiting scientists and scientific meetings until a later date.[193]

TABLE 12.—UNITED STATES-ITALY COOPERATIVE PROGRAM IN SCIENCE

Fiscal year	Number of projects	Funds granted by NSF	Other U.S. funds	Total U.S. contribution	Total Italian contribution
1967 [1]	2	$551,000	(2)	(2)	(2)
1968 [3]	16	174,415	[4] $677,808 (752,000)	$852,223	$883,000
1969 [5]	(2)	436,233	306,265	742,498	(2)
1970 [6]	(2)	35,000 (645,648)	(2)	(2)	498,544
1971 [7]	(2)	8,500	(2)	(2)	(2)

[1] 1967 data from: U.S., Department of Health, Education, and Welfare, Office of Education, Institute of International Studies, "Inventory of Federal Programs Involving Educational Activities Concerned With Improving International Understanding and Cooperation: An Interagency Survey Conducted for the Congress of the United States," June 1969, p. 359.
[2] Not available.
[3] 1968 data from: U.S., National Science Foundation, Office of International Programs "United States-Italy Cooperative Program in Science," internal report, 1968, pp. 5–6. Figures in parentheses from: "Fiscal Year 1970 National Science Foundation Authorization: Hearings," op. cit., p. 575.
[4] AEC, $152,500; Agriculture, $50,000; DOD, $204,660; NBS, $199,148; Ohio State, $10,000; University of California, $61,500.
[5] 1969 data from: U.S. National Science Foundation, "Annual Report, Fiscal Year 1969," 1970, p. 105.
[6] 1970 data from: U.S. National Science Foundation, "Annual Report, Fiscal Year 1970," 1971, p. 94.
[7] 1971 data from: U.S. National Science Foundation, "Annual Report, Fiscal Year 1971", 1972, p. 55.

U.S.-India Program for the Exchange of Scientists and Engineers.—One of the major purposes of the program for U.S.-India Exchange of Scientists and Engineers is to "stimulate economic development through association with U.S. experts."[194] U.S. scientists and engineers however, have not shown a high level of interest in the program.

In 1966, the acting head of the Office of International Scientific and Technological Affairs, Department of State, requested the Foundation to support, implement, and manage the program. After scientists and diplomats in both countries had agreed on the terms of reference, a formal agreement for cooperation was concluded in New Delhi on February 14, 1967. The Foundation assumed administrative and support functions of the program March 10, 1967; responsibility was charged to the Office of International Science Activities.[195]

The agreement, which is reviewed annually, provides for short exchange visits of two weeks to several months. The sending country

[192] *1970 National Science Foundation Authorization: Hearings, Vol. II*, op. cit., p. 575.
[193] *1970 National Science Foundation Authorization: Hearings, Vol. II*, op. cit., p. 575.
[194] "U.S. Scientific and Technological Agreements with Other Countries." *International Science Note* Department of State (September 25, 1970), p. 5.
[195] TIAS 6299, 18 UST, 1391, 1967.

pays the external travel costs and the host country pays subsistence expenses. The National Council of Scientific and Industrial Research of India (CSIR) is the foreign counterpart organization. Both the NSF and the CSIR approve selection of individual grantees and their programs. Exchanges of senior level scientists and engineers are emphasized. The original agreement did not specify particular subjects for exchange. Subsequent activities, at least for Americans, have included mathematics; physical, medical, biological, engineering, and social sciences; history and philosophy of science; and interdisciplinary areas, such as geochemistry, meteorology, and oceanography.[196]

The Foundation announces the program to academic departments and to a selected mailing list of potentially interested individuals.[197] U.S. applicants are evaluated on age, occupation, publications, specialized subject proficiency, academic degrees, experience, language proficiency other than English, nonprofessional interests if relevant, previous visits to India, duration of proposed visit, purpose and program of visit, and statement of scientific and economic importance to both countries of their visit to India.[198]

The Foundation does not require that American applicants be evaluated on their ability to adapt to a foreign culture; and provides no special training or orientation for participants. After his visit, the American scientist or engineer is required to submit a report to the Foundation describing his scientific activities in India and his general reaction. The Foundation is developing plans to exchange reports with India in an effort to improve the program.

The bilateral agreement provides for an annual maximum of exchanges totaling 800 man-days each way. Indian scientists and engineers have participated extensively in the program: in the fiscal years 1968, 1969, and 1970, visits of Indians to the U.S. totalled 186, 948, and 913 man-days respectively. Americans have not responded equally. Corresponding figures for the three years were 67, 217, and 369. (For details see Table 13). According to the Department of State, the program is beneficial primarily to Indian scientists and engineers who come to this country to "examine industrial methods and processes." [199]

U.S.-Australia Agreement for Scientific and Technical Cooperation.—The United States-Australia Agreement for Scientific and Technical Cooperation is similar to the U.S.-Italy Agreement: cooperative research is emphasized; each government bears the cost of its own participation, and no funds are allocated specifically for the program. The origins of the program date to May 1968 when President Lyndon B. Johnson, visiting Australia, promised Prime Minister Gorton that a U.S. scientific delegation would visit Australia to discuss and expand the existing cooperation between the American and Australian civilian scientific communities. In October of that year, an American delegation visited Australia led by Dr. Donald Hornig, the Pres dent's science adviser, and Dr. Philip Handler, Chairman of the National Science Board. After eight days of discussion the officials signed a formal agreement for scientific cooperation.[200]

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[196] U.S. National Science Foundation, "Exchange of Scientists and Engineers: U.S./India," program announcement, non-dated; "India-U.S. exchange of scientists: terms of reference;" and NSF, data sheet on "U.S.-India Exchange of Scientists and Engineers," prepared by OIP, January 15, 1971.

[197] Interview with Dr. Raphael Ronkin, OIP, February 26, 1971.

[198] "Exchange of Scientists and Engineers: U.S./India," program brochure, op. cit.

[199] "U.S. Scientific and Technological Agreements with Other Countries," op. cit., p. 4.

[200] "U.S. Australia Agreement for Scientific and Technical Cooperation," Oct. 16, 1968, TIAS 6589, 19 UST 6714.

TABLE 13.—UNITED STATES-INDIA EXCHANGES OF SCIENTISTS AND ENGINEERS PROGRAM [1]

Indians to United States				Americans to India					
Fiscal year	Total number	Total cost to NSF (dollars)	Total man-days	Total number	Total cost to NSF (dollars) (travel only)	Total man-days	Subject	Subtotal Americans: Cost (dollars)	Subtotal Americans: Man-days
1968	5	6,534	186	2	2,650	67	Physiology	1,300	27
							Physiology	1,350	40
1969	17	30,178	948	7	7,781 [2] (9,104)	217	Coastal dynamics	(3)	23
							Aerodynamics	1,330	60
							Physics	910	22
							Physics	1,524	postponed
							Aerodynamics	1,275	30
							Coal research	1,386	30
							Civil engineering	1,356	52
1970	12	29,185	913	11	14,791	369	Physics	1,403	15
							Physics	1,421	postponed
							Pharmacology	1,321	postponed
							Aerospace	1,301	120
							Aerospace	1,450	32
							Statistics	1,301	60
							Aerodynamics	1,275	27
							Coal research	1,386	24
							Hematology	1,290	20
							Civil engineering	1,356	38
							Industrial engineering	1,287	33
1971 [4]	8				[5] 22,565				

[1] Fiscal year 1968 to 1970 data supplied by Office of International Programs, National Science Foundation; Fiscal year 1971 data from NSF, "Annual Report, Fiscal Year 1971," op. cit., p. 55.
[2] The figure from NSF, "Annual Report, Fiscal Year 1969," op. cit., p. 106.
[3] Federal employees.
[4] Two grants extended to fiscal year 1971.
[5] For both Indians and Americans.

The purposes of both Governments were:

(a) to seek increased opportunities for scientists and engineers to engage in joint research projects and exchange of scientific and technical information;

(b) to facilitate long and short-term visits of scholars for the purpose of research, special studies, and lectures;

(c) to promote direct contact between scientific and technical institutions and workers;

(d) to facilitate attendance at scientific and technical conferences; and

(e) to exchange planning information in fields where programs of mutual interest are being pursued in both countries.[201]

The NSF was designated the U.S. executive agency; its Australian counterpart is the Department of Education and Science. Each of these Agencies jointly approves and coordinates the activities of any of its national agencies participating in the program. The duration of the agreement is five years; the executive agency in each country reviews the pace of progress "from time to time." Current memos of understanding provide for programs treating: "rangelands, chemical identification and analysis of dangerous drugs, and biomedical sciences." [202]

[201] "Joint Communique issued by Hon. Malcolm Fraser, Minister for Education and Science of the Commonwealth of Australia and Dr. Donald F. Hornig, Special Assistant to the President of the U.S. for Science and Technology," following discussions held in Australia, October 9-16, 1968.
[202] U.S., National Science Foundation, Office of International Programs. "Program Announcement on U.S.-Australia Cooperative Science Program," October 1970, 1 p.

This agreement, like other bilaterals, is designed to supplement and strengthen existing scientific and technological cooperation between the two countries. Funds for the support of the activities of American scientists may come from any U.S. source, including the regular research support programs of the NSF. The OIP approves American proposals for cooperative research.

According to the NSF program officer, the two countries require the preparation of a joint annual report, but the Foundation keeps no detailed account of activities conducted under the program. The preparation of a report is handicapped because:

(1) there are no specific funds allotted by NSF for program activities;

(2) other Federal agencies fund activities under the program;

(3) some cooperative U.S.-Australian activities which began before the agreement are now included in it, but others are not; and

(4) scientists sponsored by the program are not required to report to the NSF on their activities.[203]

One of the major objectives of the U.S.-Australia cooperative program is to benefit Australian science. Usually the science budgets of countries with which the United States has science agreements are smaller than U.S. science budgets. In addition, funding mechanisms tend to be less well established. Before inception of the U.S.-Australian program, Australia did not have a mechanism to fund the international travel of its scientists; this agreement helped institutionalize one.[204] Commenting on the effectiveness of the U.S.-Australia program, the State Department observes: "Thus far, except for some collaborative research in drug detection, not much has developed, the principal problem being one of funding."[205]

NSF-sponsored activities, as of 1 December 1970, were: (1) Australians working in the United States: thunderstorms, 12 months; forest fire research, 2 months; structure of the lower atmosphere, 3 months; rangelands, 1 month; photosynthesis, 1 month; biomedical research, 2 visits of 1 month each; and (2) Americans working in Australia: scientific ballooning, 2 months.[206] In fiscal year 1971 the Foundation awarded one grant for the program: "$4,000 for a joint seminar on photosynthesis, held in Australia."[207]

U.S.-Republic of China (Taiwan) Cooperative Science Program.—The U.S.-Republic of China Cooperative Science Program, which began in 1969, is designed, like the exchange with India, to stimulate economic development through association with U.S. experts.[208] It is "broad and non-specific, with no large administrative overhead";[209] the Taiwan Government contributes the bulk of the funding.

The origin of scientific cooperation between the United States and Taiwan governments dates back to 1964, when a nongovernmental Sino-American Science Cooperation Committee was established jointly by the Academia Sinica in Taipei and the U.S. National Academy of

[203] Interview, Dr. Raphael Ronkin, February 26, 1971.
[204] Idem.
[205] "U.S. Scientific and Technological Agreements with Other Countries," op. cit.
[206] U.S. National Science Foundation, "U.S.-Australia Agreement for Scientific and Technical Cooperation: Brief Résumé of Activities," December 1, 1970, supplied by Raphael Ronkin, Program Officer, U.S.-Australia Agreement for Scientific and Technical Cooperation, OIP, NSF.
[207] NSF, *Annual Report, FY 1971*, op. cit, p. 55.
[208] "U.S. Scientific and Technological Agreements with Other Countries," op. cit., p. 5.
[209] Taken from Louis Levin, Executive Associate Director, NSF, Memo on "Conversation on October 18, 1968, with Dr. Bruce Billings, U.S. Representative in Taiwan and John Lacey, SCI, Department of State, about U.S.-Taiwan Cooperative Agreement," October 22, 1968, supplied by NSF.

Sciences. Chinese initiatives to establish a governmental cooperative science program were made first in 1966 during a visit of Vice President-Premier C. K. Yen of China to the United States. Discussions continued in Taiwan in 1967 during the visit of the President's Science Adviser. In 1968, the Department of State appointed a Special Assistant for Science and Technology at the U.S. Embassy in Taiwan. Shortly thereafter, the Office of International Scientific and Technological Affairs and the "China Desk," Department of State, began to negotiate with both the Taiwanese Government and the NSF on arrangements for a formal cooperative science agreement.[210] An "Intergovernmental agreement effected by an exchange of notes," formalized the program; it was signed January 23, 1969, in Taipei by the U.S. Ambassador to Taiwan and the Minister of Foreign Affairs of the Republic of China.[211] NSF formally accepted responsibility for the program March 13, 1969, after it received assurance that the Chinese Government would help fund the program and that the Foundation's own financial responsibilities would be limited.[212] The National Science Council in Taiwan was named the foreign counterpart organization. The agreement, whose duration is open-ended, provides that each of the executive agencies coordinates and jointly approves projects carried out. While the program is aimed primarily at academic scientists, governmental and industrial projects as well as those of non-profit institutions are eligible. Each Government was given the responsibility for supporting the activities of its own scientists; a provision was included for jointly supported cooperative projects. Cooperation includes all fields of science and technology, including the social sciences.

Four types of activities may be considered for U.S. scientists in the program:

(1) short term visits of U.S. scientists to lecture, consult and participate in symposia, and the like;

(2) long-term visits of U.S. scientists to spend from six months to one year instructing at the graduate level and conducting collaborative research in the natural sciences;

(3) cooperative research in any area of science; and

(4) seminars on any scientific subject including science education.[213]

The program began in the fiscal year 1970. It is small in terms both of funding and scope of activities. Grants awarded by the NSF in 1970 amounted to $105,140; and in 1971 to $79,200. The Republic of China has contributed $250,000 for the two-year period, 1970–1971.

Under the long-term exchange of scientists portion of the program, four Americans went to the Republic of China during the fiscal year

[210] From data sheet on "U.S. Republic of China Cooperative Science Program," prepared by NSF, January 15, 1971; Max Hellmann, Office of International Science Activities, NSF, "Diary Note: Subject: U.S.-Republic of China Cooperative Agreement," August 29, 1968; Levin, "Conversation . . . October 18, 1968, op. cit., and Internal memo, NSF from L. J. Haworth, Director, to Arthur Roe, Head, OISA, December 27, 1968 (discussing proposed bilateral agreement).

[211] TIAS 6639, 20 UST 374.

[212] Levin, "Conversation, October 18, 1968"; op. cit.; Letter Secretary Rogers to Dr. Haworth, February 21, 1969; and Letter, Dr. Haworth to Secretary Rogers, March 13, 1969. All documents supplied by NSF.

[213] Details may be found in: U.S. National Science Foundation, "United States-Republic of China Cooperative Science Program" program brochure, NSF 69-35; U.S. National Science Foundation, "U.S.-China Cooperative Science Program, Guidelines for Short-term Visiting Scientists," October 20, 1969; U.S. National Science Foundation,"U.S.-China Cooperative Science Program, Guidelines for Submitting Long-term Visiting Scientists Proposals," October 29, 1969; U.S. National Science Foundation, "U.S. Republic of China Cooperative Science Program. Cooperative Research," (guidelines), no date; and U.S. National Science Foundation, "U.S.-China Cooperative Science Program, Guidelines for Submitting Seminar Proposals," November 1969.

1970 for a total of 65 months. Their activities were in botany, mathematics, marine geology, and engineering. Three of the four Americans sent were of Chinese descent. In the fiscal year 1970, 25 Americans were sent to China under the short-term visit segment of the program. In the fiscal year 1971 the Foundation supported a total of five Americans to research and teach in Taiwan.[214] Topics were engineering, mathematics, and biochemistry. "Significant results" reported by the NSF include: "the artificial propagation of an important food fish, increased understanding of the 'bukane' disease of rice, and the discovery of new information on schistosomiasis. . . ." [215]

United States-France Agreement on the Exchange of Scientists.—According to Robert F. Hull, Office of International Programs, NSF, the United States-French Agreement on the Exchange of Scientists, reached on July 20, 1970, was motivated primarily to satisfy French scientists' desires to rectify certain imbalances in the pattern of scientific exchange between the two countries. American scientists frequently elected to research and study in French laboratories and universities, but usually only in certain disciplines, and near Paris. French scientists wanted to see a broadening of U.S. participation, to emphasize especially mathematics, physics, chemistry and engineering, and tenures in laboratories and universities located in regions other than Paris. In addition, the French scientific community wanted to develop a program which would encourage more French scientists to study and research in the United States.[216]

The bilateral program originated during the Spring, 1968, when Dr. Maurice Levy, the newly-appointed French scientific attaché to the United States, began discussions with the NSF to establish an agreement for the exchange of scientists between the Foundation and the National Center for Scientific Research (CNRS).[217] CNRS, similar to the NSF, is a French Government agency dealing with developing, coordinating, funding, and operating science policy functions. Negotiations continued when the President's Science Adviser met in Paris in September 1969, with the French Minister for Industrial and Scientific Development. The Minister visited the United States two months later. During this visit the officials announced appointment of coordinators for the program: for France, the Director General for Cultural and Scientific Relations and Technical Assistance at the Foreign Ministry, and the Delegate-General for Scientific and Technological Research; and for the United States, the Director of the National Bureau of Standards.

During the September meeting, the representatives of both countries agreed to limit the program to an exchange of young postdoctoral scientists between the NSF and the CNRS. A draft memorandum embodying this agreement was prepared by the NSF in the Fall of 1969 and transmitted to the French Scientific Mission. Discussion continued, culminating in a memorandum signed on July 20, 1970, by

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[214] Data on size and program funding from: U.S. National Science Foundation, "(Data Sheets) on U.S.-Republic of China Cooperative Science Program, FY 1970," supplied by NSF; U.S. National Science Foundation, *Annual Report, FY 1970*, 1971; *Annual Report, FY 1971*, op. cit., p. 55; and NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit.

[215] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., p. H-2.

[216] Interview, Robert F. Hull, Office of International Programs, NSF, February 26, 1971. The NSF reports that the agreement was concluded "at the request of the French National Center for Scientific Research . . . (with the approval of the Department of State) . . . ." (*1974 National Science Foundation Authorization : Hearings*, op. cit., p. 356.)

[217] Background material taken from: Robert F. Hull, "Memo on U.S.-France" *In* "Contribution to OIP Annual Report," FY 1970 (III.A.5), July 10, 1970, internal Memo, NSF, 3 pp.

the Director of the National Science Foundation, for the United States, and Hubert Curien director-general of the National Center for Scientific Research for France. [218]

The agreement provided for a 3-year program which could be renewed. Awards are made for study or work only in the mathematical, physical, chemical and engineering sciences, and in the biological sciences exclusive of medicine. [219] Visits typically last between five and fifteen months. Exchange scientists and dependents receive travel funds; the host institution provides a stipend for living and domestic travel expenses. The NSF also furnishes institutional allowances to the U.S. host institution for French scientists. [220]

The 1970 agreement provided for support by each agency totaling the U.S. dollar equivalent of $50,000 for the academic year 1971–1972. In fiscal year 1971, the NSF awarded grants to 11 French scientists for study in the United States. Twelve American scientists received awards for study in France. Total funds obligated by NSF in 1971 amounted to $113,647.[221] Eight American scientists were supported during fiscal year 1972, as were eight French scientists.[222]

Scientific Exchanges With Romania.— [223] A delegation from Romania, headed by Alexandru Birladeanu, Deputy Chairman of the Council of Ministers of the Socialist Republic of Romania and Chairman of the Romanian National Council of Scientific Research, came to the United States on June 18, 1968, at the invitation of Dr. Donald F. Hornig, President Johnson's science adviser. A joint statement [224] issued by Mr. Birladeanu and Dr. Hornig at the conclusion of the three-week visit referred to the exchange program which had been in effect between the two countries since 1960 and expressed an intention to expand mutually beneficial projects of scientific cooperation.

In particular, both Governments sought opportunities for scientists and engineers to engage jointly in research, scientific and technical information exchange, and mutual fellowship programs. Each country agreed to encourage long- and short-term visits of scholars and specialists to each country for research, study, lectures, and attendance at scientific and technical conferences. Specific cooperative areas mentioned included: transportation, coal research, preservation of wildlife, physical standards, and the peaceful uses of atomic energy. Each government also agreed to designate a "science officer" to its Embassy in the other's capital. The formal agreement for scientific cooperation was included as part of the cultural exchange agreement signed by the two countries on November 28, 1968.[225]

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[218] "Memorandum of Arrangement for the Exchange of Scientists between the National Science Foundation of the U.S. and the National Center for Scientific Research of France," July 20, 1970.

[219] Social sciences will be added during the fiscal year 1974 program. (*1974 NSF Authorization: Hearings*, op. cit. p. 356.)

[220] Idem, and "Announcing the 1971-72 Program for French-U.S. Exchange of Scientists between the NSF and the CNRS," program announcement by National Science Foundation, E-70-G-17.

[221] NSF, *Annual Report, FY 1971*, op. cit., p. 55.

[222] U.S. National Science Foundation, *Annual Report, FY 1972*, 1973, p. 53.

[223] Similar agreements were later entered into with Hungary, Czechoslovakia, and Bulgaria. The NSF is implementing agency for these agreements under the Expanded East Europe Cooperative Science Program. There is no indication in NSF budget materials that foreign currency funds are used for these activities, although the Foundation does have a separate Special Foreign Currency Program which provides for funding of scientific research with Poland and Yugoslavia. These NSF directly-administered scientific exchange programs are entirely separate from the NAS administered interacademy programs with the Eastern European countries, which are also funded by the Foundation, using U.S. dollar funds. See the next chapter of this study.

[224] "Romanian scientific delegation visits the United States." Office of Science and Technology press release, July 8, 1968, and text of the joint statement, *U.S. Department of State Bulletin*, 59 (August 12, 1969 pp. 178–179.

[225] U.S., National Science Foundation, *Annual Report, FY 1969*, 1970, p. 104.

This formal exchange supplements the U.S.-Romanian program for the exchange of scientists administered by the National Academy of Sciences. Under terms of the agreement, the Office of International Programs was named implementing agency for the United States, and the Romanian National Council for Scientific Research the implementing agency for Romania. Guidelines for content and scope were worked out by the two agencies; the formal exchange program began in fiscal year 1970.

The program has not been very active. During fiscal year 1970, the Foundation supported the visits of two Americans to Romania, at a cost of $35,000. During the same period seven Romanian scientists spent a total of 48 man-months travelling and studying in the United States.[226]

A joint agreement to broaden exchanges under the program was signed on November 27, 1970, following the visits to Romania of President Nixon and Dr. Lee DuBridge, the President's Science Adviser. The new agreement also provided for the two nations to explore the possibility of developing joint research projects in a variety of fields.[227]

In 1973 the Foundation reported to the Congress on activities under the agreement:

> In the last two fiscal years, 28 Romanians have visited the United States and nine Americans have traveled to Romania. The main interest on the Romanian side has been in the applied sciences, engineering, and such specialized technological fields as fuel technology, food processing, and textile manufacturing. The program affords an opportunity for Romanian scientists to work in U.S. laboratories on problems of interest to researchers in both countries. U.S. scientists, who have visited Romania under this program, have worked with their Romanian colleagues on such subjects as internal combustion pollutants, coordination chemistry, polymers, nonlinear integral equations, and fluid mechanics.[228]

United States-Spain Agreement of Friendship and Cooperation.—Authority for the United States to maintain and operate military installations in Spain, sanctioned by the Defense Agreement of 1953 and extensions thereof, was due to expire in late 1970. Military and political considerations on both sides of the Atlantic led the United States to seek continued use of military facilities in Spain and continued assistance to Spain "in strengthening its own defense system." Economic and political pressures within Spain and the United States motivated expansion of the military agreement into other cooperative areas including technical assistance. A new agreement providing for both military and nonmilitary cooperation was signed August 6, 1970.[229]

This agreement provides for scientific and technical cooperation; however, U.S. technical assistance to Spain, rather than bilateral cooperation, is stressed. Specifically, the agreement provides for:

> [Continuation and expansion of exchanges under the Fulbright program, involving exchanges of] teachers, research experts, scientists, scholars and students [in] all branches of learning, especially natural and applied sciences, economics, and the language and culture of the two countries;[230]
>
> [U.S. technical assistance to Spain, subject to Congressional appropriations of funds, to expand] the Spanish educational system and Spanish scientific and

[226] NSF, *Annual Report, FY 1970*, op. cit. pp. 94–95.

[227] Department of State Press Release 327, November 27, 1970, including text of the program of exchanges in Educational, Scientific, Cultural and other fields for 1971 and 1972.

[228] *1974 NSF Authorization: Hearings*, op. cit., p. 316.

[229] "United States-Spain Sign Agreement of Friendship and Cooperation," statement on Joint Communique signed August 6, 1970, *Department of State Bulletin* (August 31, 1970), p. 237.

[230] Articles 4 and 5.

technical development [to provide for] advanced training of professors and other teaching personnel, particularly in the scientific disciplines [and] documents, equipment, and materials for research laboratories and libraries. . . ; [231]

[A special program on scientific and technical cooperation involving]: A. activities of major interest and yield; B. preparation of plans for collaboration between research centers of the two countries; C. [programs for sending to Spain] American professors and researchers of established reputation to cooperate in the advanced training of scientific and technological researchers; and D. appropriate administrative channels to administer programs.[232]

Four areas of scientific and technical cooperation are emphasized: civilian uses of atomic energy, space exploration, marine sciences, and medical and biological sciences. Separate chapters provide for cooperation also in environmental and urban development and assistance in the development of Spanish agricultural programs.[233]

This agreement became effective September 26, 1970, and will remain in force for five years, when it will be subject to renewal.[234]

Agreements and activities subsequent to signing indicate that cooperation in science and technology, initially, will be modest. The agreement did not define the terms of financial support for civilian activities authorized by the program. However, it did specify that funding for nonmilitary program elements, which include areas other than science and technology, will be subject to annual Congressional approval. The United States committed a maximum of $3 million to support all civilian program elements in fiscal year 1971.[235]

Activities to implement the technical assistance provisions of the agreement began in the summer of 1970 when "U.S. and Spanish officials . . . visited institutions to explore the most effective possibilities for mutual research and scientific exchange." [236] On August 20, 1970 discussions on implementation of the science and technology aspects of the agreement were held by the Bureau of International Scientific and Technological Affairs, Department of State (the agency originally in charge of writing the terms of agreement on science and technology), and the NSF Office of National and International Programs.[237] Assistant Secretary of State John Richardson Jr. was named coordinator for use of the $3 million supplied to the Department of State for nonmilitary cooperation.

NSF was asked to serve as executive agency for science and technology,[238] and to assist the Department of State in developing program guidelines. FY 1971 activities were limited to program development and no funds were obligated.[239] In reporting to the Congress early in 1972 on this agreement, the Foundation said only that " . . . funds for the continuation of the program will be transferred to the Foundation in fiscal year 1973." [240]

Scientific Cooperation With Brazil and Other Latin American Countries.—The United States and Brazil concluded an Agreement on Scientific Cooperation on December 1, 1971. The aim of the program, according to the State Department, would be to "intensify

[231] Article 6.
[232] Chapter III, Scientific and Technical Cooperation, Articles 9, 10, 11, and 12.
[233] Chapter IV, articles 14, 15, 16 and Chapter V, articles 17, 18, 19, and 20.
[234] Article 28.
[235] Letter from Secretary of State William P. Rogers to Gregorio Lopez Bravo, Minister of Foreign Affairs of Spain, August 6, 1970.
[236] "United States-Spanish Science Cooperation," *International Science Notes* (September 1970), p. 6.
[237] "Bilateral Science Programs, U.S.-Spain," material prepared by Office of International Programs, NSF, January 15, 1971.
[238] Letter from U. Alexis Johnson, Acting Secretary, Department of State to William D. McElroy, Director NSF, November 27, 1970.
[239] NSF, *Annual Report, FY 1971*, op. cit., p. 55.
[240] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., p. H-2.

the cooperation between the scientists of the two countries and to provide additional opportunities to exchange ideas, information, skills, and techniques to collaborate on problems of mutual interest, to work together in special environments, and to utilize special facilities."[241]

The duration of the agreement is five years. Executive agencies are the NSF in the United States, and the National Research Council of Brazil. It was proposed that the United States allocate $300,000 for fiscal year 1973 program operations.[242]

NSF is working out details and procedures for similar agreements with Argentina and Mexico.[243] It was estimated that $300,000 would be required for 1973 activities for each program.[244]

United States-Iran Program for Scientific Cooperation.—A U.S.-Iran Program for Scientific Cooperation was agreed upon in an exchange of letters signed at Tehran on May 23 and 27, 1968. The formal agreement envisioned general scientific cooperation and exchanges of personnel and information especially in geology, nutrition, and disease. The Department of State delegated lead agency responsibility for the United States to the Smithsonian Institution. The Iranian Ministry of Science and Higher Education was named the counterpart executive agency. Under terms of the Agreement each side would bear the costs of its own participants. The duration of the original agreement was for three years. According to a later State Department evaluation of the program, "unfortunately funds have not been available even to stimulate investigation . . . ."[245]

In 1972 the National Science Foundation announced that it "agreed to accept Executive Agency responsibility for a renewed bilateral cooperative science program between the United States and the Government of Iran. The Foundation plans to support American scientific participation in about six binational seminars, twelve exchange visits of U.S. and Iranian scientists and two cooperative research projects".[246]

OTHER PROGRAMS ADMINISTERED BY THE OFFICE OF INTERNATIONAL PROGRAMS

The Office of International Programs administers three other activities which send American nongovernmental scientists abroad. These, which will be described next, are: Planning and Developing International Science Programs, the International Institute for Applied Systems Analysis, and the Special Foreign Currency Program.

U.S. Participation in Planning and Developing International Science Programs.—The only explicit travel support activity of the Office of International Programs is a modest program in support of U.S. participation in the planning, development, organization, and coordination of international scientific programs and meetings. Currently called the "Scientific Organization and Resources Program," it

[241] "United States and Brazil Sign Agreement on Scientific Cooperation," *Department of State Bulletin* (December 27, 1971), p. 747.

[242] Taken from data supplied to FC, ICST, Subcommittee on Bilateral Relations, December 4, 1971, consisting of a draft catalogue of U.S. bilateral scientific agreements.

[243] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., p. H-2.

[244] Material supplied to IC, FCST, December 4, 1971, by State Department, op. cit.

[245] "U.S. Scientific and Technological Agreements with Other Countries," op. cit.

[246] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., p. H-60.

consists of annual awards to the Office of the Foreign Secretary, National Academy of Sciences, (NAS) to support NAS activities including:

(1) travel expenses associated with meetings of the U.S. national committees for member unions of the International Council of Scientific Unions;

(2) funds to convene meetings of the Advisory Committee on International Organizations and Programs;

(3) support for the Academy staff involved in the activities of the national committees;

(4) funds for the payment of the U.S. dues to the ICSU and its member unions;

(5) awards for U.S. scientists to participate in decisionmaking meetings of international organizations, both governmental and nongovernmental;

(6) activities to ensure that proposals from the U.S. scientific community receive proper attention at all levels of appropriate international scientific organizations; and

(7) activities to ensure dissemination to American scientists of information about the activities of international organizations.[247]

NSF's use of inconsistent categories in the collection and reporting of annual data makes it difficult to achieve an accurate and balanced overview of the Foundation's funding of this program.[248] Using a broad grouping categorized as "Scientific Liaison with International Scientific Organizations and Programs," the Foundation reports approximately $400,000 in expenditures for this program for each of the fiscal years 1966, 1967 and 1968; $173,535 for 1970; $400,000 for 1971; and $500,000 estimated for 1972.[249] $700,000 was requested for the fiscal year 1974.[250]

Activities are administered by the Section on International Programs, NAS. According to Mr. Edward Rowan, section head, the meetings are especially valuable because they provide for informal communications between scientists; they serve as trade markets for professionals wishing to switch jobs, and they also "serve to provide information on scientific activities in other countries."[251] A useful byproduct is their contribution to "peace and understanding," since many initiatives for international scientific collaborative projects originate at these meetings. However, Rowan also stresses

[247] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *1972 National Science Foundation Authorization: Hearings*, 92d Cong., 1st sess., 1973, p. 346; U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *1971 National Science Foundation Authorization: Hearings*, 91st Cong., 2d sess., 1970, pp. 210–211.

[248] The Foundation awards the Academy several grants or contracts each year for participation in this program. Authorizations/appropriations hearings have not presented consistently categorized data. In order to find amounts awarded, it is necessary to pick out and collate awards listed in several places in the grants and awards books, a difficult task since the Foundation until 1971 reported support for NAS activities under a number of different program categories.

[249] The Foundation has utilized several different categories and labels to describe this program since 1960. Data for 1966, 1967, and 1968, are from: *Inventory of Federal Programs . . .*, op. cit.; Additional data are from: U.S., Congress, House, Committee on Appropriations, *Independent Offices Appropriations, FY 1968: Hearings*, 90th Cong. 1st sess., 1967, pp. 180, 197, 227, and 421; U.S., Congress, House, Committee on Appropriations, *Independent Offices Appropriations, FY 1969: Hearings*, 90th Cong. 2d sess., 1968, pp. 1203, 1203–1204; U.S., Congress, House, Committee on Appropriations, *Independent Offices Appropriations, FY 1970: Hearings*, 91st Cong. 1st sess., 1969, pp. 462–465; U.S., Congress, House, Committee on Appropriations, *Independent Offices Appropriations, FY 1971: Hearings*, 91st Cong. 2d sess., 1970, pp. 836–837; and U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development: *1972 National Science Foundation Authorization: Hearings*, op. cit., pp. 346–247.

[250] *1974 National Science Foundation Authorization: Hearings*, op. cit., p. 319.

[251] Interview, March 16, 1971.

that U.S. scientists originate most of these initiatives. Scientists of other countries consequently are said to resent this American domination of new initiatives.

Awards for attendance at specific meetings of each of the unions adhering to the International Council of Scientific Unions, (ICSU), are typically funded by separate divisions of NSF. Mr. Rowan's office maintains some centralized reporting on these activities. (See Tables 14 and 15.) Each chairman of a delegation is required to report such details of the meeting as attendance, comments (scientific and diplomatic), activities of the U.S. delegation, and consideration of resolutions. The Academy does not give delegates predeparture briefings on scientific or diplomatic positions. However, the State Department is interested in deliberations at these meetings and since 1950 has supported the travel of its own delegates to them.[252]

During 1967 and 1968, the Academy and members of the ICSU decided that the quality of meetings was suffering because organizing committees relied on local scientists for their arrangements. The Academy subsequently organized an *ad hoc* group to prepare two reports on their problems and status. The first report, published in 1968, offered recommendations for improving the quality and organization of international scientific meetings:

1. Participation of the international sponsor in the planning of meetings.
2. Screening of the papers to be presented at meetings.
3. Recognition of the importance of informal contacts at meetings in the allotment of time and space for informal discussion.
4. Close attention to physical facilities and arrangements.
5. Establishment by international unions of committees of past organizers who can advise current national organizing committees.
6. Adequate secretariats for organizing committees of large meetings and, in the case of the largest meetings, the services of a professional congress organizer, if one with proper qualifications is available.
7. Concentration of sessions of large meetings in one area where all are easily accessible to each other.
8. More selective sponsorship of meetings by international organizations.
9. Avoidance of unnecessary duplication by means of better communications about prospective meetings through the regular exchange of information by scientific organizations in the same general field and through better use of periodically published lists of forthcoming meetings.
10. Financial assistance to the organizers of meetings, either through loans from a revolving fund of the sponsoring body or through the collection of a small surcharge on registration fees at the previous meeting in the series.
11. Publication of papers given at a meeting in the form of proceedings only in answer to a real need and because of clear advantage over publication in other forms.
12. Encouragement of small meetings in developing countries on subjects of special interest to the particular regions in question.
13. [Attention to adequacy or excessiveness of American participation in international scientific meetings.]
14. [Encouragement of the holding of more international scientific meetings in the United States.][253]

Apparently the quality of these meetings has improved considerably following the Academy's adoption of these practices.

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[252] Ibid.

[253] "Report of the Committee on the Quality and Organization of International Scientific Meetings." Office of the Foreign Secretary, National Academy of Science, June 1968 (the Noyes Report), pp. 8–9.

TABLE 14.—OFFICE OF THE FOREIGN SECRETARY, PARTICIPATION IN CONGRESSES AND GENERAL ASSEMBLIES OF INTERNATIONAL SCIENTIFIC ORGANIZATIONS, 1970

	NAS–NRC delegation	Total U.S. participation	Total participation	Countries represented
UICC:				
Cancer	3	4,000	6,018	72
Microbiology	[1] 2	300	3,000	33
IAU: Astronomy	8	479	2,300	46
IUTAM: Theoretical and applied mechanics	4	37	150	20
IMU:				
Mathematics	10	500	4,500	39
Ornithology	[1] 1	102	850	44
IUB: Biochemistry	3	550	3,500	49
FID: Documentation	2	22	625	30
IPSO: Physical sciences of the ocean	2	105	600	33
SCOR: Oceanic research	1	6	40	17
IABO: Biological oceanography	1	2	44	22
CMG: Marine geology	1	100	300	32
ISRM:				
Rock mechanics	2	37	700	22
Plant protection	[1] 1	50	1,728	57
ICSU: International Council of Scientific Unions	5	16	125	44
IUBS: Biological sciences	9	9	93	25
Total	55	6,315	24,573	

[1] Observer.

Source: Supplied by National Academy of Sciences.

TABLE 15.—U.S. PARTICIPATION IN INTERNATIONAL SCIENTIFIC CONGRESSES, 1960 TO 1970

Year	Number of Congresses	U.S. participation	Total participation	NAS–NRC delegation
1960	6	2,295	7,271	274
1961	8	4,237	13,660	103
1962	9	2,501	12,151	61
1963	12	2,386	14,711	253
1964	8	4,905	11,874	76
1965	8	2,721	11,379	51
1966	16	4,155	30,038	105
1967	13	3,169	14,717	94
1968	13	4,973	14,993	87
1969	12	3,671	12,921	81
1970	16	6,315	24,573	55
Total	121	41,328	168,288	1,140

Source: Supplied by National Academy of Sciences.

The International Institute for Applied Systems Analysis.—The International Institute for Applied Systems Analysis was established in Vienna in 1972. The Office of International Programs, NSF, supports U.S. participation through grants awarded to NAS, the U.S. adhering agency, which selects American governmental and nongovernmental scientific participants. Approximately $1 million (estimated) was awarded to the Academy for this purpose in both 1972 and 1973.[254]

The Institute, which is nongovernmental and international, originated in discussions between high-level scientific and governmental officials.[255] President Nixon outlined the importance of U.S. participation in the activity in his report to the Congress on "Foreign Policy for the 1970's: "This institution" he said "would initially bring together scholars from some eight nations of East and West to apply the most

[254] *Authorizing Appropriations to the NSF, FY 1973*, House Report 92–977, op cit. p. 56.

[255] "Origin: The idea for this Institute was developed by McGeorge Bundy while he served in the Johnson Administration. McGeorge Bundy discussed this concept with Sir Solly Zuckerman, and Mr. D. M. Gvishiani of the Soviet Union and other prominent officials in Western Europe. The concept was also discussed with members of Congress before officials of other countries were asked about the establishment of this kind of Institute. The Director of the Foundation has also discussed this concept with the members of both the House and Senate Committees" (*1972 National Science Foundation Authorization: Hearings*, op. cit., p. 265.)

sophisticated analytical tools available to the major problems of contemporary civilization." [256]

The initial budget totaled $3 million; the Soviet Union has pledged $1 million, "with remaining funds to be made up by the other member countries." Other participants are the United Kingdom, France, Italy, West Germany, Poland, and East Germany; Canada, Japan, and Bulgaria are considering membership.

Special Foreign Currency Program.—Since 1959 the National Science Foundation has maintained a program for collecting, translating, abstracting, and disseminating foreign science information to meet the requirements of Federal agencies and the general scientific community. The program makes available selected scientific and technological literature produced by foreign scientists. Funds for this program, from fiscal year 1959 to 1970, came from NSF-purchased foreign currencies. Approximately $1 million in foreign currency funding was devoted to the program from 1964 to 1970. Since the fiscal year 1970, the Foundation has been given a Special Foreign Currency appropriation, enabling the agency to utilize payments in foreign currencies which the Treasury Department has determined to be in excess of the normal requirements of the United States in certain countries.[257]

In mid-fiscal year 1971 the Foundation expanded its excess foreign currency translation program to support cooperative scientific research and related activities benefiting both United States and foreign scientists in six foreign countries: India, Morocco, Poland, Tunisia, Egypt, and Yugoslavia.[258] The Foundation subsequently extended the program to Pakistan in FY 1972 and to Burma and Guinea in FY 1973.

The scientific activities supported under this program are considered to be of mutual benefit to both U.S. and foreign scientific communities, but lack priority to warrant their funding from the Foundation's appropriation.[259] The program, under the category "Scientific Research and Related Activities," encompasses four kinds of activity:

(1) collaborative research undertaken by U.S. and foreign scientists;

(2) joint studies, conferences, symposia, seminars, or meetings;

(3) visits of U.S. scientists to foreign institutions to teach or conduct research; and

(4) travel by U.S. scientists to meetings or other scientific activities in special foreign currency countries and travel by scientists of the special foreign currency countries to the United States or elsewhere.[260]

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[256] In *Authorizing Appropriations to the NSF, FY 1973*, House Report 92-977, op. cit.; See also: *1972 NSF Authorization: Hearings*, op. cit., p. 364.

[257] Under authority of Section 104(b)3 of the Agricultural Trade Development and Assistance Act of 1954 as amended.

[258] NSF, *Justification of Estimates of Appropriations, FY 73*, op. cit., p. P-1.

[259] Idem.

[260] Idem.

Proposals for projects under the special foreign currency program are to be initiated by both U.S. and foreign scientists and science educators. All programs would be coordinated with and have the approval of the State Department and the foreign country before they are undertaken. Funds are awarded by the separate divisions of the Foundation, not by the Office of International Programs.[261]

Overviewing activities under the research and related activities section of the program for the first year since its inception, the Foundation reported:

> From the inauguration of the program, in mid-FY 1971, to December 31, 1971, the Foundation awarded grants for 21 cooperative research projects in Yugoslavia, Egypt, and Poland. It also made 96 awards to American scientists to support their attendance at international conferences, congresses, and symposia, or their participation in the development of joint research projects to be conducted in Yugoslavia, Poland, India, Morocco, and Tunisia.
>
> Long-term projects being supported or proposed for support concern earthquake engineering, electrical engineering, environmental sciences, and other areas of science and technology of prime importance to both the foreign countries involved and the United States.[262]

Obligations for informational activities of the program have totaled $1,000,000 for each year from 1970 to 1974 (estimated). In fiscal year 1971, when the scientific research and related activities segment of the program began, the Foundation obligated $996,322. This figure was increased to $1,999,598 in fiscal year 1972, and to $4,000,000 estimated for the years 1973 and 1974. The total fiscal year 1974 request for this program was $5,000,000.[263] (A detailed budget breakdown, by function, is given in Table 16.)

TABLE 16.—NATIONAL SCIENCE FOUNDATION, SPECIAL FOREIGN CURRENCY PROGRAM, BY FUNCTION

[Thousands of dollars, equivalents]

	Fiscal year—					
	1969, actual	1970, estimated	1971, estimated	1972, estimated	1973, estimated	1974, estimated
Foreign scientific and technological information activities	0	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Research and other science activities	0	0	1,000,000	2,000,000	4,000,000	4,000,000
Scientific research			600,000	1,200,000		
Science education			330,000	660,000		
International travel			70,000	140,000		
Program total	0	2,000,000	2,000,000	3,000,000	5,000,000	5,000,000

Sources: Data for 1969, est., 1970, est., and 1971, est.: U.S., Congress, House, Committee on Appropriations, "Independent Offices and Department of Housing and Urban Development Appropriations for 1971: Hearings, Pt. 2," 91st Cong., 2d sess., 1970, pp. 927 and 931. Data for 1971, est. and 1972, est. from: U.S. National Science Foundation, "Justification of Estimates of Appropriations to the Congress, FY 1973, 1972," p. P-1. Data for 1973 and 1974 from U.S. National Science Foundation, "Justification of Estimates of Appropriations to the Congress, FY 1974," 1973, p. O-1.

Foreign currency funds obligated in the fiscal year 1972 (in dollar equivalents) range from over $1,000,000 for Yugoslavia to$ 2,517 for Pakistan and Burma. (See Table 17.)

[261] *Independent Offices Appropriations, FY 1970: Hearings*, op. cit., p. 508.
[262] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., p. P-2.
[263] Data from: U.S., National Science Foundation, *Justification of Estimates of Appropriations to the Congress, FY 1972*, 1975, passim; *Justification of Estimates of Appropriations . . . FY 1973*, op. cit., passim; and *1974 National Science Foundation Authorization: Hearings*, op. cit., p. 365.

TABLE 17.—NSF, OBLIGATIONS FOR FISCAL YEAR 1972 RESEARCH, SCIENCE EDUCATION AND RELATED ACTIVITIES

Country	Number of projects		Foreign currency obligated (equivalent)
	Research	Travel	
Yugoslavia	12	41	$1,025,801
Morocco	1	2	499,745
Poland	3	41	193,147
Egypt	2	9	139,163
India	3	9	110,584
Tunisia	2	3	28,641
Pakistan and Burma	0	3	2,517
Total	[1] 23	[2] 108	1,999,598

[1] $1,902,933.
[2] $96,665.

Sources: U.S. Congress, House Committee on Science and Astronautics Subcommittee on Science, Research, and Development, "1974 National Science Foundation Authorization: Hearings," 1973, p. 325.

In 1972 the Foundation requested increased dollar authorization, in the sum of $150,000, under the support category of International Cooperative Scientific Activities to improve administration of the special foreign currency program. Only these dollar funds would be used by the Office of International Programs for:

> (1) indirect costs of American universities associated with the administration of projects funded with excess currency; (2) support of scientists from excess foreign currency countries in U.S. universities . . .; (3) purchase of minor pieces of equipment . . .; and (4) travel of U.S. scientists to excess currency countries which have restrictions of the use of their currency for international travel purposes (India, Burma, Guinea, Poland, and Morocco).[264]

The fiscal year 1974 request totaled $200,000.[265]

Travel To Attend Scientific Meetings

The NSF supports several programs awarding travel funds to U.S. scientific and technical personnel to participate in international scientific meetings or to attend scientific meetings abroad. The Office of International Programs supports two types of travel programs: (1) U.S. participation in planning and attending activities of international scientific organizations, through grants awarded to the National Academy of Sciences; and (2) travel grants to individuals under terms of bilateral agreements. The NSF Research Directorate administers two types of awards: (1) travel grants to individuals to attend scientific conferences held abroad; and (2) block travel grants to professional associations, which directly select individuals to receive travel funds. Only these two Research Directorate programs will be described in this section. The Division of Graduate Education in Science supports individuals to attend NATO Advanced Study Institutes and foreign conferences on science education.

SCOPE AND LIMITATIONS OF INTERNATIONAL TRAVEL GRANTS PROGRAM

NSF programs for U.S. participation in international scientific meetings or in meetings held abroad began in 1950 and were implemented initially under the Foundation's authority for science information to strengthen the base of American science.[266] Although

[264] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., p. H-4.
[265] *1974 National Science Foundation Authorization: Hearings*, op. cit., p. 325.
[266] The NSF enabling Act authorized and directed the Foundation "to foster the interchange of scientific information among scientists in the United States and foreign countries. . . ." Section 3(a)(5) of the NSF Act of 1950 was cited as primary justification for early information activities until passage of the NSF amendments of 1968.

the Foundation's authority for such programs gradually increased,[267] such activities were not clearly mandated until passage of the 1968 amendments (P.L. 90–407) which broadened the NSF's authority in this field.

This slow evolution hampers evaluation of the scope and number of activities carried out in support of international travel. First, since the development and administration of the Foundation's programs were constrained by the need to support them in terms of strengthening domestic science, the Foundation did not centralize administration of programs and did not keep adequate records of all travel activities. For instance, in 1953 the Foundation reported generally that "Attendance of American scientists at international meetings is closely related to scientific information since this is an important channel for exchange of views on new scientific developments." By 1970, after passage of amending legislation, the purposes and scope of the international travel grants program were considerably broadened:

> The International Travel Program provides for grants to U.S. scientists to (1) attend international scientific congresses and meetings; (2) obtain or exchange information on research, science education, or information relating to international scientific programs and associated activities; and (3) cooperate in international scientific activities.[268]

Second, the Foundation utilized the only early authority it had, support for information exchange, to justify, develop, and report most other early NSF programs in international science. For instance, utilizing this authority, the Foundation developed its programs in support of translating foreign scientific information, studies of foreign science literature, support of the acquisition of foreign science studies, support for U.S. participation in international scientific meetings, and organization and support of the Soviet and Eastern bilateral programs. As a result, the Foundation's reporting for international scientific information activities, and for international travel activities under it, was not consistent either in budget presentations before the Congress or in annual reports.

These problems were described in a report the Foundation prepared in 1964, entitled "Improving the Dissemination of Scientific Information." The report observed: "The Foundation's activities in the science information area [specifically referring to international scientific information exchange] are so diverse that it is difficult to classify them into a manageable number of headings . . . ." [269]

Similar confusion holds with respect to the Foundation's inconsistent reporting in its *Annual Reports*, and *Annual Reports of Grants and Awards*. The Foundation has used different report categories in budget presentations, annual reports, and annual reports of grants and

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[267] For a description of this evolution see: *The National Science Foundation: A General Review of Its First 15 Years*, op. cit., pp. 178–9.

[268] *1972 National Science Foundation Authorization: Hearings*, op. cit. p. 346.

[269] Cited in: *The NSF: A General Review of Its First Fifteen Years*, op. cit., p. 193. Specifically "The Foundation requested $700,000 for International Scientific Information Exchange in FY 1966. . . . Partial support is provided for the international travel expenses of selected U.S. and foreign scientists for attendence at international scientific conferences and meetings and for visits of U.S. scientists to foreign scientific research institutions, universities and libraries for the purpose of strengthening scientific research and education in the United States. The program also continues exchange of scientists between the U.S. and East European countries." (Ibid., pp. 192–3)

awards.[270] The reporting situation was improved considerably in the 1971 report of grants and awards when an attempt was made to include all international and foreign science activities, separately categorized, under the heading of "National, International, Specialized Research, and Sea Grant" programs to correspond more closely with the categories used in *Annual Reports* and in Congressional budget presentations. The old category of "International Scientific Information Exchanges (Travel)" was dispensed with, reflecting the Foundation's enlarged mandate to support international activities on their own merits. However, some inconsistency still prevails, since data presented at authorizations hearings still include a heading for "International Information Activities" under "Science Information Exchange."

Data presented below reflect the limitations of evaluating travel programs with scarce and inconsistent information on funding and activities. However, they do indicate, on the one hand, that the Foundation has taken several steps to cope with the increasing proliferation of international scientific meetings. The Foundation has established policies to select a small number of meetings which would be most beneficial to the American scientific community and to sponsor the travel to these meetings of younger, more culturally adaptable attendees rather than older, more established "scientific elites." On the other, available information about these programs, comments, and evaluation of international scientific exchange activities in general, seems to indicate that the Foundation's support of travel to international scientific meetings might serve a wider range of scientific and diplomatic objectives and more continuity in planning if grantees were given predeparture briefings, if some awardees were required to be competent in foreign languages, and if more analysis were made of the travel reports grantees submit to the Foundation.

The International Travel Grants Program.—The international travel grants program, funded by NSF divisions and offices other than OIP, was established in 1952. It involves two types of awards: (1) awards to individual scientists and (2) block awards to non-profit professional associations, who select grantees and disseminate travel funds to them.

A standard selection and award procedure is used; each year, the individual divisions of the Foundation select certain meetings, in areas of particular interest to the Foundation for which participation support may be granted. Individual scientists or professional associations submit application forms to each division. If funds are awarded to a professional association, the association publishes notification of the award, soliciting applications, in appropriate professional journals. In order to eliminate duplicate competitions the Foundation does not make awards for individual travel grants to meetings for which it has already awarded block travel funds to a professional association.

[270] For instance, in FY 1964 grants to individuals to attend scientific meetings were included under the category, "International Scientific Information Exchange (Travel)," which fell under the broad category of "Science Information Service." However, the Soviet and Eastern European exchanges program, which was handled together with travel grants in the budget presentation, was not reported under "International Scientific Information Exchange (Travel)," but under "International Science Research Activities." In FY 1966, the International Organizations and Programs Project was reported under the "International Science Research Activities" category, like the Soviet and Eastern European Exchange program. In 1967, however, the Soviet and Eastern European Exchanges program was reported under "Science Information Service support." A separate category was established for "International Scientific Information Exchanges (Travel)," but support of the International Organizations and Project program was placed under a new category, "International Science Research Activities."

Awards are in U.S. dollars. They are generally limited to the equivalent cost of jet economy air transportation from the city of origin to the scientists' destination abroad and return. Per diem may be paid when an individual is traveling as a representative of the U.S. Government. Travel must be by U.S.-flag carriers except in special circumstances.

Criteria for evaluation of international travel grant applications vary with each NSF division. According to Dr. William Riemer, who was in charge of the 1971 international travel grants program for the Division of Biological and Medical Sciences, usually a different staff member within each division has responsibility for program implementation each year; there is no outside review of applicants' qualifications. Because meetings are usually held in Europe in the summer, the Foundation prefers to support meetings held in Asia, Africa, and Latin America in the fall. Divisions vary in their preference for supporting large or small meetings; some divisions prefer to support older, well-established scientists; others favor younger scientists "who do not have cultural blinders." The Foundation does maintain one official criterion for evaluation of grant applications: preference is given to individuals delivering scientific papers. Awardees are not required to have particular language qualifications.

The Foundation requires recipients of individual travel awards to file an official report but only of scientific activities in which they have participated. There is no official requirement to report on the international scientific aspects of the meeting; however, each division may request its grantees to report on the number of individuals attending, the countries represented, the highlights of the program, and the general impressions of the person reporting.

According to Dr. Riemer, the individual subject divisions of the Foundation review incoming reports; reports are sent only infrequently to the State Department and to the Office of International Programs, especially if the meeting was held in a country with which the United States has a bilateral scientific agreement.[271]

The Foundation's activities in support of the international travel grants program have been modest. In 1952 the Foundation awarded 23 grants totaling $17,153. Congressional action forced suspension of the program in the mid-fifties; but the program was reinstated in 1957, probably as part of the general increase in Foundation activities in response to the launch of Sputnik. In 1957 the Foundation awarded about $120,000 for this program. Since 1960 the Foundation has awarded international travel grants to approximately 600–900 individuals annually at costs totaling about $500,000 to $600,000 including awards to professional associations and to the National Academy of Sciences. (See Tables 18 and 19.)

According to the Foundation, there are many problems connected with its support of international travel:

> The number of international scientific meetings is increasing sharply, perhaps too much so. It may be that some scientists spend too much of their time going to such meetings, and too little in their laboratories developing new results to talk about at the meetings. The problem the Foundation faces, therefore, is to pick the significant meetings to which support should be offered and then to offer support for travel expenses to the right scientists. Care is taken by the use

[271] Material taken from Interview with Dr. William Riemer, Division of Biological and Medical Sciences, NSF, March 1, 1970; NSF, "Application for International Travel Grant;" and NSF, "Instructions for International Travel Grant Applications."

of appropriate screening groups to ensure that brilliant and promising young scientists as well as older and more distinguished ones are enabled to attend meetings. Care must also be taken to avoid supporting so many Americans that they constitute an overwhelming number of scientists in attendance at any one meeting.[272]

TABLE 18.—NSF INTERNATIONAL TRAVEL GRANTS, NUMBER OF TRAVELERS, COST—FISCAL YEARS 1952-1973

Fiscal year	Total number of travelers	Total cost (dollars)	Average cost (dollars)
1952 [1]	23	17,153	
1953 [2]	54	33,565	
1957 (actual) [3]		122,069	
1957 (actual) [4]	200		600
1957 (actual) [5]	205	118,286	
1958 [6]	200	122,069	
1958 (actual) [4]	200		600
1958 (actual) [7]	190	113,220	
1959 (estimated) [4]	835		600-800
1961 [8]	539	506,000	
1961 [9]	617	473,302	
1961 (actual) [10]	539	506,000	
1963 (actual) [11]	650	[12] 749,358	750
1964 (actual) [13]	745	[14] 685,735	
1965 (actual) [15]	660		750
1965 (actual) [16]	745	[17] 683,815	
1966 (actual) [18]	998		
1966 (actual) [19]	646		
1967 (actual) [20]		800,000	
1967 (actual) [19]	859		
1968 (actual) [18]	671		
1968 (actual) [21]		444,951	
1969 (actual) [22]	671		
1969 (actual) [23]		429,204	
1970 (actual) [24]	483		
1971 (estimated) [22]		405,000	
1973 (estimated) [25]	900-950	500,000	

[1] U.S., National Science Foundation, "Annual Report, Fiscal Year 1952, 1953."
[2] U.S., National Science Foundation, "Annual Report, Fiscal Year 1953, 1954."
[3] U.S., Congress, House, Committee on Appropriations, "Independent Offices Appropriations, Fiscal Year 1959: Hearings, 1958," p. 294.
[4] Ibid., p. 344.
[5] U.S., National Science Foundation, "Annual Report, Fiscal Year 1957, 1958."
[6] U.S., Congress, House, "Independent Offices Appropriations, Fiscal Year 1958: Hearings, 1957," p. 344.
[7] U.S., National Science Foundation, "Annual Report, Fiscal Year 1958, 1959."
[8] U.S., National Science Foundation, "Annual Report, Fiscal Year 1961, 1962."
[9] U.S., Congress, House, Committee on Appropriations, "Independent Offices Appropriations, Fiscal Year 1963: Hearings, 1962," pp. 885, 895.
[10] U.S., National Science Foundation, "Annual Report, Fiscal Year 1961, 1962."
[11] U.S., Congress, House, Committee on Appropriations, "Independent Offices Appropriations, Fiscal Year 1965: Hearings, 1964," p. 800.
[12] Travel, $489,258; USSR-EE, $260,100.
[13] U.S., Congress, House, Committee on Appropriations, "Independent Offices Appropriations, Fiscal Year 1966: Hearings, 1965," pp. 605, 826.
[14] Travel, $451,113; USSR-EE, $234,622.
[15] U.S., Congress, House, Committee on Appropriations, "Independent Offices Appropriations, Fiscal Year 1967: Hearings, 1966," p. 105.
[16] Ibid., p. 105.
[17] Travel, $245,000; USSR-EE $234,622.
[18] "Inventory of Federal Programs Involving Educational Activities," op. cit., p. 367.
[19] U.S., National Science Foundation, "Annual Report, Fiscal Year 1966, 1967."
[20] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, "The Participation of Federal Agencies In International Scientific Programs: Report of the Science Policy Research and Foreign Affairs Divisions, Library of Congress, 90th Cong., 1st sess., 1967," p. 85.
[21] "1970 National Science Foundation Authorization: Hearings, vol. II," op. cit., p. 580.
[22] U.S., Congress, House, Committee on Appropriations, "Independent Offices Appropriations, Fiscal Year 1971: Hearings, 1970," p. 840.
[23] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, "1971 National Science Foundation Authorization: Hearings, 1970."
[24] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, "1972 National Science Foundation Authorization: Hearings, 1971," p. 346.
[25] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, "1973 National Science Foundation Authorization: Report, 1972," p. 56.

[272] *1970 National Science Foundation Authorization: Hearing*, op. cit pp. 255–6.

TABLE 19.—NSF, INTERNATIONAL TRAVEL GRANTS, AMERICANS ABROAD, FISCAL YEARS 1961 AND 1970

Fiscal year	Total funds awarded	Travel grants to individuals		Travel grants to National Academy of Sciences to support attendance of Americans at meetings		Travel grants to professional associations to support attendance of Americans at meetings		Travel of Americans to NATO Advanced Study Institutes		Courtesy travel service administrative services
		Funds awarded	Number of travelers	Funds awarded	Number of conferences	Funds awarded	Number of conferences	Funds awarded	Number of travelers	
1961 [1]	606,654	295,550	240	104,600	3	169,776	11	30,569	54	
1970 [2]	(817,774) [3] 667,774	230,196	397	260,140	7	142,695	15	34,743	66	150,000

[1] Data for 1961 compiled from: U.S. National Science Foundation, "11th Annual Report, 1961", 1962, pp. 255–257, "International Science and International Science Education," and pp. 364–371, "Attendance at International Meetings."
[2] Data for 1970 compiled from: U.S. National Science Foundation, "National Science Foundation Grants and Awards," 1970, 1971, pp. 90–99, "International Science Information Exchange (Travel)," and pp. 85–86, "International Cooperative Science Activities."
[3] Total funds awarded for travel program, excluding contract for administrative services for the program total $667,774. Total funds, including $150,000 for administrative services for the program, are $817,774.

National and Special Research Programs

National and Special Research Programs are major, often interdisciplinary, research efforts which relate to specific geographic areas or are of such a broad scope and magnitude that extensive coordination of planning, management, funding, and logistic support are essential to insure maximum effectiveness and efficiency in program performance. Some of the programs involve extensive international coordination and cooperation with other U.S. Government agencies and foreign and international bodies for the planning and conduct of research. "In terms of men [involved] and money spent, [NSF-supported] international research programs comprise the great bulk of science-related operations of the National Science Foundation.[273] Estimated expenditures for these programs for fiscal year 1973 exceed $60 million. (See Table 20.) Most of these programs are administered by the Assistant Director for National and International Programs. However, some of the research funded under the activities comes from support of basic research under the Research Directorate. While alluding to the international significance of these programs, the Foundation does not include them under the support category of "International Cooperative Science Scientific Activities," either in budget presentations before the Congress, or in *Annual Reports*. The Office of International Programs has no responsibility for these activities. (In comparison with the cost of these research programs, authorizations for OIP activities for 1973 total $4,700,000.)

[273] *Inventory of Federal Programs Involving Educational Activities Concerned With Improving International Understanding and Cooperation: An interagency survey* . . . , op. cit., p. 365.

TABLE 20.—NSF, NATIONAL RESEARCH PROGRAMS

	Fiscal year—							
	1966	1967	1968	1969	1970	1971	1972 estimated	1973 estimated
International biological program		497, 000	700, 000	1, 220, 000	4, 000, 000	7, 502, 134	10, 000, 000	10, 500, 000
Global atmospheric research program			200, 000	510, 000	1, 490, 000	1, 839, 500	2, 500, 000	3, 500, 000
International decade of ocean exploration						15, 000, 000	20, 000, 000	18, 000, 000
Ocean sediment coring program				2, 430, 000	6, 500, 000	7, 126, 889	8, 500, 000	9, 000, 000
Arctic research program						2, 000, 378	3, 500, 000	4, 000, 000
Antarctic research program	8, 362, 896	7, 577, 012	7, 643, 926	6, 860, 000	7, 410, 000	7, 762, 321	26, 800, 000	25, 000, 000
1973 solar eclipse (logistic support)								600, 000
International year of the quiet Sun	1, 617, 283	708, 176						
International Indian Ocean expedition	1, 067, 707							

Source: Data for fiscal years 1969, and 1970 are from: NSF, "Annual Report, fiscal year 1971," op. cit., p. 38. Data for fiscal year 1971, 1972, 1973 are from: NSF, "Justification of Estimates of Appropriations," fiscal year 1973, op. cit., p. C-1.

National and international research programs are frequently international in both scope and character. Some, such as the Antarctic Research Program and the International Year of the Quiet Sun, are undertaken in accordance with international agreements formalized in treaty obligations. Usually the programs are initiated when several governments and their scientists recognize the need for a concerted multinational effort. Typically the programs, if not formalized under bilateral or multilateral treaties, are sanctioned, coordinated, partially supported, and sometimes governed by intergovernmental science bodies or their affiliates. Programs under this category include the International Biological Program (IBP), the Global Atmospheric Research Program (GARP), the International Decade of Ocean Exploration (IDOE), and the now terminated International Indian Ocean Expedition and International Years of the Quiet Sun.

NSF responsibilities for these programs take a number of forms. In some, the Foundation plays the role of lead U.S. agency to coordinate the funding, research, management, and information dissemination activities of other Federal agencies, industry, universities, and non-profit research organizations. The programs are administered under complex arrangements. NSF supports the participation of the American nongovernmental community through grants and contracts awarded to academic scientists.

U.S. nongovernmental scientific travel abroad under the programs consists of:

—meetings to plan research projects;

—attendance at international scientific conferences which treat ongoing or completed research; and

—overseas research jointly with foreign scientists.

Often these programs involve collaborative research among scientists of several different nations. For example, the shipboard activities conducted on board the Foundation-supported *Glomar Challenger* in connection with the Ocean Sediment Coring Program have involved research scientists from more than 12 nations. Similarly, NSF-sponsored activities in the Antarctic encompass collaborative research between American and foreign scientists at both foreign stations and on board foreign vessels. The Global Atmospheric Research Program will involve internationally conducted experiments in the Altantic in 1974; the International Biological Program has involved parallel research studies by scientists from many different nations.

Like other NSF basic research programs which involve international or foreign science activities, participants are not required to meet any special criteria. With the exception of some polar program research, the Foundation apparently does not require grantees to meet language qualifications nor to be briefed on the special conditions they might encounter in conducting research in a foreign location. The Foundation does not require or maintain detailed reporting on the foreign activities undertaken in support of these programs; thus, there is little or no comprehensive information available to evaluate the scope and quality of participation in them by the American nongovernmental scientific community.

U.S. ANTARCTIC RESEARCH PROGRAM

The Antarctic Research Program was funded at the level of $43.7 million est. in the fiscal year 1973.[274] As such it is the most costly of the current research programs. It will be described next to illustrate international activities subsumed under the category of national research programs.

The U.S. Antarctic Research Program had its origins in the astronomical observations carried out in 1957–1958 under the International Geophysical Year (IGY.)[275] The U.S. Government had built a number of observatories and stations in the Antarctic to carry out obligations under the IGY. The Government decided to maintain these after completion of the IGY investigations to continue scientific investigations and to support patterns of international cooperative research which had been initiated during the preceding years.

The Antarctic Treaty, signed in 1959 and ratified by the United States and 11 other Nations, provided that the Antarctic would be used only for peaceful purposes and that international scientific cooperation should be continued there.[276] The National Science Foundation had served as coordinator of U.S. Antarctic programs from the end of the IGY until initiation of activities under the Treaty. Under a Bureau of the Budget directive relating to the conduct and planning of the U.S. Antarctic Research Program, the Foundation was given additional responsibility for developing, managing, and coordinating an integrated U.S. intergovernmental science program for the area. NSF continues to manage the U.S. Antarctic program. U.S. research is coordinated with that of the 11 other Treaty signatories through ICSU. International scientific exchanges and cooperative field research projects are implemented through bilateral and multilateral agreements.

The Antarctic Policy Group, composed of the Secretary of State as Chairman, the Secretary of Defense, and the Director of the National Science Foundation, determines policy, approves long-range plans, and provides general guidance for the program. The NAS Committee on Polar Research advises on the program, and effects contact with foreign academies and the International Council of Scientific Unions.[277]

NSF-sponsored research, funded by both scientific research divisions and the Office of Polar Programs, includes ". . . both field work . . . and study in the United States of specimens . . . ." Support is also given for science information activities and for polar research centers. Investigations involve scientists from universities, Federal research laboratories, non-profit research institutions, and industrial research laboratories. "Approximately 200 scientists," according to the Foundation, "are in the field each austral summer:"

> Twenty-five to 30 scientists conduct the year round investigations at the four U.S. Stations: McMurdo, South Pole, Siple, and Palmer. Another 40–50 investigators and their assistants are engaged in ocean-related research aboard the research vessels *Eltanin* and *Hero*, and in the United States, data analysis and

[274] Research support totaled $24.0 million; $19.74 million was used for the purchase of three ski-equipped LC-310 airplanes for use in the Antarctic Program. (*1974 National Science Foundation Authorization: Hearings*, op. cit., pp. 167–167 and 191.)

[275] On this topic see a preceding study in this series: *The Political Legacy of the International Geophysical Year*.

[276] "Twelve Nations Sign Treaty Guaranteeing Nonmilitarization of Antarctica and Freedom of Scientific Investigation," *Department of State Bulletin* (December 21, 1969), pp. 1–7.

[277] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., pp. C-30–31.

interpretation, map making, specimen-sorting operations and curatorial services, and other related activities engage approximately 150 workers at any given time throughout the year.[278]

In annual reports and presentations before the Congress, the Foundation has described how Antarctic research involves international collaboration and exchanges of scientists. As an example, the Foundation reports that in 1970–1971:

> Scientists from Argentina, Chile, the United Kingdom, the U.S.S.R. and the United States conducted a joint expedition to Deception Island to study the results of the recent eruptions of that volcanic island. The Research vessel *Hero* . . . carries out research cruises in the waters of Tierra del Fuego as well as the Antarctic Peninsula. In these efforts we have Argentine and Chilean scientists aboard working with ours. The research vessel *Eltanin* regularly accommodates Australian, French, and New Zealand researchers, as well as other foreign scientists.[279]

The Foundation credits the program with developing measures for the preservation of flora and fauna, tourism policies for the Antarctic, and mechanisms to disseminate information about research results. Politically, "The Antarctic Treaty has served as a model for the Treaty on Outer Space and for discussions of an international agreement on the use of the seabed." [280]

Table 21 gives NSF data listing Americans who visited foreign stations on the Antarctic continent or foreign ships to carry out collaborative research with scientists from the United Kingdom, Japan, the U.S.S.R., Argentina, and France. U.S. scientists participating in the program, according to the NSF Officer for Polar Programs, are generally part of a small "school" of U.S. South Polar specialists. Because of the isolation which must be endured for long periods of time, only a few individuals are interested in studying the Antarctic. Potential grantees are personally interviewed before being admitted to the program. In some cases they are required to take the U.S. Navy Submarine physical and psychiatric exams to evaluate their ability to withstand the extreme conditions found in the South Polar Region.[281]

TABLE 21.—AMERICAN PARTICIPATION IN FOREIGN EXPEDITIONS IN ANTARCTICA, FUNDED BY NATIONAL SCIENCE FOUNDATION, 1960–70

	Number of individuals	Number non-governmental	Total amount of grants (in dollars)
Year:			
1960	1	1	27,900
1961	1	0	66,960
1962	1	1	43,400
1963	1	1	28,400
1964	3	2	47,300
1965	4	2	69,600
1966	3	2	52,500
1967	1	1	45,500
1968	7	5	64,100
1969	3	2	69,500
1970	3	2	32,800

Source: Data supplied by Office of Polar Programs, NSF. Details on project, foreign site, and name of grantee are available.

[278] Ibid., p. C-31.
[279] *International Cooperation in Space and Science: Hearings*, op. cit., pp. 117–123.
[280] *1971 National Science Foundation Authorization: Hearings*, op. cit., p. 196.
[281] Supplied by Walter R. Seelig Associate Program Manager International and Cartographic Affairs, Office of Polar Programs, NSF, April 1, 1971.

Americans who are located at foreign research stations are given language training, if necessary. Their participation must be approved by the foreign host country, as in bilateral science agreements. And unique among U.S. nongovernmental scientific programs abroad is the requirement for American polar researchers to consult with the USIA to obtain informational media to show to his foreign colleagues. Reports are required on both technical and living conditions.[282]

National Research Centers

National Research Centers have been established for research in areas of science requiring specialized facilities, equipment, staffing, and operational support beyond the capabilities of existing educational and research institutions. Federal support, according to the Foundation, is required because of the high initial facility and equipment costs and the need to make these facilities available on a national basis.[283]

Under this program the Foundation provides support for the National Astronomy and Ionosphere Center (NAIC) at Arecibo, a center specializing in radio and radar astronomy and aeronomy; the National Radio Astronomy Center (NRAO); two optical astronomy centers, the Kitt Peak National Observatory (KPNO), and the Cerro Tololo Inter-American Observatory (CTIO); and a National Center for Atmospheric Research (NCAR). Non-profit organizations or universities operate and manage these research centers under contract with the Foundation. (See Table 22).

[282] Interview Seelig, op. cit., Additional details on U.S. scientists who have served at foreign research stations in the Antarctic may be found in: "International Cooperation, 1968–1971," *Antarctic Journal February 25, 1971.*)

[283] NSF, *Justification of Estimates of Appropriations, FY 1973*, op. cit., p. D–1.

TABLE 22.—NSF NATIONAL RESEARCH CENTERS—FUNDS AWARDED BY NSF AND PERSONNEL

National Research Center	Type of research	Location of major facilities	Contractor	Fiscal year— 1973 estimate Amount	1973 estimate Personnel	1972 estimate Amount	1972 estimate Personnel	1971 actual Amount	1971 actual Personnel	1970 actual Amount	1970 actual Personnel	1969 Actual
National Astronomy and Ionosphere Center (NAIC).	Radio and radar astronomy and aeronomy.	Arecibo, P.R.	Cornell University (CU)	3,300,000	78	4,000,000	78	6,098,600	75	1,550,000	73	----------
Kitt Peak National Observatory (KPNO).	Stellar, solar, and planetary astronomy.	Kitt Peak, Ariz.	Association of Universities for Research in Astronomy, Inc. (AURA).	8,221,000	228	7,720,000	212	7,219,600	210	6,465,000	205	5,699,510
Cerro Tololo Inter-American Observatory (CTIO).	Stellar and planetary astronomy.	Cerro Tololo, Chile.	do	2,700,000	49	2,500,000	47	2,280,000	38	1,900,000	30	4,550,000
National Radio Astronomy Observatory (NRAO).	Radio astronomy	Green Bank, W. Va.	Associated Universities Inc. (AUI).	10,270,000	92	7,058,000	92	6,897,400	85	5,855,000	80	7,278,214
National Center for Atmospheric Research (NCAR).	Atmospheric sciences	Boulder Colo.	University Corporation for Atmospheric Research (UCAR).	18,100,000	270	19,200 000	266	14,758,906	243	11,441,800	222	11,036,737

Source: Data on personnel are from: NSF, "Justification of Estimates of Appropriations, Fiscal Year 1973," op. cit., passim, Financial data for fiscal years 1969 and 1970, from: NSF, "Annual Report, Fiscal Year 1971," op. cit., p. 45. Data for fiscal years 1971, 1972, and 1973, are from: NSF, "Justification of Estimates of Appropriations, Fiscal Year 1973," op. cit., p. D-1.

In connection with their work, U.S. nongovernmental scientific and technical personnel attached to the Centers are sent abroad to attend meetings, conduct research, consult with their foreign counterparts, or survey foreign sites. They are supported by NSF contracts for the operation of these programs. No published data are available on the foreign and international activities of these centers. In support of this study, the Congressional Research Service, in cooperation with NSF, in 1971, surveyed the foreign activities of the staff.[284]

Selections from the data obtained, Table 23, indicate that foreign activities play an important role in the operations of these centers, both in numbers of foreign visitors who participate in domestic operations and in the numbers of U.S. staff visits to other countries. These activities have increased since fiscal year 1960; but their cost is low in comparison with the total annual operating budget of each center and with the available staff man-hours. Usually neither the Director of the center nor the Foundation typically requires reporting to indicate the significance of foreign and international implications. Most of the visits are to Europe and the United Kingdom; research often takes staff members of the centers to other areas of the world including South America, the Pacific, and the Far East.

[284] Conducted with the cooperation of Mr. Daniel Hunt, head of the Office of National Centers and Facilities Operations, NSF. The following questionnaire was used:

"Would you please provide us with the following information pertinent to your National Research Center. For the time period 1960–1970, please list:

name of scientist who went abroad;
project title;
amount of funding;
foreign destination;
length of time abroad;
criteria for selection of this scientist; and
reporting requirements (both living conditions and scientific activities)."

TABLE 23.—NATIONAL RESEARCH CENTERS, FOREIGN TRAVEL, 1965 AND 1970

	1965				1970			
	Number of scientists	Man-days abroad	Destinations	Funding	Number of scientists	Man-days abroad	Destinations	Funding
NCAR	55	863	South Pacific, Europe, South America, Canada, Far East.	(1)	107	1,884	Europe, South America, South Pacific, Canada, Far East.	(1)
KPNO	14	232	England, Europe, Argentina, Tahiti	$15,900	21	252	England, Europe, Canada, Chile	$18,100
NRAO	6	184	Europe	7,727	17	333	Europe, U.S.S.R	14,360
CTIO	(2)				5	44	England, Europe, Argentina	3,500
NAIC (Arecibo Observatory)	(3)				12	283	Europe, England, Jamaica	6,656

[1] Not available.
[2] No travel 1965.
[3] No travel data submitted for 1965.

Sources: Data on NCAR: Letter Edwin L. Wolff, NCAR to Mr. Daniel Hunt, Head of Office of National Centers and Facilities Operations, NSF, Mar. 23, 1971; KPNO: Letter James M. Miller Associated Director, Administration, KPNO, to Mr. Daniel Hunt, Head, Office of National Centers and Facilities Operations, NSF, Mar. 25, 1971; NRAO: supplied by Mr. T. R. Riffe, Assistant to Director, Administration, in letter to Mr. Daniel Hunt, NSF, Mar. 19, 1971; CTIO: Letter by Mr. James M. Miller, Associate Director, Administration, to Mr. Daniel Hunt, NSF, Mar. 25, 1971; and NAIC: Letter from Mr. Eugene F. Bartell, Arecibo Project Office, Cornell University, in letter to Mr. Daniel Hunt, NSF Mar. 29, 1971. Many of the respondents also supplied detailed data for each visit for years since 1960.

International Science Education Programs of NSF

To provide a precise and accurate history of the Foundation's activities in support of "international science education" is difficult; several different offices have supported many activities for international science education or what the Foundation calls "international science education-related activities." These are reported to Congress and are programmed under a variety of different categories, including "International Science Activities." [285]

Basically, NSF supports two types of international science education activities: (1) programs described under the category of international science education, and (2) programs which enable Americans to study, research, and teach abroad as part of NSF's domestic mission.

DEVELOPMENT OF SCIENCE EDUCATION IN FOREIGN COUNTRIES

Support and development of programs to develop science education in foreign countries began in 1959. They have been experimental in nature, subject to the use of counterpart funds, and not fully crystallized. Their initiation corresponded with congressional passage of P.L. 86–232, which broadened the Foundation's authority to participate in international scientific activities, permitting NSF to start some cooperative programs in which a two-way flow led to exchanges benefiting both American and foreign scientists.

When the Foundation's programs began in 1959, they were justified under the limited Congressional mandate authorizing NSF to support science activities to strengthen American science. They were not intended primarily to support the development of science education in foreign countries. The Foundation explained this rationale in 1960:

> The primary objective of [the international science education activities program] is to strengthen our Nation's total scientific effort through improved programs of science education by providing American scientists and educators with the opportunities to join their foreign colleagues in endeavors that may prove of great value in raising the quality of science education in the United States. At the same time these program activities may result in raising the standards of education in the sciences throughout the Free World. . . . These activities are experimental in design.[286]

AID-Funded Activities.—Due to the success of NSF experiences in supporting improved methods of teaching science in the United States, the Agency for International Development (AID) and its predecessor, the International Cooperation Administration (ICA), have transferred funds to NSF to administer technical assistance and science education-oriented projects to assist in building a science infrastructure and science education base in several developing countries. Small numbers of American scientific and technical personnel have been sent abroad under these programs.

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[285] Usually data describing fellowships tenable abroad are reported under the Science Education program; NATO fellowships and travel grants under International Science Activities (because of collateral funding); Senior Foreign Scientist Fellowships under Education; Soviet-American exchanges under International Information Exchanges; travel grants to Americans under International Information Exchange (except if the awards supported travel to educational conferences); and foreign educators to the United States under collateral funding or International Science Education Activities. NSF annual reports have included reports of other activities under the category of international science education. Under this category, in 1960, the Foundation reported on U.S. scientific participation in the Organisation for European Economic Co-operation, (p. 134). Activities under the Lacy-Zaroubin agreement for the Soviet Union were included under Curricula Development Programs in the Annual Report, 1959. Translation activities were included under International Science Education in the *1960 Annual Report* (p. 135). In the *Annual Report, FY 1966*, under education-related support, the Foundation described activities under the Soviet-American exchange program, NATO Advanced Study Institutes, international travel grants, and visits of foreigners to the U.S. (p. 126).

[286] NSF, *Annual Report, 1960*, op. cit., p. 134.

Early Foundation programs recruited U.S. scientific and technical experts for assignments in the countries of the Far East and Europe. These arrangements began in 1957 under terms of a participating agency service agreement (PASA) with funds transferred from the ICA. During the 1960s the Foundation administered two similar programs with funds transferred from AID. The NSF program for Regional Development of the Universities of Central America was operative from 1963 to 1969; American participants numbered 23.[287] The Latin American Science Education Project involved seminars of Americans and Latin Americans to improve the curricula of science education. A total of 127 Americans were sent to Latin America under this program from 1966 to 1968, when the program was terminated.[288]

Cooperative Program for the Improvement of Science Education in India.—Of the three AID-funded activities, the only one which is still functioning is the Cooperative Program for the Improvement of Science Education in India.[289] This program will be summarized.

Under an agreement with the Government of India, AID began a program jointly funded with India in 1963 to improve Indian scientific and technical education. AID had let contracts to four American universities to design and administer a program to provide American consultant teachers for a program of Summer Institutes for Indian secondary school and college teachers. Dissatisfied with the results of these contracts, AID asked NSF in 1966 to assume administrative responsibility for the program. Transfer of responsibility was designed to provide a more effective program, to broaden the availability of consultants, to provide consultants year round, and to develop follow-up programs.[290]

In 1966 a series of high-level conferences of Indian and U.S. scientists, educators, and administrators, with NSF representation, was held to revamp the program.[291] Under the terms of the resulting PASA Agreement, which is renewed annually, the Foundation agreed to provide U.S. scientists and engineers to staff an NSF liaison office in New Delhi, to participate in teacher training programs, or to serve as advisors for equipment, institutional, and curriculum development phases of the agreement. From 1967 to 1970, 591 American consultants participated in the program.[292] According to Gordon Hiebert, NSF program director, the program has attracted a large number of highly qualified individuals. Americans in the program included elementary school teachers, school administrators, high school science teachers, college professors, government and industrial scientists, and Nobel laureates.

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[287] Data supplied by Office of International Programs, National Science Foundation.

[288] Data from *Inventory of Federal Programs . . .*, op. cit., p. 333, and interview with Dr. Duncan Clements, Office of International Programs, NSF, February 1971.

[289] The NSF initiated another AID-funded program in April 1973: Scientists and Engineers in Economic Development (SEED), administered by OIP. Under NSF grants totaling $184,895, 29 American scientists and engineers will teach and conduct research in 17 countries in Africa, Asia, the Caribbean, and Latin America. See: NSF, "Grants To Aid Developing Countries Awarded U.S. Scientists and Engineers." NSF Press Release, April 20, 1973 (NSF 73-141).

[290] U.S., National Science Foundation, "India Program." In-house memo, non-dated, p. 2. Legislative authority: P.L. 87-195, Foreign Assistance Act of September 4, 1961, as amended; additional data from Interview with Gordon Hiebert, in charge of U.S.-Indian Cooperative Program for the Improvement of Science Education in India, Office of International Programs, February 26, 1971; and "NSF Program in India," *Science Education News* (May 1968).

[291] Present among the American representatives were Dr. Donald Hornig, Science Advisor to the President, and Dr. Arthur Roe, head of the Office of International Science Activities, NSF. ("U.S.-Indian Cooperation to be Expanded in Science Education," NSF News Release, May 3, 1966, NSF-66-120.)

[292] U.S., National Science Foundation, "NSF/AID India Program—Preliminary Fact Sheet," August 17, 1970, and "Cooperative Program for the Improvement of Science Education in India; Information for Consultations," Prepared by Office of International Programs, NSF, January 1970, 16 pp.

Participants are selected and funded according to AID administrative procedures. Internal NSF review committees evaluate credentials; prospective consultants receive a low-level security check [293] and must be approved by the Civil Service Commission, the New Delhi office of the Agency for International Development, and the Indian Government.[294] Consultants are authorized air tickets prepaid in foreign currency, some miscellaneous travel expenses and travel per diem, and consultant fees. The Foundation provides each consultant with a detailed information sheet containing information on travel and living conditions. Preparation for consultants includes also a 1–2 day orientation provided by the NSF/New Delhi staff.

The Governments of India and the United States both contribute funds. Indian contributions are in the form of a trust fund set up by the Government. Since initiation of NSF activities in 1966 to 1970 the rupee allotment for the program has totaled the equivalent of U.S. $1,822,168; U.S. AID dollar funding from 1966 to 1971 has totalled $3,451,058.[295]

The NSF believes that the program has been successful. Gordon Hiebert, NSF official in charge of administration, reports that while AID attempted to teach U.S. science in India, the Foundation has developed and taught science education uniquely related to the Indian situation, a more successful approach. Additional program accomplishments were described to the Congress in 1969:

> The follow-up program has the objective of improving the training of teachers of science in India, and improving the materials they use in their teaching. Current and proposed activities include: Establishing better relations between the universities and their constituent colleges (where science teachers are trained), and between the university-college system and the school system; helping Indian scientists write new textbooks in the sciences, mathematics, and engineering; improving laboratory experiments and equipment; and making science films available. . . . Programs have been established to help with the preparation, design, and production of laboratory and demonstration equipment in India from indigenous materials.[296]

The Foundation has found that many of the special curricula developed for India can be usefully applied in the United States and in other countries. For instance, a special program developed to train Indian engineers in entrepreneurship has been adapted in several locales in this country. NSF reports also that many of the Americans who served in the Indian program have later made useful contributions to other AID-financed science education programs: in Nepal, administered by the University of Illinois; in Afghanistan, administered by the Teachers College, Columbia University; and in Malaysia, administered by the American Association for the Advancement of Science.[297]

The American contribution to this cooperative program was cut in 1970. Budget cuts in this country forced suspension of the funding of Americans to participate in the summer institute phase of the program; Indian teachers and scientists have been given complete direction of this activity. Small numbers of consultants will still be recruited to assist with the curriculum development phase of operations.[298]

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[293] Interview with Gordon Hiebert, Office of International Programs, National Science Foundation.
[294] NSF, "NSF/AID Indian Program-Preliminary Fact Sheet," August 17, 1970.
[295] Data supplied by Office of International Programs, NSF.
[296] *National Science Foundation Authorization, FY 1970: Hearings, Vol. II*, op. cit., p. 582.
[297] Interview, op. cit.
[298] Idem. and NSF, *Annual Report FY 1970*, op. cit., p. 95.

NATO-FUNDED ACTIVITIES

The National Science Foundation, in cooperation with the Department of State, administers two NATO civil science programs which send junior and senior scientists abroad. One program is called the NATO Senior Fellowships in Science; the other is the NATO Postdoctoral Fellowship in Science.

NATO Senior Fellowships in Science.—The primary objective of the Program which began in FY 1967, is "to enable universities and nonprofit scientific research institutions in the United States to send senior staff members to study new scientific techniques and developments at research and educational institutions in other NATO nations, or in countries cooperating with NATO." [299] Fellowships are not awarded for support of research or advanced academic study, but only for "advanced training in new specializations, as a means of strengthening the scientific work of U.S. institutions at a graduate or advanced level." [300]

The Division of Graduate Education cooperates with the Department of State in administering the program by evaluating and selecting fellows. Nominees are evaluated by panels of scientists convened by the NSF and appointed by the National Research Council. The following criteria must be met:

—full professional standing,

—at least 5 years experience in research, teaching, or other relevant professional work, and

—the linguistic abilities necessary for profitable discussion with colleagues in the country to be visited.[301]

Awards are made only in selected areas of science: mathematics, physics, medicine, biology, engineering, and social sciences; history and philosophy of sciences; and interdisciplinary work.

Tenures for NATO Senior Fellowships range from one to three months; in unusual circumstances a tenure of less than four weeks or a maximum of six months may be approved. Fellows receive a subsistence allowance and air tourist travel allowances. They are permitted to continue receiving salary or allowances provided by the nominating institution. Awardees are required to do their scientific work in nonprofit scientific institutions in countries, other than the United States, that are members of NATO. In 1970 these countries were: Belgium, Canada, Denmark, France, Federal Republic of Germany, Greece, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Turkey, and the United Kingdom. "Consideration will also be given to applicants who propose to conduct their fellowship activities in other countries that cooperate with NATO if exceptional and compelling reasons warrant it." Fellows are required to submit an activities report at completion of tenure.

Although the program is slowly growing, only a small number of awards ranging between 13 and 36 annually have been made since fiscal year 1967. Gross obligations, as provided by NATO head-

[299] U.S., National Science Foundation, "NATO Senior Fellowships in Science," Program Brochure, 1970-71 (NSF E-70-G-7).
[300] Idem.
[301] Idem.

quarters, totaled about $37,000 in 1967, $27,000 in 1968, and $49,000 and $66,000, respectively, in 1969 and 1970.[302]

NATO Postdoctoral Fellowships in Science.—Under a 1959 agreement, NSF and the Fellowship Office of the National Research Council cooperate with the Department of State in administering the program of NATO postdoctoral fellowships in science. This program is designed to provide for "closer collaboration among the scientists of NATO countries."

Applicants must have a doctoral degree, usually received within the last five years. And they must demonstrate a special aptitude for advanced training or postdoctoral study in the following eligible fields: mathematics, physics, medicine, biology, engineering, social sciences, history, philosophy of sciences, and interdisciplinary research. As in the case of the NATO Senior Fellowship Program, fellowships are not awarded for support of work toward an advanced degree nor for residency training, clinical work, or work in education or business, social work, diplomacy, history, or law.[303]

Applicants are evaluated by panels of scientists appointed by the National Research Council; final selection is made by the Foundation. Language skills are considered; applicants must be accepted for study by the foreign institution before a fellowship is awarded, and applicants must sign an oath or affirmation attesting to allegiance to the United States. Special consideration is given to promoting projects involving international scientific collaboration.[304]

Postdoctoral fellowships are normally awarded for a tenure of either 9 or 12 months in a nonprofit scientific institution in a NATO member country or in a country which cooperates with NATO. Fellows are given stipends, dependency allowances, round trip air travel and a special $150 stipend. There is little public information describing activities under this program; for the fiscal years 1968 to 1970 annual awards numbered 39, 40, 45 and costs ranged from $296,000 in 1968 to $325,000 in 1970.[305]

Advanced Study Institutes.—Each year since 1959, NATO has sponsored a number of international conferences, called Advanced Study Institutes. NSF has supported the international travel of a limited number of U.S. participants to these institutes since 1960.[306] Justification for travel support is based on the U.S. national interest and emphasizes situations in which U.S. participants are "at a disadvantage in obtaining travel support because of the distances involved." [307]

"These meetings," according to the NSF, "are held during the summer for periods ranging from one to eight weeks, [and] provide exhaustive treatment of a particular scientific topic by scholars of

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[302] U.S., National Science Foundation, Division of Graduate Education in Science, *Fiscal Year 1970 Activities Report*, limited distribution, 1969, p. 42. Annual reports of the Division also give data on grantees, subject specialization, tenure, and location of award.

[303] U.S. National Science Foundation, "NATO Postdoctoral Fellowships in Science," Program brochure, 1970, NSF E-70-G-2.

[304] Idem.

[305] Data for FY 1968 are from: U.S., National Science Foundation, Division of Graduate Education in Science, *Annual Report, Fiscal Year 1968*, p. 12. Data for FY 1969 are from: U.S., National Science Foundation, Division of Graduate Education in Science, *Annual Report Fiscal Year 1969* (1969), pp. 32–33. Data for FY 1970 are from: U.S., National Science Foundation, Division of Graduate Education in Science, *Fiscal Year 1970 Activities Report*, for limited distribution. (1969), pp. 42–3. Note: In each of the above instances, data are from Division files and may not be the same as to official reporting data.

[306] According to a 1970 NSF announcement: "No provision is made at the present time for travel grants to U.S. lecturers at these Institutes." Division of Graduate Education in Sciences, "National Science Foundation. NATO Travel Grants," (1970), 1 p.

[307] Division of Graduate Education in Science, *Annual Report, FY 1969*, op. cit., p. 34.

international reputation." [308] The Institutes are chaired and organized by an individual scientist who has received program approval and funds from NATO. The audience normally is composed of "student participants," who typically are advanced graduate students or young postdoctorals. Announcements of NATO Advanced Study Institutes appear in appropriate professional journals.

The Division of Graduate Education in Science administers the program through awards to the Directors of the Institutes who select travel grantees. NATO ASI awards normally cover only the cost of round-trip jet-economy air fare between the applicant's point of origin and the ASI.

The Foundation considers the NATO ASI program to be ". . . one of the NATO's most successful cooperative scientific endeavors. [As of FY 1968] more than 3,500 scientists, now participate annually in these Institutes, and it is estimated that the proceedings of about two-thirds of the Institutes appear in book form." [309] The Foundation has awarded 700 travel grants for this program between the fiscal year 1960, when it began, to 1970.[310] Reporting on the program is similar in its uneven quality to NSF reporting on other exchange programs; there are no readily available in-house or published data describing the number of individuals supported and amount of funds awarded each year. However, the number of awards made by the Foundation, has apparently remained stable for the last ten years: approximately 60–80 travel awards, at a cost ranging from $30–50 thousand per year. (See Table 24.)

TABLE 24.—NSF-NATO TRAVEL GRANTS FOR ADVANCED STUDY INSTITUTES.

Fiscal year	Number of travelers	Number of NATO institutes	Number of institutes supported by NSF	Cost
1961 [1]	54			$30,569
1966 [2]	66			41,755
1967 [3]	72			41,138
1968 [4]	77	46	31	42,351
1969 [5]	83			43,657
1970 [6]	73			37,474
1970 [7]	66			34,743

[1] Data for fical year 1961: compiled from NSF 1961 annual report, op. cit.
[2] Data for fiscal year 1966 from: "Inventory of Federal Programs Involving Educational Activities Concerned with Improving International Understanding and Cooperation," op. cit., p. 355.
[3] Data for fiscal year 1967 from: "Inventory of Federal Programs Involving Educational Activities Concerned with Improving International Understanding and Cooperation," op. cit., p. 355.
[4] Data for fiscal year 1968 from: U.S. National Science Foundation, Division of Graduate Education in Science, "Annual Report, fiscal year 1968," op. cit., p. 12.
[5] Data for fiscal year 1969 from: U.S. National Science Foundation, Division of Graduate Education in Science, "Annual Report, fiscal year 1969," op. cit., p. 34.
[6] Data for fiscal year 1970 from: U.S. National Science Foundation, Division of Graduate Education in Science, "Activities Report, fiscal year 1970," op. cit., p. 44.
[7] Data for fiscal year 1970 compiled from: U.S. National Science Foundation, "Grants and Awards, 1970, 1971," pp. 90–99, (NSF publication 71-2).

Note: Division of Graduate Education reports give name of grantee, cost of grants, and name and location of Institute. Annual reports data do not separately report awards for NATO-ASI awards. They must be found by searching through the awards generally reported for international travel.

[308] *Inventory of Federal Programs Involving Educational Activities Concerned with Improving International Understanding and Cooperation* op. cit., p. 355.
[309] Division of Graduate Education in Science, *Annual Report, FY 1968*, op. cit., p. 12.
[310] "Questionnaire on Government Exchange Programs." Prepared by Division of Graduate Education in Science, NSF for The Exchange Study. NATO Travel Grants, Program Code No. 703, response to question 1 (1).

"Fellows are required to submit terminal reports . . . describing their activities and accomplishments and evaluating the program." [311] The Foundation does not transmit these reports to other U.S. Government agencies which maintain science programs or attachés abroad. No predeparture orientation is provided. According to the Foundation, the only significant problems faced by recipients of NATO travel grants have been in finding adequate housing while abroad.[312]

INTERNATIONAL TRAVEL GRANTS FOR SCIENCE EDUCATION

The NSF International Travel Grants program in Science Education differs from the regular NSF International Travel Grants program in that it supports only international travel for science education.[313] The purpose of the program "is to assist U.S. educators to enhance their capabilities to contribute to science education in the United States." Individuals or organizations are eligible to receive these awards. They support U.S. attendance at international conferences of educational societies or international organizations they may also be used to support U.S. educators visiting foreign universities and educational laboratories. Authorization for such grants may be made by the following agencies of the Foundation: the Office of Science Information Service, International Science Activities, Computing Activities; and the following Divisions: Biological and Medical Sciences, Engineering, Mathematical, and Physical Sciences, Environmental Sciences, and Graduate Education. The Division of Graduate Education in Science administers the Program on behalf of the Foundation.[314]

Any U.S. scientist, including Federal employees, may apply directly to the Foundation for an international travel grant for education.[315] International travel grants applicants must "indicate how the proposed travel would relate to science education or to the exchange of information about science education, and how it would enhance his individual contribution to science education in the United States." The grant is limited to round-trip jet-economy air fare between the applicant's home or institution and his foreign destination; grantees are required to travel by U.S.-flag carriers.[316] Recipients of such grants, like recipients of other NSF international travel grants, must submit a "brief fiscal report on . . . use of the grant funds and a brief narrative report describing the accomplishments of [the] trip." [317]

The program began in 1966; it has remained a low-level activity since that time (at the level of approximately $2–3 thousand annually);[318] but increases in the program in fiscal year 1970 to $13,000 indicate that it may assume greater importance.[319] From 1966 to

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[311] "Questionnaire on Government Exchange Programs." Prepared by Division of Graduate Education in Science, NSF, for the CU Exchanges Study (1970).

[312] Idem.

[313] Legislative authority: Public Law 81-507, National Science Foundation Act of 1950, as amended, 42 USC 1861-1875.

[314] U.S., National Science Foundation, "International Travel Grants for Science Education." Program announcement, May 1969, 2 p.

[315] Applications from Federal employees are considered only when: "The applicant has permission from his agency to undertake the travel; funds are not available from the agency to support the travel; and the travel is not expected to contribute directly to the mission of the agency." ("International Travel Grants for Science Education," op. cit.)

[316] Idem.

[317] Idem.

[318] Data for 1966, 1967 and 1968 from *Inventory of Federal Programs . . . op. cit.*, pp. 357–8; Data for 1969 are from NSF, Division of Graduate Education in Science, *Annual Report, FY 1969*, op. cit., pp. 44, H-1.

[319] NSF, Division of Graduate Education in Science, "Fiscal Year 1970, Activities Report," pp. 54; G-1-3.

1970 the Foundation awarded approximately 50 individual travel grants. The bulk of the conferences supported have been in Western Europe.[320]

According to NSF, no special preparation or counseling is given to these grantees to participate in international science education meetings; no problems have arisen with the program; and no provisions are made for providing reports of these activities to other U.S. agencies with similar domestic or foreign missions.[321]

International Education Activities as Part of Domestic Mission

U.S. scientists and technical personnel have traveled, studied, and done research abroad under provisions of the National Science Foundation Act of 1950, as amended, which permits the award of NSF fellowships for scientific study or scientific work, tenable at any appropriate nonprofit U.S. or non-profit foreign institution.[322] Four types of fellowships, tenable in either this country or abroad, are available.

(1) *Senior postdoctoral fellowships.*—"designed for experienced scientists who have demonstrated marked ability and special aptitude for productive scholarship in the sciences and have achieved recognized stature in their profession;" usual tenure is 9 or 12 months, with a normal Foundation stipend of $1,250 per month, supplemented by salaried income from institutions to match normal salary.[323]

(2) *Postdoctoral fellowships.*—primarily for young scientists who have demonstrated special aptitude for advanced training, with a usual tenure of 9 or 12 months, and a normal stipend of $6,500 for 12 months.[324]

(3) *Graduate fellowships.*—for study leading to master's or doctoral degree for students who have demonstrated ability and special aptitude for advanced training in the sciences; normal tenure for 9 or 12 months with a 12-month stipend ranging from $2,400 to $2,800.[325]

(4) *Science faculty fellowships.*—to enhance the teaching capabilities of junior college, college, and university science teachers; normal tenure of 9 or 12 months, with a stipend based on normal salaried income but not to exceed $15,000 for a 12-month period.[326]

Each of these fellowship programs is funded by the NSF Division of Graduate Education. Awards are made for study or training in mathematics; physical, medical, biological, engineering, and social sciences; the history and philosophy of science, and interdisciplinary science. Awards are not made in education or business fields, nor in history or social work. With the exception of the graduate program, awards are not made for study leading to a higher academic degree.

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[320] *Inventory of Federal Programs, . . .* op. cit., p. 357.

[321] "Questionnaire on Government Exchange Programs." Program Code 711. "International Travel Grants for Science Education." Prepared for CU Exchanges study.

[322] The Foundation's authority reads: "[The Foundation is directed] to award . . . scholarships and graduate fellowships for scientific study or scientific work in the mathematical, physical, medical, biological, engineering, and other sciences at appropriate nonprofit American or non-profit foreign institutions" (Sec. 10). Legislative authority: P.L. 81-507, National Science Foundation Act of 1950, as amended, 42 USC 1861-1875.

[323] U.S., National Science Foundation, "Senior Postdoctoral Fellowships, brochure, 1970," E-70-G-8.

[324] U.S., National Science Foundation, "Postdoctoral Fellowships," brochure, 1970," E-70-G-3.

[325] U.S., National Science Foundation, "Graduate Fellowships," brochure, 1970, C-70-G-4.

[326] U.S., National Science Foundation, "Science Faculty Fellowships for the Improvement of College Science, Mathematics, and Engineering Teaching, brochure, 1970," E-70 G-1.

Individuals who apply for these awards and who want to study in a foreign institution use the same application procedure [327] as for awards tenable in domestic institutions. Evaluation procedures are similar: senior postdoctoral, postdoctoral, and graduate applications are evaluated by panels convened by the National Research Council; science faculty applicants are evaluated by scientific panels appointed by the Association of American Colleges.[328] Applicants must include "the duly executed Oath of Affirmation" required by Section 15(d) of the National Science Foundation Act of 1950. In addition, awards are subject to the geographic distribution requirements the Foundation imposes.

Fellowship awards tenable abroad differ in three ways from those tenable domestically: grantees are also given travel expenses and a nominal stipend for equipment and research; applicants must specify what particular scientific benefits will accrue from study at a particular foreign institution, and applicants must be admitted at the foreign institution prior to applying for the award.

Issues surrounding the programs for the award of NSF fellowships abroad have not been discussed in depth in either authorization or appropriations hearings or in NSF annual reports. The Foundation does include detailed information on awards for these programs in Annual Reports. (See Table 25.) Similarly, the Division of Graduate Education in Science provides statistical information in in-house annual reports. (See Table 26.) Some information on operational questions was provided by NSF in response to the State Department questionnaire on Government exchange programs. Data in these three information sources generate the following observations:

—since the program began in 1952 (until 1970), the Foundation has awarded 2,790 fellowships which were used overseas for the four programs;

—the majority of fellows who study abroad do so in Europe, especially the United Kingdom, followed by France, Germany, and Switzerland;

—of the four programs, the one with the fewest number of fellowship holders who elect to study abroad is the graduate fellowship program, where 2 percent or fewer of grantees annually have gone abroad.

—science faculty fellows average foreign study at the rate of 10 percent per year. Postdoctoral and Senior postdoctoral fellowship holders evidence greatest interest in foreign study. Approximately one-half to one-third of postdoctoral fellows have elected to study abroad since the program began; the percentage has been decreasing in the last several years. About 75 percent of the postdoctoral fellowships awarded each year are for study abroad.

[327] "The evaluation of applicants will be based on their ability as evidenced by letters of recommendations, previous scientific accomplishments and other indicators of scholarly activity, and on the proposed plan of study or research. The appropriateness of the fellowship's institution for the proposed plan of study or research will also be considered."

[328] Applications for postdoctoral and graduate fellowships are made directly to the Fellowship Office of the NRC which directly administers the program.

TABLE 25.—NSF FELLOWSHIP AWARDEES, FOREIGN TENURE

	Fiscal year—											
	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Total
Western Europe:												
Austria	3	2	2	1	4		1	1			1	15
Belgium	3	5	2	2	4	7	3	1	3	2	2	34
Denmark	10	16	10	11	12	10	4	3	5		5	82
Finland	1							1			1	3
France	28	37	26	25	38	29	28	18	14	3	4	250
Germany	21	31	30	27	26	15	21	12	8	9	7	207
Greece	1				5	1						7
Iceland							1					1
Italy	9	12	5	8	8	11	11	5	4	2	1	76
Netherlands	9	4	9	9	9	9	9	8		2	4	72
Norway	3	5	4	2	1	5	1	2		1		24
Spain		1	2		1							4
Sweden	15	9	11	14	8	9	11	1	7		3	88
Switzerland	8	26	22	16	19	25	30	6	10	9	12	183
England	62	83										145
Ireland	1											1
Northern Ireland								2				2
Scotland	2	6				1	5	3				17
United Kingdom			275	274	246	88	97	75	72	55	76	1,258
United Kingdom, total	65	89	275	274	246	89	102	80	72	55	76	1,423
Eastern Europe:												
Rumania					1							1
U.S.S.R.						2	1				2	5
Yugoslavia						1	1				1	3
North America:												
Canada		2	5	14	6	7		9	11	6	4	64
Bermuda											1	1
Latin America:												
Argentina				1			1					2
Brazil	1			1		1						3
Costa Rica					1							1
Chile				1		1	1					3
Ecuador		1										1
Mexico				2		1	1	1	2			7
Peru	1						1					2
Africa:												
British West Africa	1						2				2	4
East Africa				1								1
Malagasy Republic			1									1
Nigeria	1											1
Senegal						1						1
Uganda			1									1
Union of South Africa					1	2						3
Mid-East and South Asia:												
India	1		3	1				1				6
Iran		1										1
Israel	4	7	13	6	5	11	9	2	8	2	4	71
Lebanon				1								1
Malaysia					1	1		1				3
Turkey										1		1
East Asia:												
Australia	5	5	7	8	14	7	11	6	6	4	6	78
Japan	5	4	1	3	3	2	3	3	4	1		29
New Zealand	1	1	3	3	2	4	1	1		3	2	21
Taiwan						1						1
Annual total	196	257	432	431	415	252	254	162	154	99	138	2,790

Source: Data figured from NSF annual reports and grants and awards books, fiscal years 1960–70. Data given by NSF differentiate between fellowship awards for graduate, postdoctoral, senior postdoctoral and science faculty. These categories are combined in this listing. Figures for United Kingdom were not reported in consistent fashion and at times were extrapolated and summed. Regional categories were prepared by the author.

TABLE 26.—NSF FELLOWSHIPS TENABLE ABROAD, FISCAL YEARS 1960–70

Fiscal year	Number of awards made	Number of awards made tenable in foreign institutions	Percent of awards made tenable in foreign institutions
Graduate fellowships:			
1960	1,200	24	2.0
1961	1,537	20	1.3
1962	1,761	34	1.9
1963	1,880	47	2.5
1964	1,900	33	1.7
1965	1,934	27	1.4
1966	2,500	40	1.6
1967	2,450	39	1.6
1968	2,500	42	1.7
1969	2,500	38	1.5
1970	2,582	30	1.2
Postdoctoral fellowships:			
1960	180	90	50.0
1961	235	125	53.0
1962	245	134	55.0
1963	245	124	51.0
1964	240	110	46.0
1965	229	108	47.0
1966	230	111	48.0
1967	150	63	42.0
1968	120	45	37.0
1969	130	47	36.0
1970	169	54	32.0
Science faculty fellowships:			
1960	285	22	7.7
1961	285	36	12.6
1962	325	33	10.0
1963	325	31	9.5
1964	325	27	8.3
1965	325	42	13.0
1966	326	35	10.7
1967	250	15	6.0
1968	223	23	10.3
1969	212	14	6.0
1970	212	17	8.0
Senior postdoctoral fellowships:			
1960	75	62	83.0
1961	91	74	81.0
1962	95	74	78.0
1963	95	72	76.0
1964	96	76	79.0
1965	98	70	71.0
1966	95	70	74.0
1967	65	51	78.0
1968	55	41	74.0
1969[1]			
1970	58	36	62.0

[1] No competition in 1969.

Sources: Data on number of applicants and number of awards are from charts prepared by Division of Graduate Education in Science, NSF: "Distribution of Fellowship and Traineeship Awards Applied For and Offered, Fiscal Years 1952–70," prepared June 30, 1970; data on number of awards made tenable in foreign institutions are from: NSF annual reports, fiscal years 1960–70; percentages figured from data given.

The numbers of awards for fellowships abroad in the four program areas has decreased since the height of the program in the mid-sixties (probably due to the balance of payments problems).

Financial data are not reported separately for these awards in hearings. The only readily available information on funding for these foreign aspects of the four programs comes from the U.S. Office of Education study, which gives the following figures for the fiscal years 1966, 1967, and 1968, respectively: $2,201,705; $1,365,866; and $1,291,000.[329] According to NSF, fellows sent abroad under this activity are not given any special "kind of preparation, counseling, orientation, and language training" before departure. The only attempt made to enhance communication between participants is that "Each fellow going abroad is sent a list of all presently abroad or who will be abroad in six months. They are responsible for making their own contacts." No special follow-up is made to secure the Fellows' reactions to the overseas experience or to obtain information on their foreign activities and the results of these activities while abroad. However, "fellows are required to submit terminal reports to the Foundation describing their activities and accomplishments, and evaluating the program as a whole." Apparently these reports are not used by U.S. missions abroad.

Responding to specific items in the Questionnaire, the Foundation says there are no problems in the administration of the program; the program should be expanded considerably; the Foundation has

[329] *Inventory of Federal Programs . . .*, op. cit., p. 351.

no knowledge of how the fellows' performance varies with the special conditions of the foreign country or institution. The only difficulty known to the Foundation relates to "finding adequate housing." [330]

Conclusions: Some Illustrative Questions of Policy

The bulk of the Nation's programs in support of U.S. nongovernmental scientists abroad are supported by the NSF and are administered either directly by the Foundation or by the National Academy of Sciences with NSF funds. NSF obligations for international scientific activities totaled approximately $118 million in fiscal year 1974; there usually is no accurate information available to estimate the total annual cost of programs which send abroad nongovernmental scientific and technical personnel; most NSF international activities involve such exchanges. These programs include: joint cooperative research; educational fellowships; research awards for domestic activities with funds available for use in foreign scientific activities; technical assistance programs supported with collateral funds awarded by AID; support of scientists for travel to scientific conferences; a variety of bilateral science agreements; and NAS-administered activities, including the program of exchanges with the U.S.S.R. and Eastern Europe; and support of U.S. participation in planning and developing international scientific meetings and programs.

NSF exchange programs send scientists to all areas of the world; their purposes are as widespread as their geographic distribution. Some programs support the accumulation of information to advance American science, or science for its own merits; some promote educational advancement of American and foreign scholars; some facilitate international cooperative research programs; and some serve political objectives through bilateral scientific communication. These programs are increasing in number and importance, with respect to U.S. commitments for both science and foreign affairs.

Two factors constrain NSF foreign science exchange activities: (1) the accumulated effects of the absence, until 1968, of a clearly enunciated mandate for engaging in foreign and international activities; and (2) the need for the Foundation to meet requirements imposed by scientific scholarship to insulate support activities from undue political and governmental interference.

When the Foundation was first established in 1950, the Congress did not give the agency explicit authority for foreign and international scientific activities. Most NSF programs were initiated before the Congress clarified this responsibility in 1968. Thus, they were initiated under the limited authority requiring the Foundation to support, justify, and administer foreign and international activities in terms of supporting the growth of domestic science. Probably as a result, the information presented in this chapter indicates that the Foundation does not seem to have developed clear-cut policies and internal program operations which provide for coordinated administration of these programs. Foreign exchange activities are scattered throughout all NSF divisions. While the Foundation established an office for foreign and international science in 1955, that office, even today, has relatively little responsibility for overseas science programs. The

[330] "Questionnaire on Government-Exchange Programs. Program Code No. 701," NSF fellowship programs for U.S. citizens: Senior Postdoctoral, Postdoctoral, Science Faculty, and Graduate Fellowship Programs. Division of Graduate Education in Science, February 4, 1971.

Office of International Programs directly administers only about 5 percent of the NSF's international and foreign science activities. It does not seem to maintain close liaison with other NSF offices which administer the bulk of these programs. There is little evidence to suggest that the Director of National and International Programs provides these coordinating functions on a continuing basis.

Owing to the Foundation's need to meet the requirements of scientific scholarship, and as a result of the fragmentation of activities, the Foundation has not maintained consistent and appropriate records of its foreign scientific exchange programs. With the exception of the international travel program, one or two cooperative scientific projects, and some bilateral activities, the Foundation generally does not require grantees to report on international or foreign activities. Similarly, except for a small number of programs, the Foundation does not require grantees to meet any special language or other cultural qualifications for the conduct of activities overseas, nor to report to the Foundation on the particular implications, if any, of the conduct of these activities. Only in fiscal year 1970 did the Foundation begin to attempt to collect data, and then in only a perfunctory fashion, on overseas activities undertaken with NSF funds.

Among the more important implications of these factors are the following:

Since the NSF did not keep adequate records on nor consistently report to the Congress on foreign and international scientific activities, it is hard to obtain a valid picture of their scope and evolution;

Fragmentation of support and administration of foreign and international scientific activities, in the absence of any explicit reporting requirements, has kept the Foundation from defining and developing a role as a lead U.S. agency in support of international science and scientific exchange activities. While a number of these programs very probably have advanced the cause of international science and international politics, there is little information on their achievements or impacts. The absence of both data and a mechanism to plan programs on a Foundation-wide basis undermines NSF's responsibility for determining program priorities in both the short- and long-range future. Systematic determination of priorities, both within and among programs seems to be required, since the programs are both increasing and becoming more significant as tools of foreign policy.

A number of NSF programs suffer from poor participation rates by U.S. scientists. These include bilateral agreements for technical assistance or to promote political cooperation. U.S. scientific participation is circumscribed by language barriers and sometimes by insufficient scientific reward. It is conceivable that NSF could design programs which would satisfy more easily criteria for U.S. scientific participation and for country planning needed to develop the science infrastructure of developing countries. For example, the Foundation might insist on better evaluation of the experiences of the programs it supports, better reporting, improve in-house evaluation of reports and of program accomplishments and problems, and more attention to requirements for effective performance.

Programs for foreign and international science funded by the Office of International Programs and other Divisions of the Foundation are rapidly enlarging. In addition, the Foundation's responsibilities for foreign and international science were expanded under terms of President Nixon's Reorganization Plan No. 1, which took effect on July 1, 1973. This action transfers to NSF some Executive Office functions for determining of domestic and foreign science policies and for interagency coordination. It also designates the Foundation's Director as the President's Science Adviser and personal representative for foreign scientific affairs.[331] It is an open question whether the Foundation's organization for foreign and international science can meet the needs imposed by these expanded responsibilities.

Other specific questions might be asked:

Should the Foundation enlarge its overseas science staff?

Should the Foundation evaluate the merits of delegating to the NAS increasing responsibilities in international science?

Should the Foundation improve in-house reporting requirements and coordination of foreign and international activities?

Should the Foundation reestablish the International Science Advisory Committee?

Should the Foundation require more systematic evaluation of its far-flung support activities, especially in examining apparent inadequacies of some bilateral technology-assistance programs?

Should the Foundation provide for more systematic coordination with the activities of the Bureau of International Scientific and Technological Affairs, Department of State?

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[331] "Transfer of OST Functions to Director of NSF," *National Science Foundation News Release* (January 26, 1973), NSF 73-104.

IV. United States and Soviet-Eastern European Inter-Academy Scientific Exchanges

Introduction

The United States and the Soviet Union agreed to the terms of a new bilateral accord for science and technology on May 24, 1972. The agreement, one of a series of four which resulted from the Washington-Moscow summit meetings, augmented previous scientific and technical exchange agreements, including those annexed to biennially renewed cultural relations treaties.[332]

The 1972 accord created a Joint Commission on Scientific and Technical Cooperation to maintain continuing negotiations and joint program planning in order to establish and guide cooperative research projects agreed to in the accord.[333]

The first meeting of the Joint Commission was held in March 1973. It was originally proposed that the President's Science Adviser and the Office of Science and Technology, Executive Office of the President, would provide U.S. administrative support. Under President Nixon's Reorganization Plan No. 1, January 1973,[334] the Director of the National Science Foundation was given responsibility to represent the United States on the Joint Commission.

The first deputy chairman of the State Committee of the Soviet Council of Ministers for Science and Technology was his counterpart at the first meeting. Due to constraints of protocol, the first deputy minister replaced the chairman of the State Committee, who was originally designated counterpart of the President's Science Adviser.[335] Among the programs agreed to at the first meeting were "direct cooperation"—primarily on a Government and agency-to-agency basis—in energy, computer applications to management, agricultural research, microbiological synthesis, chemical catalysis, and water resources.[336]

The 1972 accord for cooperation in science and technology includes provisions for mutually agreed upon joint cooperative research. Thus, it significantly enlarges the scope of previous scientific and technical agreements which supported primarily exchanges of personnel and information. This development and the signing of additional cooperative agreements in applied science and technology fields, in both

[332] Two accords were signed on May 23, 1972: (1) "The Agreement on Cooperation in the Field of Environmental Protection . . ." and (2) "The Agreement . . . in the Cooperation in the Field of Medical Science and Public Health. . . ." In addition to the Science and Technology Agreement, another agreement signed on May 24, was "The Agreement . . . on Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes. . . ."

[333] "U.S. and U.S.S.R. Sign Exchange Agreement for 1972–1973," *Department of State Bulletin* LXVI, No. 1716 (May 15, 1972), pp. 707–713, including text of the agreement.

[334] "Transfer of OST Functions to Director of NSF," *NSF News Release* (January 26, 1973), NSF 73-104, 3 pages.

[335] "U.S.–U.S.S.R. R and D Accord: More, But Not Much," *Science and Government Report* (April 1, 1973), p. 3. On July 1, 1973 the President designated the Director of the NSF as the President's Science Adviser. It remains to be seen whether the chairman of the State Committee of the Soviet Council of Ministers for Science and Technology will participate in future Joint Commission meetings, even though the protocol problem has been removed.

[336] "U.S.–U.S.S.R. Joint Commission Announces Approval of Action Programs for Cooperative Research," *National Science Foundation News Release* (March 21, 1973), 5 pp. (NSF 73-131.)

1972 and 1973,[337] have led many observers to proclaim that the United States and the Soviet Union have taken a first step toward true cooperative scientific relations.

At the same time, however, the new agreements have been criticized on the grounds that their objectives cannot be met unless administrators, diplomats, and scientists overcome the financial, bureaucratic, and political hurdles which have characterized American and Soviet and Eastern European exchanges to date,[338] and unless these recent actions do, indeed, represent a real and continuing effort by the Soviets to engender mutually beneficial cooperation as implied by these apparent moves toward détente and a reordering of priorities toward cooperation with the West.[339]

This section reviews the origin and evolution of the Soviet and Eastern European/American inter-Academy scientific exchange agreements in order to give some perspective and historical background to the history, up to 1972, of the only formal program of nongovernmental scientific exchanges between the United States and the Communist countries.

Scope and Limitations

The political estrangement between the United States and the Soviet Union after 1945 posed insurmountable difficulties for American scientists and technical personnel who wished to study, conduct research, and lecture in the Soviet Union and in Eastern European countries. Before 1959, Americans were not permitted to participate in any scientific activities in the Soviet Union.[340] All Government-

[337] As noted above, the 1972 agreements provide for cooperation in environmental protection, medical science and public health, exploration and use of outer space for peaceful purposes, and science and technology. The June 19, 1973 agreements augment these provisions to include cooperation explicity in studies of the world ocean, agriculture, and transportation. These specific fields of cooperation will be handled separately by appropriate scientific and technical agencies in each country, cooperative research agreed to in the Science and Technology Agreement will be under the overall administration, on the American side, of the Joint Commission. The National Science Foundation has been given authority for handling coordination of the American aspects of the program. Until July 1973 the executive director of the Commission was located in the Office of International Scientific and Technological Affairs, Department of State. Details of implementation are still being worked out. For areas of cooperation see: "General Agreement Between the United States of America and the Union of Soviet Socialist Republics on Contacts, Exchanges, and Cooperation in the Fields of Science, Technology, Education, and Culture, June 19, 1973." *Weekly Compilation of Presidential Documents*, 9, No. 25 (1973), p. 796. Also: "Record of the First Meeting of the U.S-U.S.S.R. Joint Commission on Scientific and Technical Cooperation," Distributed by the National Science Foundation. (1973), 9 pp. plus appendices.

The 1973 agreement also included provisions to support the renewal of the specialized agreements for exchanges between (1) The National Academy of Sciences of the United States of America and the Academy of Sciences of the Union of Soviet Socialist Republics; and (2) the American Council of Learned Societies and the Academy of Sciences of the Union of Soviet Socialist Republics.

[338] For a review of general reactions to the accord see: "The U.S.-Soviet Agreement in Science and Technology," By Claire R. Geier, Science Policy Research Division, Congressional Research Service, Library of Congress, Multilith 72-179 SP, August 10, 1972. The details of the new accords were reviewed by the Subcommittee on International Science and Space, House Committee on Science and Astronautics, in Hearings on the *U.S.-U.S.S.R. Cooperative Agreements* (1972), 208 pp. and in a report issued by the Subcommittee, *U.S.-U.S.S.R. Cooperative Agreements* (August 1972), 28 pp. (Committee Print.) Dr. Philip Handler, President, National Academy of Sciences, whose Office of the Foreign Secretary administers the scientific and technical bilaterals under the cultural exchange agreements, reported to the Subcommittee on possible developments required to insure success of the new accord. His testimony was adapted for an article in the *NAS-NRC News Report* (August-September 1972), "The Moscow Agreements and U.S.-Soviet Scientific Relationships, pp. 8-11.

[339] Nicholas Wade, writing in *Science* magazine has called the new and "vague" 1972 agreements mere "icing on the cake of Soviet-American amity." ("Nixon-Brezhnev Summit: A New Clutch of Compacts." *Science* (July 6, 1973), pp. 38-40. An in-depth evaluation of the political and economic factors surrounding recent Soviet-American expanded cooperation may be found in another study in this series: U.S., Congress, House, Committee on Foreign Affairs, Subcommittee on National Security Policy and Scientific Developments, *U.S.-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer and Diplomacy*, By John P. Hardt and George D. Holliday, 1973. (See vol. I, pp. 525-606.)

[340] Interview, Mr. Lawrence Mitchell, Director, USSR and East European Affairs, Office of the Foreign Secretary, National Academy of Sciences, March 3, 1971. In 1969 Professor Robert Byrnes reported to the Congress: "In 1956, the U.S. had less than ten scholars who had spent an appreciable period of time in the Soviet Union." (U.S., Congress, Senate, Committee on Government Operations, Subcommittee on National Security and International Operations, *International Negotiation: Exchange of Scholars with the Soviet Union: Advantages and Dilemmas: Memorandum*, 91st Cong., 1st sess., 1969, p. 5. [Committee Print.]

funded exchanges between the United States and the U.S.S.R. even today, unlike exchanges with countries of the non-Communist world, are conducted under formal, rigidly enforced, official cultural relations treaties and *quid pro quo* exchange agreements. The first of these was signed in 1959 as an inter-Academy agreement and since then has been renewed every two years and annexed to the biennially renewed Cultural Relations Treaty between the two Nations. (The 1972–1973 Soviet-American accords noted that inter-Academy science and technology agreements were to continue and be renewed in cultural relations treaties.) The 1959 agreement included provisions for the mutual exchange of a small, select number of American and Soviet scientists J. 28–625 Sp. 7 F. 112–120 46-10 nite n 26150 Echino April 8, 1974 to study and do research, but not to lecture. "The commencement of the program," according to Dr. Harrison Brown, Foreign Secretary, National Academy of Sciences, "marked the first real opening in United States-Soviet scientific relations since before World War II. . . ." [341] Brown continues: ". . . The formal exchange program serves as an adaptive mechanism to benefit the scientists of two countries, enabling two basically incompatible systems to mesh at one small interface." [342]

Educational exchange agreements, also part of the Cultural Relations Treaties, place American students and senior level scholars in universities under the jurisdiction of the Ministry of Education and in research institutes other than those under the jurisdiction of the Soviet Academy of Sciences. Soviet students and scholars are placed in American universities and in selected academic research centers. The International Research and Exchanges Board (IREX), New York, administers these programs with funds provided by the Government and private agencies. The majority of exchanges of American social and behavioral scientists with the U.S.S.R. and Eastern Europe are authorized by an agreement negotiated in 1966–67 providing for exchanges administered in this country by IREX on behalf of the American Council of Learned Societies and the Academy of Sciences of the Soviet Union.[343]

Until 1972, American and Soviet scientific and technical exchanges in atomic energy and public health were managed under separate provisions of the cultural and educational exchange treaties. The Atomic Energy Commission and the Public Health Service handled funding,

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[341] *A General Review of International Cooperation in Science and Space: Hearings*, op. cit., p. 151.

[342] Ibid., p. 170.

[343] IREX was established in 1968 by the American Council of Learned Societies and the Social Science Research Council. Generally, IREX coordinates academic exchange activities for its 63 member universities with the Soviet Union and Eastern European countries. Activities are funded by the Ford Foundation, the Bureau of International Education and Cultural Affairs, the Department of State, and participating universities. Exchange activities include those authorized under agreement between the American Council of Learned Societies and the Academy of Sciences of the U.S.S.R. with the Ministry of Higher and Specialized Secondary Education, U.S.S.R., for language study and research in psychology. IREX also administers similar programs with Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and Yugoslavia; in addition to its own programs, which include research grants in social sciences or humanities for Research on Eastern European and Baltic countries, travel grants, and grants for summer language study. Details are available *In:* IREX, *Exchange Programs with Eastern Europe and the Soviet Union: 1971–1972* (New York: IREX, 1970), and NAS, *Information for Prospective Applicants for Participation in the Exchange Programs between the NAS, USA and the Academies of Sciences of the USSR, Bulgaria, Czechoslovakia, Poland, Romania and the Council of the Academies of Yugoslavia in Academic Year 1971–1972* (September 1970), 4 pp.

selection, and administration of these activities.[344] (As noted above the activities previously authorized under these agreements are incorporated into and are expanded in the 1972 and 1973 agreements.) It is expected that appropriate Government agencies will continue to be responsible for day-to-day administration of cooperation in specific scientific and technical areas.[345]

The inter-Academy scientific exchanges, authorized in annexes to the Cultural Relations Treaties, are administered in the United States by the National Academy of Sciences (NAS) and in the Soviet Union by the Soviet Academy of Sciences. The NAS maintains a small staff to administer the program, the Section on the USSR and Eastern Europe in the Office of the Foreign Secretary. An NAS Advisory Committee on the U.S.S.R. and Eastern Europe provides policy guidance.

The program is funded by the Office of International Programs, National Science Foundation. Exchange agreements are negotiated on a two-year basis; renewals establish limits for specific man-months and subjects for exchange. Each country pays the transportation of its citizens to the other; the host country is responsible for living expenses, tuition, and related expenses. Foreign policy guidance and procedural advice are given by the Soviet and Eastern European Exchanges Staff, U.S. Department of State.

With the exception of other exchanges in specific fields of atomic energy and public health, the Soviet-American inter-Academy exchange was, prior to 1972, virtually the only Government-funded program which sent "hard" non-agency senior-level scientists and technical personnel to the Soviet Union. The importance of the inter-Academy operation has been implied in several recent studies. For instance, Professor Robert F. Byrnes has reported that data collected by the Soviet and Eastern European Exchanges staff, Department of State, demonstrate that "Almost eighty percent of the Soviet participants in the basic program administered [in Soviet-American academic exchange programs] have been scientists and engineers, while somewhat less than ten percent of the Americans have been in science or technology." [346] Professor Frederick C. Barghoorn, who conducted an in-depth survey of Soviet-American exchanges, reported similarly:

> . . . the overwhelming majority of Soviet exchanges, especially in academic exchange programs are specialists in the natural sciences and in engineering. This concentration of scientists and engineers among the Soviet participants . . . has become even more pronounced during the last year or two. . . . Americans . . . are mainly historians, literary scholars, and social scientists.[347]

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[344] Under terms of the previous agreements between the U.S. and the U.S.S.R. and Eastern Europe, personnel in specific scientific and technical fields were exchanged between U.S. mission-oriented agencies and their foreign counterparts. Usually these programs, at least on the U.S. side, involve sending Governmental scientific and technical personnel to the other country. The United States-Soviet Health Exchange Agreement was administered by the Coordinator, U.S. Soviet Health Exchange, Office of International Health, Public Health Service; atomic energy exchanges were handled by the Division of International Affairs, U.S. Atomic Energy Commission; and exchanges in agriculture were administered by the Foreign Agricultural Service, U.S. Department of Agriculture.

[345] Interview, Dr. Norman Neureiter, former staff member of the U.S. side of the Joint Commission, Department of State, July 1973. See also: "Record of the First Meeting of the U.S.-U.S.S.R. Joint Commission on Scientific and Technical Cooperation," op. cit.

[346] Byrnes, op. cit., p. 11.

[347] Frederick C. Barghoorn, "The Special Case of U.S.-U.S.S.R. Exchanges," *International Educational and Cultural Exchange* (Fall 1969), pp. 36–7.

According to a 1965 Department of State report, the majority of Eastern Europeans who come to the United States on exchange programs funded by private American Foundations are in science and technology. But "such a provision . . . for return of visits of American scientists to Eastern Europe . . . is not found in [these private programs]." [348]

Underlying the Soviet concentration on sending large numbers of scientists and technical personnel to the United States, according to Byrnes, is a desire to profit from American scientific and technical advances:

> Those of the Party and the government who make the decisions . . . seek to strengthen the Soviet system and to weaken ours. Their primary concern has been to obtain scientific, technical, and military information from the United States . . . [and to] strengthen their economy. . . . The Soviet Union has obtained a significant increment to its scientific and technical knowledge from these programs, from basic knowledge concerning polio vaccines, to training in econometrics, and . . . business management [and] the latest work in biochemistry.[349]

The inter-Academy agreements, like all previous scientific agreements with the Soviet Union and both the 1972 and 1973 agreements, specify reciprocity in numbers, subjects, and duration of exchanges. This obstacle, Dr. Brown implies, limits American scientific exchange activities in the Soviet Union to fields the Soviets wish to study in the United States: " . . . The Soviet Academy determines fields in which it wishes to send scientists to the United States and . . . the individual participants are subsequently selected to correspond with the field. Thus the Soviet Academy seeks to maximize scientific benefits according to prearranged plan. . . . " [350] But U.S. objectives, Brown continues, are to ". . . accommodate American scientists whose research interests would be furthered by contacts in the U.S.S.R. with Soviet colleagues. These different approaches," Brown adds, "underscore the utility of the Exchange Agreement as an adaptive mechanism to enable the scientists of the two countries to engage in professional activities which would otherwise be subject to almost insuperable difficulties." [351]

Senior level programs of scientific exchange with Poland, Czechoslovakia, and Yugoslavia are conducted on the basis of nongovernment Academy-to-Academy agreements, first arranged in 1966. These are less formal than activities under the comprehensive intergovernmental cultural relations agreement with the Soviet Union. An Academy-to-Academy exchange agreement with Romania was arranged on the basis of an intergovernmental exchange of notes first signed in 1960 and renewed biennially. This agreement provides also for exchanges in specific fields handled by other agencies, such as in atomic energy, public health, housing, and transportation. Applied science and technology oriented exchanges between operating agencies

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[348] Letter from Herman Pollack, Acting Director, International Scientific and Technological Affairs, Department of State, to Arthur Roe, Head, Office of International Programs, NSF, May 8, 1965 [writing in support of the Foundation's funding of a program of NAS administered exchanges with the countries of Eastern Europe].

[349] Byrnes, op. cit., p. 11. This objective was underscored in a 1972 evaluation of the use of science and technology in Soviet domestic and foreign policies. " . . . It is clear," the study reports, "that the greater part of the Soviet effort involving foreign science and technology continues now as in the past to be concentrated on the acquisition of information useful to the USSR in developing its own plans." The evolution of Communist Party documentation and activities in support of this goal are elaborated upon in Mose L. Harvey, Leon Goure, and Valdimir Prokofieff, *Science and Technology as an Instrument of Soviet Policy* (With a foreward by Ambassador Foy D. Kohler) (Miami: Center for Advanced International Studies, University of Miami, Fla., 1972), p. 95.

[350] Report of the Foreign Secretary to the Annual Meetings of the National Academy of Science, April 1971. *In International Cooperation in Science and Space: Hearings*, op. cit., p. 222.

[351] Idem.

in the United States and their counterparts in Eastern European countries other than Romania are arranged on the basis of intergovernmental negotiations between the agencies under the policy and procedural guidance of the State Department.

The following pages overview the factual, financial, and administrative history of exchanges between the United States and the Soviet Union and the countries of Eastern Europe. They evidence the difficulties in normalizing scientific relations between political adversaries, the very gradual expansion of the program, and the important role played by nongovernmental scientists in assisting diplomats to overcome political obstacles. They review mutually restrictive policies and their impacts on expanding the size and scope of the programs. A summary section describes the qualified scientific and political achievements of the programs to date. This is followed by a shorter account of the still-developing scientific exchange program between the United States and the Peoples Republic of China.

THE DIFFICULTIES OF CONDUCTING RESEARCH ON A COMPLEX PROGRAM

The complexity of the Soviet and Eastern European exchange program precludes a comprehensive evaluation of scientific and diplomatic interactions. Dr. Harrison Brown, Foreign Secretary of NAS, whose office administers the program, reports that "It is very complex; it is perhaps the most complex program that I have ever had the honor of trying to supervise." [352]

> Our discussion in handling the . . . programs [Brown continues] has been with the National Science Foundation, which finances the program with the State Department which has overall cognizance . . . because this is part of the intergovernmental cultural exchange agreement, with the Department of Defense, which has numerous restrictions concerning the movement of Soviet scientists in the United States. [353]

On this point, Barghoorn notes: the difficulties of obtaining information on an exchange program between two political adversaries also hamper the conduct of useful research on its accomplishments and limitations. [354] And he continues: "Anything approaching a full and systematic description or analysis of the processes and effects of U.S.-Soviet educational, scientific, artistic, and other exchanges would require studies larger in scope and more precise in method than any as yet undertaken. . . . [355]

UNAVAILABILITY OF CONSISTENT AND RELIABLE DATA

Evaluation is further hampered by the absence of reliable and public information on annual activities. The NSF, which funds these programs, is under statutory obligation to report annually to the Congress in authorization and appropriations hearings and also in annual reports of grants awarded. However, the Foundation gives superficial details of the Soviet and Eastern European exchanges; gross financial

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[352] *A General Review of International Cooperation in Science and Space: Hearings*, op. cit., p. 160.

[353] Barghoorn, op. cit., pp. 32-33.

[354] Ibid.

[355] Barghoorn enlarges on this point: "Analysis, evaluation, or indeed even simple description of communications processes between the United States and the Soviet Union is likely . . . to be a . . . frustrating exercise. The difficulties confronting the researcher reflect the difficulties, complexities, and frustrations inherent in the communications and exchange processes themselves. In dealing with the delicate, often confidential information concerning personal contacts between Americans and citizens of states such as the U.S.S.R., where government tends to regard as the concern of the state, activities, regarded in the West as mainly private, discretion is required, and of course vital information is likely to be unavailable, or in very short supply." (Barghoorn, ibid., pp. 32-33.)

data; and some descriptive material citing especially meritorious activities. It has not made a systematic attempt to provide the Congress with a detailed summary of activities and problems culled from materials available from the National Academy of Sciences.

The National Academy of Sciences is a quasi-public scientific advisory group chartered by Congress to provide advice to the Government on matters involving science, technology, research, and development. While a large portion of the Academy's activities are funded by contracts with Federal agencies, its operations and activities, which reflect the need to maintain the integrity of science as incorporated in the Charter, are not subject to annual authorization and appropriations oversight. The Academy does prepare annual reports for the Congress, but these are published typically several years after completion of the fiscal year being summarized.

The Academy prepares several types of in-house, unpublished material on the Soviet and Eastern European bilaterals. These documents support proposals the Academy submits to the Foundation for program funding and provide NAS members with an annual summary of the activities of the Office of the Foreign Secretary. These documents, which were used in preparing this study, are: *Annual Reports of the Foreign Secretary;*[356] the *Semiannual Report of Scientific Exchanges Under the 1966 Memoranda of Understanding between the National Academy of Sciences and the Academies of Eastern Europe;*[357] data sheets giving numbers of exchanges both ways for both short- and long-term visits, 1959–1970;[358] and the *Annual Proposal of the National Academy of Sciences to the National Science Foundation.*[359]

The Need for Academy-to-Academy Exchanges

Bilateral scientific exchange agreements between the United States and the countries of the non-Communist world are negotiated diplomatically by the State Department and implemented by the NSF. The U.S.-Soviet agreement and the bilateral scientific agreements which were later negotiated with the Eastern European countries are handled differently.[360] These agreements, also called inter-Academy

[356] Prepared for the Spring meetings of the Academy. They are mimeographed unpublished typed reports. The section treating Soviet and Eastern European exchange is usually a candid discussion of the number of exchanges both ways, efforts to solve problems of filling quotas, descriptions of surveys, visits and other activities undertaken by the staff in both the United States and abroad, highlights of visits made by members of each Academy in support of removing diplomatic constraints on the programs, and description of facilitative services the staff provides in support of scientific activities with the U.S.S.R. and the Eastern European countries over and above the bilateral inter-Academy agreements. With the exception of reports prepared for inclusion in annual proposals to the NSF, this material is the only publicly available source of information on quota fulfillment and special administrative and diplomatic problems in implementing exchanges.

[357] Prepared by the Soviet and Eastern European Section of the Office of the Foreign Secretary. Reports give data on American and Eastern European exchanges completed, in progress, or proposed for the curren year, including name, address, subject, duration of visit and location of visit; they include narrative materials describing visits between members of respective academies to arrange and improve bilaterals particularly with respect to funding, selection of research topics, and tours of foreign scientific facilities by the staffs of both Academies. In addition, they describe some of the political and diplomatic obstacles to the conduct of exchanges. One difficulty a researcher encounters in assessing the data on exchanges included in these reports is that since visits completed, in progress, and planned are reported, the researcher must sift through these three types of data to insure that duplication is eliminated.

[358] These lists are the only reliable and readily available material on exact numbers, subjects, and durations of exchanges between the United States and the U.S.S.R. No annual data are given: instead, data are in blocks of four-year duration, making it difficult for the researcher to describe year-by-year activity and variations in activity. No information is given on the name of the grantee.

[359] Includes a review of the program for both the Soviet Union and the countries of Eastern Europe similar in detail and scope to that included in the Annual Report of the Foreign Secretary to the National Academy of Sciences.

[360] An exception to this pattern holds in the case of the bilateral agreement with Romania. The NAS directly implements activities with the Romanian Academy of Sciences; the NSF directly implements scientific exchange activities with other scientific institutions in Romania. After this paper was written the NSF announced that it was also beginning to fund and administer programs for exchange and joint cooperative research, on an institution to institution basis, with also Hungary, Czechoslovakia, and Bulgaria. The institutions involved are primarily academic. (See: *1974 National Science Foundation Authorization: Hearings*, op. cit., p. 317.)

agreements, are administered by the National Academy of Sciences; furthermore, a large portion of the diplomatic maneuvering behind the initiation of agreements, revisions, renewals, and daily operations are handled by the NAS and its counterparts, the Soviet Academy of Sciences, and the Academies of Sciences of the Eastern European countries.

Two reasons explain this difference in administration of the bilaterals with the Communist bloc. The first is political; the second reflects the locus of the conduct of scientific research in the Soviet Union and Eastern Europe.

Unlike their American colleagues who, in visiting non-Communist countries, are free to make their own personal arrangements with their scientific counterparts for research, study, and travel, Americans visiting the Soviet Union and other Communist countries of Eastern Europe are constrained by regulations of the Departments of State and Defense in the United States and by those of the Foreign Ministry of the host countries. The activities of scientists from Communist countries are similarly restricted. Typically, Soviet and American scientists in the host country are excluded from certain industrial sites and research laboratories in "sensitive" geographic locations; their length of stay and activities are limited by provisions in visas issued by the State Department or the Foreign Ministry. In the case of the Soviet Union as host, visitors from the United States are required to stick, more or less, to planned itineraries with appropriate guide and interpreter accompaniment.

These restrictions impose serious strains on the conduct, integrity, and independence of free scientific interchange. The origin of the Soviet-Eastern European programs illustrates the hypothesis that these strains would be mitigated if major and early precedent-breaking responsibility for program development and administration were given to scientists, and, insofar as possible, nongovernmental scientists, rather than exclusively to foreign policy administrators. Among the specific advantages of this arrangement are the following. Staff members of the NAS, unlike staff of the Department of State's Educational and Cultural Exchange Bureau, are intimately familiar with requirements for the conduct of research and with the problems of designing potentially fruitful research projects within the limits imposed by political restrictions on scientific activity. Furthermore, since this staff is prestigious and nongovernmental, both sides to the agreement undoubtedly have greater confidence that the programs and the scientists exchanged under them would be as beneficial as possible to the advancement of science, the mutual determination of priorities for exchange, and the cultivation of personal relationships so necessary for developing continuous cooperation.

The NSF, as principal U.S. funding agency for scientific research and development, has a long tradition of noninvolvement with political activities on the grounds that such involvement might obstruct the conduct of free, unfettered scientific exchange between nations. However, the alternative of direct NSF administration of the bilaterals has been precluded by considerations governing the locus of conduct of scientific research and development in the Warsaw Pact countries. Due to the centralized nature of Communist organization and fund-

ing for scientific research and development; the focus of basic research in the U.S.S.R. is in the institutes of the Soviet Academy of Sciences.[361]

The Need for Scientific Consultation in Establishing Agreements

The history of the initiation and renegotiation of U.S. and U.S.S.R./Eastern European bilateral inter-Academy scientific agreements illustrates the important role played by the two Academies in fashioning terms compatible with requirements for both science and politics. It demonstrates also a need for continuous negotiation between scientists and diplomats in efforts to enlarge the number, subject areas, and types of exchanges. These topics will be addressed in the following sections.

SOVIET-AMERICAN PROGRAMS

The first Soviet-American program of scientific exchanges began in 1958, in the aftermath of the flight of Sputnik. At the request of the State Department,[362] these activities were implemented at first on an *ad hoc*, nongovernmental basis by the Academies of Science of both countries under authorization of Section IX of the Lacy-Zaroubin Agreement of January 1958, the first cultural exchange understanding between the United States and the Soviet Union.[363] In December 1958, in response to a request from NAS, the "National Science Board approved NSF 'consideration of support' to the NAS–NRC for a U.S.-U.S.S.R. interacademy exchange of scientists in the event that federal funds were required."[364]

Six months later, the Academy submitted a proposal to NSF for support for an exchange of scientists with the Soviet Union. The National Science Board approved the request in May 1959 for a two-year period. During the interval, NAS, at the request of the State Department, negotiated terms of a detailed agreement with the Soviet Academy of Sciences. It was concluded July 1959 (the Bronk-Nesmeyanov agreement). In September 1959, the NSF granted funds to the Academy for a one-year program of exchanges. This agreement was subsequently included in the new cultural relations treaty of 1960–61, signed by Llewellyn Thompson, U.S. Ambassador to the Soviet Union, and G. A. Zhukov, Chairman of the State Committee of the U.S.S.R. for Cultural Relations with Foreign Countries.[365]

The inter-Academy agreement signed in 1959 provided for a small, reciprocal two-year program of exchanges. Subsequent two-year agreements, which have been part of the broader biennially renewed

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[361] Brown, *In: A General Review of International Cooperation in Science and Space*, op. cit., p. 151. On the Soviet R and D system see: UNESCO, *Science Policy and Organization of Research in the U.S.S.R. Science Policy Studies and Documents No. 7* (Paris: UNESCO, 1967), 116 pp. and Organisation for Economic Co-operation and Development, *Science Policy in the U.S.S.R.* (Paris: OECD, 1969), 618 pp.

[362] Taken from materials supplied by the NSF and Draft Catalogue, supplied by Subcommittee on Bilateral Relations, International Committee of the Federal Council for Science and Technology, December 6, 1971.

[363] The Lacy-Zaroubin agreement was the end result of three years of negotiation, begun in 1955, to begin cultural and educational exchanges between the United States and the U.S.S.R. The history of this period was recently summarized in a Department of State publication: "At the 1955 Geneva meeting the Heads of Government of the United States, France, the United Kingdom, and the Soviet Union directed their Foreign Ministers to 'study measures which could bring about such freer contacts and exchanges as are to the mutual advantage of the countries and peoples involved.' The Foreign Ministers of the four countries met in Geneva in October 1955 to carry out the directive given them by the Heads of Government. On the item of increased East-West contacts, the representatives of France, the United Kingdom, and the United States presented a proposal for 'further exchanges of persons in the professional, cultural, scientific and technical fields' and for the beginning of 'exchanges of persons engaged in language and other area studies.' No agreement was reached on this or on the other two agenda items: European security and Germany, and disarmament. The final communique stated that further discussion on all three topics would take place through diplomatic channels." ("A Decade of Scholarly Exchanges with the Soviet Union," *FAR Horizons* (July 1968), pp. 5–6.)

[364] Materials supplied by NSF and by the International Committee of the Federal Council for Science and Technology December 6, 1971, op. cit., passim.

[365] TIAS 4362, November 21, 1959.

intergovernmental agreements for cultural, scientific, technical, educational and other exchanges, have continued and slowly expanded the scientific exchange program since 1959:[366]

The inter-Academy exchange commenced with provision for 44 scientists of each country to visit the other for a total of 70 months over a period of 2 years, an extremely modest beginning which stressed short visits of 1 month. In 1962, when the program was renegotiated, the NAS took the initiative to adjust the balance away from the short survey visits in the direction of the longer research visits, for which Americans at least took their families along to participate in the new experience. In 1962 a new pattern was established which has continued more or less up to the present: 30 lecture-survey visits of 1 month; 26 research visits totalling 160 months for the biennium, with more emphasis placed on the longer research visits.[367]

The evolution of renegotiation of the broader cultural relations agreements under which the inter-Academy agreement is conducted slowly expanded provisions for U.S.-Soviet scientific exchanges into other areas. The 1962 agreement formalized exchanges in the humanities and social sciences between the American Council of Learned Societies, currently at the level of 12 scholars for 3–10 months "for the purpose of becoming acquainted with scholarly research in the fields of the humanities and social sciences as well as for conducting research in the scholarly institutions of the other side." [368] It provided also for summer exchanges of language teachers. A significant expansion of the 1970 agreement was for the exchange of U.S. and Soviet professional and trade association delegations in 20 fields covering a variety of applied scientific and technical problems. The first seven fields are listed under the subheading "Man and His Environment," and include broad-based topics of major importance to an industrial society. The 13 other exchanges are on topics of more limited scope.[369]

The cultural relations agreement for 1970 and 1971 was signed in Washington on February 10, 1970. With the exception of minor changes in number and duration of exchanges, this agreement was essentially the same as the agreements between the two Academies in previous years. One significant addition was a provision for the two Governments to facilitate exchanges of professors and instructors to lecture in the natural sciences, technical sciences, and humanities, and the social sciences. The 1972–73 inter-Academy agreement, signed April 11, 1972, expanded man-months of permissible exchange to 190 each way. No specific arrangements were made for the conduct of joint symposia or scientific research; the agreement provided for the Academies to work out these details.[370]

The 1972–73 agreement is summarized below (paraphrase):

1. *Number and duration of exchanges.*—a. Exchanges of 12 prominent scientists, at least half of them to be members of the respective Academy, for periods up to one month to lecture, conduct seminars, or familiarize themselves with scientific research;

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[366] Under 6 intergovernmental agreements for scientific, technical, educational, and cultural exchanges concluded every two years between U.S. Ambassador to the Soviet Union or other State Department officials and their counterpart Soviet officials: TIAS 4362, 11/21/25; TIAS 5112, 3/8/62; TIAS 5582, 2/22/64; TIAS 6149, 3/19/66; TIAS 6570, 7/15/68 and 2/10/70.

[367] Brown, *In: International Cooperation in Science and Space: Hearings*, op. cit., p. 152.

[368] "A Decade of Scholarly Exchanges with the Soviet Union," op. cit., p. 2.

[369] "Scholarly Exchanges with the U.S.S.R.," *FAR Horizons* (May 1970), p. 4. Additional industrial and professional association exchanges are included in Section II of the 1970 agreement.

[370] NAS, "Annex I. Agreement on Exchange of Scientists between the National Academy of Sciences of the USA and the Academy of Sciences of the USSR in 1972 and 1973," 2 pp.

b. Exchanges of a maximum of 14 scientists from each country, for one month visits for the familiarization with research;

c. Exchanges of a maximum of 35 scientists, with total visits not to exceed 190 man-months, to conduct scientific research or to pursue advanced study; visits to last from 3–10 months;

2. *Nomination and selection.*—Nominees to be approved by both Academies. Scientists are evaluated on education, professional employment, scientific specialization, publications, location of proposed visit, knowledge of foreign language, and title of lectures;

3. *Additional exchanges.*—Which permit revisions of the agreed upon terms as well as provision for visits for scientific conferences;

4. *Program review.*—Both Academies are to exchange small delegations each year to review the inter-Academy exchange program "at the policy level;"

5. *Financing and administrative arrangements.*—The sending Academy is to provide round-trip transportation and salaries for its scientists; the receiving Academy to provide in-country transportation costs, living quarters, medical expenses, special allowances, and reimbursement for research equipment expenses.[371]

EASTERN EUROPEAN PROGRAMS

In general, inter-Academy scientific exchange programs with the Eastern European countries are carried out not under formal intergovernmental agreements but under "Memoranda of understanding between the national academies of both countries who are parties to the bilateral agreement." [372] "These arrangements," according to the NAS, "are meant to augment existing scientific exchanges and constitute part of the continuing effort of the NAS to expand and develop contracts between American and foreign scientists." [373]

One exception to the lack of intergovernmental inter-Academy agreements is the case of Romania, under which exchanges are implemented under a periodic exchange of diplomatic notes between the two governments. The origin and evolution of agreements with the Eastern European countries, similar to those with the U.S.S.R., underscore the important role played by the National Academy of Sciences in fashioning nonpolitical links between scientists of politically divergent cultures.

Genesis of Agreements: Poland and Yugoslavia.—The genesis of formal scientific exchange agreements between the United States and the countries of Eastern Europe dates back to 1962. In September of that year, Harrison Brown, foreign Secretary of the NAS, toured the Academies of Sciences in the countries of Eastern Europe to discuss "the desirability of making it easier for American scientists and their scientists to exchange professional visits." [374] Upon his return, the Foreign Secretary reported to the NAS Advisory Committee on the U.S.S.R. and Eastern Europe on the favorable reception he had

[371] Idem.

[372] These inter-Academy Eastern European exchange activities are separate and distinct from the programs the National Science Foundation directly administers with Bulgaria, Czechoslovakia, Romania and Yugoslavia. See note 360 above.

[373] National Academy of Sciences, "Information for Prospective Applicants for Participation in the Exchange Programs between the National Academy of Sciences of the USA and the Academies of Science of the USSR, Bulgaria, Czechoslovakia, Poland, Romania, and the Council of the Academies of Yugoslavia in Academic Year 1971–1972." (Washington: National Academy of Sciences 1970), p. 1.

[374] Letter from Frederick Seitz, President, and Harrison Brown, Foreign Secretary, National Academy of Sciences, to Leland J. Haworth, Director, National Science Foundation, December 19, 1963, requesting financial support from the NSF for exchanges between the National Academy of Sciences and the Academies of Poland and Yugoslavia.

received. The Committee authorized the Foreign Secretary to investigate "establishing informal exchange arrangements with interested academies in Eastern Europe and recommended that a beginning be made with Poland and Yugoslavia", since there already were favorable relations between U.S. scientists and scientists of these countries.[375] Shortly thereafter, the Academy, in consultation with the NSF, prepared a draft memo of understanding to serve as a basis for the exchange arrangements. The draft was reviewed and approved by the State Department, U.S. Embassies and legations in Eastern Europe, and "other interested parts of the Government."[376]

The inter-Academy agreements concluded by the NAS and the Science Academies of Poland and Yugoslavia were designed from the start to be less formal than the scientific exchange agreement with the Soviet Union. "Our goal," wrote the NAS officials, "is to have exchange understandings as flexible as possible." Continuing:

> We would like to be able to help American scientists get to Eastern Europe as they find it professionally necessary or desirable . . . without reference to a rigid number of exchange or to fields stipulated in advance. . . . There will have to be some limitation on complete freedom of action . . . because of budgetary considerations, and . . . the sensitivity of some fields. . . . The scientist and his interest will be proposed at the same time, not field first and scientist afterward as under . . . the 1962 exchange agreements, with the Soviet academy. . . .[377]

The NAS and the Academies of Sciences of Poland and Yugoslavia continued negotiations during later 1962 and most of 1963. In December 1963, after it had received approval from the Governing Board of NAS, the Office of the Foreign Secretary formally requested $15,960 from the NSF to inaugurate a program of exchanges for the academic year 1963–64. NSF forwarded the proposal for review to the State Department, which subsequently approved the request "as being in the foreign policy interest of the United States . . ." and asked NSF to support the NAS request.[378] NSF approved the NAS proposal in February 1964.

After exploratory visits between scientific delegations of the Academies, the NAS in 1965 received NSF approval to widen the exchange program to include Romania, Hungary, and Czechoslovakia.[379] "The main purpose of the three new programs," according to the Academy, "would be essentially the same as the original two":

> . . . to establish a working channel through each of the foreign organizations to the scientific community . . . [to] further science internationally and [to] facilitate survey and research visits of American scientists . . . .[380]

Extension of the Program: Romania and Czechoslovakia.—After receiving State Department approval NSF, in 1965, awarded $15,000 to NAS to support the visits of small American delegations to other Eastern European countries to explore establishment of formal scientific exchange activities.[381] Formal "Inter-Academy Memoranda

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[375] Idem.
[375] Idem.
[377] Idem.
[378] Letter from R. Rollefson, Director, Office of International Scientific Affairs, Department of State, to Leland J. Haworth, Director, NSF, January 22, 1964.
[379] NAS–NRC, Office of the Foreign Secretary. "Proposal for Amending Task Order No. 74, to Broaden Exchanges of Scientists Beyond a Present Program for Yugoslavia and Poland to Include Romania, Hungary and Czechoslovakia." Sent to NSF, April 14, 1965.
[380] Idem., p. 1.
[381] NAS–NRC, Office of the Foreign Secretary, "Exchange of Scientists Between the National Adademy of Sciences, U.S.A. and the Academies or Research Councils of Poland, Yugoslavia, Romania, Czechoslovakia, and Hungary, for the Period September 1, 1967 to August 31, 1968." Continuation of Contract NSF, C–310, proposal submitted June 8, 1967, p. 1.

Inter-Academy exchange visits made under this grant were: NAS delegation to Romania, December 1965: Hungary, May 1966; Czechoslovakia, September 1966. Delegations to the U.S.: Romanian Academy, October 1965 ;Czechoslovakian Academy, May 1966; and Yugoslovian Academy, September 1966;

of Understanding on Scientific Cooperation" were entered into with: the Council of Academies of the Social Federal Republic of Yugoslavia, January 1, 1966; the Polish Academy of Sciences, February 1, 1966; the Academy of the Socialist Republic of Romania, March 18, 1966; and the Czechoslovak Academy of Sciences, July 1, 1966.

Bulgaria.—Negotiations with Bulgaria did not proceed as swiftly as those with other Eastern European countries. Discussions with the Bulgarian Academy continued over several years after Dr. Brown's initial visit to Eastern Europe in 1962.[382] In 1968, NSF granted the NAS approval to expand activities to Bulgaria; no additional funds were needed.[383] Negotiations between the two Academies continued during 1969 and 1970, and involved additional visits of Dr. Brown to Bulgaria in 1969 and of a delegation from the Bulgarian Academy of Sciences to the United States in May 1970. A Memorandum of Understanding on exchanges was concluded May 23, 1970.[384] Under the agreement the Academies will support visits totaling 10 man-months in the first year and 20 man-months in the second year in both directions. Specifically encouraged are short visits for lecturing, conducting seminars, surveying current research, and exchanging professional views. The behavioral sciences are included in the agreement.

Expansion of the Program: Yugoslavia and Romania.—Exchanges with the Yugoslavian academy were conducted at only about two-fifths of the agreed-upon level of exchange for the first few years of the agreement. In 1970 the two academies agreed to try to fulfill the originally established level of 40 man-months per year. At the same time, the agreement was expanded to other areas of cooperation: transportation and urban affairs, environmental quality, oceanography, science teaching, computer applications, metallurgy, petrochemicals, and electronics. A Yugoslavian scientific attaché was attached to the Embassy in Washington to assist in implementing these arrangements.

These decisions were formulated in response to visits of Dr. Lee DuBridge, the President's Science Adviser, to Yugoslavia, September 1969;[385] discussions on scientific and technological cooperation between President Nixon and Yugoslavia's President Tito during the former's visit to Yugoslavia in September 1970;[386] and the return visit of a Yugoslavian scientific delegation to the United States in October 1970.[387]

Exchanges between the U.S. National Academy of Sciences and the Academy of Science of Romania were formalized in 1964 in an exchange

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[382] NAS-NRC, Office of the Foreign Secretary, "Proposal for Amending Task Order No. 74, Contract NSF C-310, Exchange of Scientists between the National Academy of Sciences. U.S.A. and the Academies or Research Councils of Poland, Yugoslavia, Romania, Hungary, and Czechoslovakia," to include Bulgaria, 1967.

[383] Idem. and NSF, Correspondent approval sheet amendment to NSF C-310, Task order No. 74, December 18, 1967, and Letter from Wilbur W. Bolton, Jr., contracting officer, NSF, to Mr. G. D. Meid, Business Manager, NAS, Task order No. 74, Amendment No. 7, February 8, 1968.

[384] "East-European Programs," *In* NAS-NRC, Office of the Foreign Secretary, "Proposal for Continuation of the Program for Exchange of Scientists Between Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and Yugoslavia for the period September 1, 1970, through August 31, 1971," Continuation of contract NSF C-310, task order no. 39, May 28, 1970, p. 2.

[385] "President's Science Adviser to Visit Europe," White House Press Release, September 12, 1969, *In: U.S. Department of State Bulletin* 61 (October 20, 1969) pp. 338–9.

[386] "Joint Communique following visit of President Nixon with President Tito," *U.S. Department of State Bulletin* 63 (November 2, 1970) p. 522.

[387] "Yugoslav Scientific Delegation visits the United States," Office of Science and Technology Press Release. October 28, 1970. *In: U.S. Department of State Bulletin* 63 (December 7, 1970) pp. 698–99. On May 18, 1973, the two countries signed a new agreement which provided for joint funding, paved the way for use of more excess foreign currencies, and established a Joint Commission to supervise exchanges. These provisions, presumably, relate to exchanges administered by the National Science Foundation, not those administered by NAS with NSF funds.

of governmental notes concerning cultural exchange.[388] After exploratory visits between Academy delegations and discussions between the President's Science Adviser and the Romanian Council for Scientific Research, the program of scientific exchanges was broadened under a new agreement signed in 1968. In addition to expanding cooperative activities, the new agreement shifted principal U.S. administrative responsibility from the Office of the Foreign Secretary, NAS, to the Office of International Programs, NSF.[389] The agreement was renewed in 1970.[390] The 1970 agreement, concluded after the visits of President Nixon and his science adviser, expanded scientific and technological exchanges and cleared the way for joint research. As before, the new agreement augments other areas of cooperation authorized under the continuing memoranda of understanding between the two countries; and like the previous program, this one is based on the principles of reciprocal financing and joint selection of research projects and exchanges.

Funding and Size of the Programs

Funds for U.S. inter-Academy exchanges with the Soviet Union and Eastern Europe are granted by the Office of International Programs, NSF. Congressional review of the Soviet and Eastern European exchanges program has been handicapped by a lack of readily available and consistent data. Until 1968, when the Foundation was given an explicit mandate for international scientific and technical activities, the Foundation used different categories to report awards and frequently reported the data under more than one category.[391] (See Table 27.)

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[388] NAS-NRC. Office of the Foreign Secretary, "Proposal for Amending Task Order No. 74, to Broaden Exchanges of Scientists Beyond a Present Program for the Period May 1, 1965 to August 31, 1966," contract NSF C-310, task order, April 14, 1965, p. 2.

[389] From: U.S., National Science Foundation, "Bilateral Science Exchange Programs, Fact-sheet: U.S. Romania." Terms of the science agreement were included as part of the Cultural Relations Agreement, signed November 28, 1968.

[390] Exchange of notes, 1970, at Bucharest, signed by Leonard C. Meeker, U.S. Ambassador for the United States, and Vasile Gliga, Deputy Minister for Foreign Affairs, Romania.

[391] Data on NSF funding of these activities are found in two sources: *Annual Reports* and *Grants and Awards* books. Until the mid-1960's NSF published one report on its activities incorporating a list of grants awarded. After that the Foundation began to publish two separate reports: *Annual Reports* and *Grants and Awards* listings. The description of Soviet and Eastern European exchange activities in the *Annual Report* is very superficial, occasionally giving numbers of exchanges and a descriptive illustration of selected activities without reports on funding. Financial data are presented in the lists of grants awarded. But owing, probably, to the Foundation's ambivalent handling of international science activities until 1968, the Foundation did not maintain a consistent format for reporting awards to the Academy for these programs. For instance, in the FY 1962 and FY 1963 reports, separate entries were given for International Science Activities. Soviet and Eastern European grants were listed under this category under the recipient subcategory the NAS-NRC. In FY 1961 the pattern changed somewhat. The International Scientific Activities category was replaced with one entitled International Scientific Information Exchange. Grants awarded were listed by state; thus, information on the U.S.-U.S.S.R./E.E. programs appeared under the category District of Columbia, followed by recipient, the Academy listed as recipient. In FY 1965 the pattern was changed again. Although the International Scientific Information Exchange category was retained the NSF began to include the category of Eastern European Exchanges under it. The Foundation used the same format in the FY 1966 report, but in 1967 changed the broad category from International Scientific Information Exchange to Science Information Service, with the subcategory Eastern European Programs. The FY 1968 and 1969 forms reverted back to the FY 1965 and FY 1966 patterns utilizing the broad category International Scientific Information Exchanges followed by the subcategory Eastern European Exchanges. In 1970 the NSF instituted a new format, reporting awards under the general heading International Cooperative Scientific Activities and the subcategory Eastern European Programs. In fiscal year 1971 the Foundation changed the reporting format again and now reports grants and awards data in a form compatible with budget presentation categories. The category "National, International, Specialized Research, and Sea Grants Programs" contains the subcategory "International Cooperative Science Scientific Activities," further differentiated into "Cooperative Science Programs." The funding to NAS for the U.S.S.R./E.E. programs may be found under the heading District of Columbia. The subheading Eastern European Programs was dispensed with. (See NSF, *Annual Report, FY 1971*, op. cit. p. 126.)

Types of grants awarded have also varied considerably over the program's history. In reporting funds awarded during the period 1960–1969, the NSF announced two separate grants to the Academy, one for Soviet exchanges and one for Eastern European exchanges (which began in 1966). However, in 1969, while two grants were announced, Soviet programs were funded separately as well as under funding given for the E. E. exchanges. The pattern was changed during the fiscal year 1970 when one grant was announced for both programs.

TABLE 27.—AWARDS MADE BY THE NATIONAL SCIENCE FOUNDATION TO THE NATIONAL ACADEMY OF SCIENCES FOR SOVIET AND EASTERN EUROPEAN EXCHANGES

Fiscal year	Broad NSF grant reporting category	Specific program	Countries covered	Amount	Months duration	Total
1974 request	National, international, specialized research, and Federal grant programs.	International cooperative scientific activities: Cooperative science program, District of Columbia.	U.S.S.R., Poland, Yugoslavia, Romania, Hungary, Czechoslovakia, Bulgaria.	$1,100,000	[1] (12)	$1,100,000
1973	do	do	do	1,016,150	12	1,016,150
1972	do	do	U.S.S.R.	913,364	13	913,364
1971	do	do	U.S.S.R., Poland, Yugoslavia, Romania, Hungary, Czechoslovakia, Bulgaria.	889,283	12	889,283
1970	International cooperative scientific activities	East European Exchange program	do	732,165	12	732,165
1969	Science information service	International scientific information exchange, Eastern European program.	U.S.S.R.	420,000	12	534,000
	do	do	U.S.S.R., Poland, Yugoslavia, Romania, Hungary, Czechoslovakia, Bulgaria.	114,000	(2)	
1968	International scientific information exchange.	East European program	U.S.S.R.	245,140	12	327,190 (580,000)
	do	do	Poland, Yugoslavia, Romania, Czechoslovakia, Hungary.	82,050	12	
1967	Science information service	East European Exchange program	U.S.S.R.	152,980	12	418,690
	do	do	Poland, Yugoslavia, Romania, Hungary, Czechoslovakia.	265,710	12	
1966	International science research activities	No title	U.S.S.R.	272,375	12	347,375
	do	do	Poland, Yugoslavia, Romania, Hungary, Czechoslovakia.	75,000	12	
1965	International scientific information exchange.	East European Exchange program	U.S.S.R.	230,000	(2)	245,000
	do	do	Poland, Yugoslavia, Romania, Hungary, Czechoslovakia.	15,000	(2)	
1964	do	District of Columbia	U.S.S.R.	218,662	11	234,620
	do	do	Poland, Yugoslavia	15,960	7	
1963	International science activities	NAS–NRC, District of Columbia	U.S.S.R.	260,100	12	260,100
1962	do	do	do	45,675	(2)	69,475
	do	do	(Interim support of the Office of the Foreign Secretary).	23,800	3	
1961	Grants other than basic research	International science and international science education.	(To NAS–NRC-visit of Soviet party to United States).	4,350	4	
1960			(To implement Bronk-Nesmeyanov Agreement).	235,000		235,000

[1] Estimated.
[2] None given.

Source: Data taken from: fiscal year 1960: U.S., NSF, "Annual Report, 1962," 1963, p. 140; fiscal year 1961: U.S., NSF, "Annual Report, Fiscal Year 1961," op. cit., p. 256; fiscal year 1962: U.S., NSF, "Annual Report, Fiscal Year 1962," op. cit., p. 274; fiscal year 1963: U.S., NSF, "Annual Report, Fiscal Year 1963," 1964, p. 282; fiscal year 1964: U.S., National Science Foundation, "Grants and Awards, Fiscal Year 1964," 1965, p. 133; fiscal year 1965: U.S., NSF, "Grants and Awards, Fiscal Year 1965," 1966, p. 103; fiscal year 1966: U.S., NSF, "Grants and Awards, Fiscal Year 1967," 1968, p. 143; fiscal year 1968: U.S., NSF, "Grants and Awards, Fiscal Year 1968," 1969, p. 157; fiscal year 1969: U.S., NSF, "Grants and Awards, Fiscal Year 1969," 1970, p. 86; fiscal year 1970: U.S. NSF, "Grants and Awards, Fiscal Year 1970," 1971, p. 86; fiscal year 1971: U.S., NSF, "Grants and Awards, Fiscal Year 1971," 1972, p. 126; fiscal year 1972, U.S. NSF, "Grants and Awards, Fiscal Year 1972," 1973; fiscal year 1973, supplied by Office of International Programs, NSF; and fiscal year 1974 from: "1974 National Science Foundation Authorization: Hearings," op. cit., p. 318.

Although these inconsistencies make it difficult to present a valid evolution of the programs, the available data indicate several trends. First, there has been a slow growth in the funding of the program reflective of the slow, but steady, expansion of the program itself. Second, reduced funding for the Eastern European program from fiscal year 1967 to 1968 may have been due to the fact that the first year's operations required special "seed" money as the program was getting started, or that the program was subject to retrenchment resulting from a congressionally initiated Government-wide effort to cut back funding for foreign research. Third, total funds expended for the Soviet and Eastern European Exchanges program were approximately $3.3 million to 1970. Of this sum approximately $2.7 million was allocated to the Soviet exchange program alone.[392] (It should be noted that total funds for all segments of the program for the four fiscal years 1971–1974 are estimated at approximately $3.9 million, and are thus more than the total program costs for its first 11 years of operation.) (For detailed information on these trends, see Table 27.) Fourth, since the start of the program in 1959 until 1970, "224 American scientists [went] to the Soviet Union for visits totaling 666 months, and 234 Soviet scientists [came] to the United States for a total of 696 months." [393]

RELATIVELY HIGH COST OF THE PROGRAM

The financial costs of the program are shared by the Academies. NAS provides to American participants round-trip economy transportation between their home and the capitals of the other countries, including transportation for accompanying members of the family if the visit is 5 months or longer. The NAS also reimburses participants for salary lost because of participation in the programs up to a ceiling of $1,500 a month, plus some support for pretravel language study, and $5 per diem for most Americans in the Soviet Union. The receiving Academy is responsible for cost of transportation of participants within the country in connection with scientific visits and cost of living accommodations, and it provides an allowance for meals. The receiving Academy is also responsible for medical services for participants.[394]

The average combined cost for an exchange visit was $7,300 since the program began until 1970. (See Table 28.) (This includes only support supplied by the NAS to Soviets while in this country and to Americans and their families for travel, salary, per diem and administrative costs. Soviet support of Americans while in the U.S.S.R., under terms of the agreement, presumably would inflate this figure considerably.)

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[392] Figured from Table 27. Since separate funds were not reported for the Soviet program and the Eastern European program in FY 1970, funds for the Soviet program were figured by extrapolating the percentage of funds for the Soviet program to total program funds for FY 1969 (80%), giving a total of funding for the Soviet program for FY 1970 of $585,732. In figuring this sum no funds given to the Soviet program in FY 1969 under the Eastern European grant were used. In addition, only the lower figure was used in figuring FY funds for the Soviet program.

[393] As will be demonstrated in the next section, there is some discrepancy in reliable annual data. This information is from Brown, *In International Cooperation in Science and Space: Hearings*, op. cit. p. 152.

[394] "Proposal for the Continuation of the Program for Exchange of Scientists . . . ," May 28, 1970, op. cit., p. 6.

TABLE 28.—A SUMMARY OF COSTS, UNITED STATES-SOVIET EXCHANGE PROGRAMS, FISCAL YEARS 1950 TO 1970

Total funds, U.S.-U.S.S.R. exchange program, fiscal years 1959–70	$3, 337, 967
Total man-months, Americans to U.S.S.R., fiscal years 1959–70	666
Total man-months, Soviets to United States, fiscal years 1959–70	696
Total Americans to U.S.S.R., fiscal years 1959–70	224
Total Soviets to United States, fiscal year 1959–70	234
Average overall cost per exchange of visits	$7, 300

(Sources: Figures from NSF and NAS data.)

NAS generated budget data for the Soviet and Eastern European program for the period September 1970–August 1971 estimated a total budget (including administrative costs, overhead, costs of exchange and visiting parties) of $914,283. This estimate covers 190 man-months of visits of Americans to the Soviet Union and Eastern Europe and 170 man-months of visits of Soviets and Eastern Europeans to the United States. The average cost per man-month is $2,540. The average estimated cost of sending Americans to the Soviet Union and Eastern Europe is higher than that of sending foreigners to the United States. The NAS estimated it would receive 63 Americans for short and long term visits, at an average cost of $2,130 (based only on expenditures planned for exchanges). It was proposed that 45 Soviets and Eastern Europeans would visit this country on short and long term visits during the same time period, at an average cost of $1,345. The Academy's indirect and administrative costs in support of the program account for 25 percent of the total estimated budget.[395] In summary, the program remains costly. The total average cost per exchange, including overhead for fiscal year 1971 was approximately $8,500 and, for 1972 approximately $7,200.[396]

FUNDING PROBLEMS

Both the Academy and the Foundation have reported problems of funding. Some of these are similar to problems which characterize other U.S. programs to send nongovernmental scientists abroad, and some are attributable to particular conditions of administering *quid pro quo* scientific exchange agreements between political adversaries. Despite the fact that funding has increased with the growth of the program, both agencies report that mid- and late-1960s funding cuts, due to both balance-of-payments problems and the general retrenchment in domestic R&D funding, have adversely affected day-to-day program operations, curtailing the number of exchanges permitted and the conduct of administrative visits and arrangements to implement the program. For example:

> A sharp reduction of funds from the National Science Foundation . . . posed serious problems in maintaining the agreed upon level of exchange visits. This was particularly true of the Soviet program. . . .[397]

[395] Figured from estimated expenditure data, and data given in Annexes 1, 2, 3, 4, 5, in NAS, "Proposal for Continuation of the Program for Exchange of Scientists. . . .," May 28, 1970, op. cit.

[396] Information for 1972 figured from data supplied in: *1974 National Science Foundation Authorization; hearings*, op. cit., p. 318, and Table 27.

[397] "Report of the Foreign Secretary to the Annual Meeting of the National Academy of Sciences, April 29, 1969," p. 5.

. . . Because of the curtailed budget and international events, Dr. Harrison Brown, on August 29, postponed his visit to Bulgaria which had been scheduled for September 1968 to discuss development of scientific exchanges.[398]

Another funding problem is the requirement, common to most exchange programs, that the American sponsoring agency, in this case the NAS, pay income taxes for foreign exchange visitors. Dr. Brown favors an amendment to the income tax law to "reduce the liability of foreign guests to income tax. The amount of taxes to which they are subject are negligible, but bookkeeping for income tax purposes is time-consuming and expensive." [399] Brown estimated that it would cost the Academy $7,000 to support income tax obligations for all Soviet and Eastern European visitors in fiscal year 1970.[400]

According to a recent commentary, the costs of the new 1972 Soviet-American scientific accords will far exceed funds expended for previous scientific exchange programs. The Honorable McGeorge Bundy told the House Committee on Science and Astronautics that:

If we are indeed to move from the age of exchange to that of active cooperation, there will be significant budgetary implications. . . . Active cooperation is much more expensive than technical and cultural exchanges. . . .[401]

United States-Soviet Programs: Numbers and Subjects of Exchanges

A serious obstacle to assessment of the numbers and types of exchanges conducted is the lack of readily available, comparable, and reliable data. NSF data on these programs are generally reliable but they cannot be used to evaluate trends in subjects or duration by subject. NAS data give subject and duration for each subject summarized for four-year periods, making it impossible to use these data to identify annual fluctuations and trends in subject and duration.[402] Within the limitations of available data, some general observations are offered below.

SPECIFIC OBSERVATIONS: SMALL NUMBERS OF EXCHANGES AND PROBLEMS IN FILLING QUOTAS IN EXCHANGES

As noted above, the size and duration of visits under inter-Academy exchange programs are determined on the basis of reciprocity. Although the terms of exchange agreements have gradually expanded the size of the program over the years, the number of exchanges actually carried out has enlarged slowly, and in fact, seems to have stabilized in the last few years. The duration of visits, however, seems to be consistently increasing. Specifically:

—compatible with the "reciprocal" provisions of the exchange agreements, approximately equal numbers and man-months of U.S. and Soviet scientists were exchanged each year, during 1959–1970;

[398] National Academy of Sciences, Office of the Foreign Secretary, "Status Report of Scientific Exchanges under the 1966 Memoranda of Understanding between the National Academy of Sciences and the Academies of Sciences of Eastern Europe, October 1, 1968—December 31, 1968," Report No. 11, January 1, 1969.

[399] Brown, *In: International Cooperation in Science and Space: Hearings*, op. cit., p. 154.

[400] "Proposal for Continuation of the Program for Exchange of Scientists . . ., May 28, 1970," op. cit., p. 7.

[401] *U.S.-U.S.S.R. Cooperative Agreements: Report*, op. cit., p. 12, see also comments of Dr. Philip Handler, *U.S.-U.S.S.R. Cooperative Agreements: Hearings*, op. cit., p. 85.

[402] As described in detail above, there are two general sources of data on these programs. The NAS provides lists of exchanges completed for the period 1959–1970, giving names, numbers, and subject areas of grantee, and locations in the United States. These data are differentiated into short and long terms and are arrayed in blocks of four year periods, thus precluding analysis of annual trends. The NSF gives annual data on total number of exchanges, sometimes differentiating between long and short visits and sometimes giving duration of total visit in man-months. Foundation data do not describe the subject of the visit.

—fewer Soviet scientists came to the United States than Americans went to the Soviet Union in the period 1967–1970; however, man-months of exchange were about equal;

—although numbers as well as man-months of exchanges both ways have gradually increased since inception of the program, current trends indicate a movement toward fewer, but longer visits. In the period 1959–1963, 39 Americans went to the Soviet Union for a total of 66 man-months; in the period 1967–1970, this increased to 106 Americans for a total of 333 man-months. Data for recent years especially, show a trend toward longer visits. (See Table 29.)

TABLE 29.—UNITED STATES-SOVIET EXCHANGES, NUMBERS AND MAN-MONTHS, FISCAL YEARS 1959–71

	Numbers								Man-months							
	Americans to Soviet Union				Soviets to United States				Americans to Soviet Union				Soviets to United States			
		NAS data				NAS data				NAS data				NAS data		
Fiscal year	NSF data	Long	Short	Total	NSF data	Long	Short	Total	NSF data	Long	Short	Total	NSF data	Long	Short	Total
1959–1963:																
1961	23				29				NA				NA			
1962	NA	5	34	39	NA	5	31	36	NA	30	36	66	NA	22	31	53
1963	NA				NA				NA				NA			
1963–1967:																
1964	13				15				52				24			
1965	34	40	34	74	43	45	43	98	91	226	46	272	105	120	53	173
1966	18				23				NA				NA			
1969–1970:																
1967	23				23				94				85			
1968	32	51	55	106	26	68	20	80	90	278	55	333	118	320	22	342
1969	21				22				76				93			
1970	36				36				106				92			
1971	------	7	14	21	------	15	10	25	------	106	14	120	------	80	10	90
1972	18	----------		18	19	----------		19	59	----------		59	73	----------		73

Note: Fiscal year 1966 data were not available in the NSF 1966 annual report. These are taken from Inventory of Federal Programs . . . , op. cit., p. 363.
NA means not available.

Sources: NAS data figured from: "Soviets to USA," 1959–63, 1963–70, 1967–70. These are materials supplied by the Soviet and Eastern European section, Office of the Foreign Secretary, National Academy of Sciences. NSF data extrapolated from data in the following sources: Fiscal year 1961: U.S., NSF, "Annual Report, Fiscal year 1961," op. cit., p. 141, Fiscal Year 1964; U.S., NSF, "Annual Report, Fiscal Year 1965," op. cit. p. 151; Fiscal Year 1967: U.S., NSF, "Annual Report, Fiscal Year 1967, 1968," p. 168; Fiscal Year 1968: U.S., NSF, "Annual Report, Fiscal year 1968, 1969," p.215; Fiscal Year 1969: U.S., NSF, "Annual Report, Fiscal Year 1969, 1970," p. 104; Fiscal Year 1970: U.S., NSF, "Annual Report, Fiscal Year 1970, 1971," p. 95; Fiscal Year 1972: "1974 National Science Foundation Authorization: Hearings," op. cit., p. 18.

In the early years of the program it was difficult to fill quotas established for exchanges with the Academies of both the Soviet Union and Eastern Europe. For instance:

In fiscal year 1965, 43 Soviet scientists visited the United States for a total of 105 man-months and 34 American scientists visited the U.S.S.R. for a total of 91 man-months (comparable figures for the preceding year were 15 Soviet visitors for 24 man-months and 13 Americans for 52 man-months). The agreement calls for 55 visits from each country totaling 180 man-months for the two calendar years of 1964 and 1965.[403]

The quota established for Soviet exchanges during the calendar biennium 1966–1967 (180 man-months) was completely filled by both Academies [Soviet and American]. This is the first instance of complete subscription since the beginning of the program in fiscal year 1960.[404]

Difficulties in filling quotas for Americans have resulted in part from restrictions Soviets place on access to facilities of especial interest to American scientific and technical personnel. They stem also from

[403] U.S., National Science Foundation, *Annual Report, FY 1965*, op. cit., p. 151.
[404] U.S., National Science Foundation, *Annual Report, FY 1968*, 1969, p. 216.

requirements for reciprocity in subject areas of exchange foreclosing visits of Americans whose areas of interest could not be accommodated. Another factor has been that whereas Soviets have stressed large-scale group tours, Americans have preferred individual visits of long duration.[405]

Apparently, however, the Soviet and Eastern European exchanges program is no longer beset with the difficulty of filling established quotas. Harrison Brown reports that although the exact cause of increased American interest cannot be fully explained, it may be due to retrenchment in funding for domestic R. & D.[406] Some spokesmen predict that the Soviets, as indicated by their recent agreement on cooperative projects, may be making conscious attempts to remove restrictions, thus engendering more American interest in science and technology in the Soviet Union.[407]

SPECIFIC OBSERVATIONS: THE INTEREST IN THE "HARD SCIENCES"

The subject field of greatest interest of Americans in the U.S.S.R. for the total program, and also for each of the four-year periods, is the general area of physics, mathematics, and mechanics. Seventy Americans have been exchanged to study these topics; they spent a total of 214 man-months in the Soviet Union. As might be expected under the *quid pro quo* arrangement, this subject field has also been of greatest interest to Soviets visiting the United States. Since inception of the program 106 Soviets have come to this country, on both long- and short-term visits, to lecture and conduct research in the field of physics, mathematics, and mechanics for a total of 268 man-months.

Much of the Soviet interest in recent years has been in computers (categorized under the general heading of "mathematics/physics"). In the period 1959–1963, Soviet citizens spent a total of 26 months in the United States investigating this topic; in the period 1967–1970, 38 Soviets spent a total of 162 man-months in this country studying the general field. The next greatest field of interest, for exchanges both ways, is that of chemistry and biochemistry. Seven Americans spent seven months in the Soviet Union investigating this topic in the period 1959–1963; during the period 1967–1970, 17 Americans spent a total of 99 man-months on exchanges in this topic. The third and fourth areas of strongest interest for Americans in the Soviet Union are engineering and the earth sciences, including geology, geophysics, meteorology, and oceanography. Twenty-five Americans have gone to the Soviet Union for a total of 93 man-months to study engineering and 26 in earth sciences for 66 man-months. For the Soviet visitor in the United States the next highest fields of interest are about equally divided among engineering, earth sciences, physiology, and biology and metallurgy. Soviets and Americans have been exchanged about equally in the areas of astronomy and radioastronomy; these exchanges have increased annually since the start of the program. In the period 1959–1963, four Americans went to the Soviet Union to study this field for a total of four months. In 1967–1970, this increased to 15 Americans for a total of 15 months. Soviet

[405] Source: interviews with Dr. John Hardt, Congressional Research Service, and principal author of another study in the series: *U.S.-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer, and Diplomacy*. See vol. I, pp. 525–606.

[406] National Academy of Sciences, "Report of Exchange Activities, May 1, 1969 to April 20, 1970," Tab 4 in "Proposal for Continuation of the Program of Exchange of Scientists." May 28, 1970, op. cit., Tab 4, p. 1.

[407] Interview with Dr. John Hardt, Senior Specialist, Congressional Research Service, Library of Congress, September 1973.

scientists have shown no interest in studying the softer scientific areas of social and psychological sciences (specifically psychology and linguistics/geography) in the United States, but 13 Americans have spent a total of 42 months in the Soviet Union in these two fields. (For an overview of exchanges by subject, see Table 30.)

TABLE 30.—AMERICANS TO SOVIET UNION AND SOVIETS TO THE UNITED STATES, BY SUBJECT AND TOTAL MAN-MONTHS, 1959–70

	Total man-months	
	Soviets to United States	Americans to U.S.S.R.
Physics, mathematics, mechanics, computers	268	214
Chemistry, biochemistry	206	219
Biology, fisheries, zoology, entomology, nematology, botany	31	90
Engineering	39	93
Geology, geophysics, meteorology, oceanography	30	66
Physiology, neurophysiology, psychiatry, surgery, pathology	34	31
Psychology, neuropsychology	0	34
Astronomy, radioastronomy	38	28
Metallurgy	29	10
Linguistics, geography, anthropology, archeology	0	8

Sources: Extrapolated from materials supplied by the National Academy of Sciences: "Soviets to United States, long-term visits, 1967–70; 1963–67; 1959–63;" "Americans to U.S.S.R., long-term visits, 1967–70; 1963–67; 1959–63;" "Americans to U.S.S.R., short-term visits, 1967–70; 1963–67; 1959–63." Subject categories were prepared by the author to represent short descriptions of research topics as given in the NAS data.

Expansion of the program to provide for a greater number of exchanges in the social sciences is a major objective of U.S. negotiators, according to Soviet experts in the United States.[408] Another objective is to remove requirements for reciprocity in subjects and duration of visit.

United States and Eastern European Inter-Academy Programs: Numbers and Subjects of Exchange

Because of the absence of detailed information it is more difficult to provide a useful summary of exchanges between Eastern Europe and the United States.[409] Available materials indicate that:

The program of exchanges between the United States and the countries of Eastern Europe has been very small (see Table 31); as in the program of exchanges with the Soviet Union, approximately equal number of visits are conducted annually each year, but more Americans go to Eastern Europe than Eastern Europeans come to the United States (see Table 31); the program of exchanges has been gradually increasing; whereas one American went to the Eastern European countries in 1966, 51 were exchanged in 1970 (see table 31); similar to the American subject interest in the Soviet Union, the greatest U.S. activity in the countries of Eastern Europe is in the physics/mathematics area, closely followed by chemistry. Poland and Romania have received most U.S. scientists in these areas (28 and 26, respectively, 1966–1970). Americans have displayed special interest in studying psychological research in Czechoslovakia.

During the period 1966–1970, 5 or fewer Americans visited each of the Eastern European countries in the following subject areas: earth sciences, botany, biology, physiology, computer sciences, sociology, psychology.[410]

[408] Interview, Dr. John Hardt, op. cit.
[409] Annual data must be computed from NAS narrative lists which include programs in progress, completed, and proposed. The researcher has to be especially careful to avoid errors of duplication.
[410] Data extrapolated from materials supplied by National Academy of Sciences.

TABLE 31.—INTER-ACADEMY EXCHANGES BETWEEN THE UNITED STATES AND EASTERN EUROPE, FISCAL YEARS 1966–70

	Fiscal year—											
	1966		1967		1968		1969		1970		Total	
	Eastern Europeans to United States	Americans to Eastern European	Eastern Europeans to United States	Americans to Eastern European	Eastern Europeans to United States	Americans to Eastern European	Eastern Europeans to United States	Americans to Eastern European	Eastern Europeans to United States	Americans to Eastern European	Eastern Europeans to United States	Americans to Eastern European
Czechoslovakia	0	1	4	7	9	10	8	7	12	15	33	40
Poland	0	0	2	8	7	10	1	8	11	18	21	44
Romania	0	0	6	4	9	12	9	15	9	14	33	45
Yugoslavia	0	0	2	3	8	7	5	6	4	4	19	20
Total	0	1	14	22	33	39	23	36	36	51	106	147

Source: Compiled from material supplied by NAS.

The Impacts of Politics and Diplomacy on the Exchange Programs

The administrative apparatus of the Soviet-American and Eastern European inter-Academy exchange program is designed to encourage its noninterference from political factors or, at least, to capitalize on the nonpolitical and nongovernmental character of its scientific components. Still, political factors do impact significantly on the number, content, and quality of exchanges, requiring continuing negotiations in order to meet the terms of the agreements. The most readily apparent impacts are those foreign policy events which enlarge scientific exchange, such as the detente between the United States and the Soviet Union which led to the signing of the 1972 scientific accords between Moscow and Washington; the priority President Nixon placed on establishing better scientific relations with Romania as a response to Romanian opposition to the 1968 Soviet invasion of Czechoslovakia;[411] and expansion of the number and scope of exchanges between Yugoslavia and the United States following President Nixon's 1970 visit.[412]

More frequently, however, political events have had a constraining effect on activities carried out under the exchange agreements. These have included the general political climate and ideological factors which diminish Soviet and Eastern European receptivity to exchanges, and visa and other restrictions.[413]

IMPACTS OF INTERNATIONAL POLITICAL EVENTS ON SOVIET AND EASTERN EUROPEAN RECEPTIVITY TO THE CONDUCT OF EXCHANGES

"The main problems which our academy has experienced in its exchange program with the Soviet Academy," according to Harrison Brown, "stem from problems in the political sphere."[414] In 1968 Brown reported:

> In this year of sobering and divisive international events, I continue to be optimistic about the positive unifying force of international science. The influence of our common intellectual enterprise far exceeds our numbers and transcends many of the immediate problems of "foreign affairs." Nonetheless, Congressional cuts . . . have reduced . . . the role of technical assistance in the help America gives developing nations. The gold flow is severely curtailing foreign travel of scientists to international meetings. The war in Vietnam continues to cast its long shadow over all official and unofficial American relations abroad.[415]

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[411] Interview with Robert F. Hull, Office of International Programs, National Science Foundation, February 26, 1971.

[412] Brown, *In: International Cooperation in Science and Space: Hearings*, op. cit., pp. 131–4.

[413] According to Byrnes, "there is an eternal 'great debate' within the Soviet ruling groups about the wisdom and utility of continuing academic exchanges." He continues: "The presence of Americans and other foreigners in Soviet universities, where the future elite are being trained; the published materials which they bring with them and on occasion share with their Soviet fellows; the conversations they have in the dormitories and in class; everything which Americans and others do in the Soviet Union is considered a threat. As one American expressed it: 'We *are* propaganda, simply because of our presence here.' In short, the very nature of the exchange program raises very difficult problems for the Soviet Union . . . . To obtain gains which it thinks important, even crucial, it must risk contamination of its intellectual elite and of the ideological future of the country. To obtain the advantages it seeks in the West, it must open up the Soviet Union to some degree to foreign scholars. To obtain scientific and technical and military information and some political advantages, it must expose itself to criticism . . . . " (Byrnes, op. cit., p. 15.) Harvey, Goure, and Prokofieff expand upon this notion and also document restrictions placed upon Soviet scientists who wish to engage in foreign activities, (*Science and Technology as an Instrument of Soviet Policy*, Chap. 5, op. cit.).

[414] *International Cooperation in Science and Space: Hearings*, op. cit., p. 153.

[415] "Report of the Foreign Secretary to the Annual Meeting of the NAS," Apr. 23, 1968, p. 1.

Brown also noted that Soviet and Eastern European attitudes toward the scientific exchange programs reflected the American presence in Southeast Asia:

. . . A resolution of the Vietnam situation will make possible a significantly greater level of cooperative scientific activities with the Soviets, who are not disposed to consider major new departures at the present time.[416]

Similarly, Professor Byrnes reports that the conduct and success of American exchange programs with Eastern European countries is directly influenced by Soviet foreign policy domination of the Communist bloc States:

We have apparently reached a plateau in our exchanges with the Soviet Union and some of the countries of Communist Europe, after a peak of interest in 1963 and 1964. In fact the invasion of Czechoslovakia in August 1968, which crushed high hopes for explaining exchanges with that country and with some of the other countries of Eastern Europe, may mark a sharp demarcation of possibilities for peaceful exchanges of all kinds with the Soviet Union and its associated states.[417]

One of the more important cooperative aspects of the exchange programs is the provision for the staff of American and foreign academies to hold joint meetings to acquaint scientists with scientific research activities in the other country and to permit discussions to plan the number and content of subsequent exchanges. Brown reported one instance among several of cancellation of conferences of this nature, in reaction to American presence in Indochina:

. . . The NAS was informed by the Hungarian Embassy in Washington that the Hungarian Academy of Sciences has "indefinitely postponed" sending its [delegation] to the U.S. for a two-week visit, during which time it was anticipated that negotiations would be completed on an exchange program between the two Academies. This information was confirmed by Hungarian Academy President T. Erdey Gruz in his letter of May 14 to Dr. Handler noting that this was a postponement "because of the present international situation", apparently referring to the presence of American troops in Cambodia.[418]

As of early 1972 only one meeting of this nature had been held by the American and Soviet Academies since inception of the program. And despite continuing overtures and negotiations by the NAS, Soviet scientists had been disinclined to hold another:

Our exchange agreement [with the Soviet Union] also provides for meetings of members of the two academies to discuss exchange matters broadly at the policy level and related matters of mutual interest. Only one such meeting has been held, in Moscow in Spring 1967 but a second is anticipated this year in the United States. This forum offers the opportunity for frank exchange of views out of the public limelight in an effort to convey to each other our estimates of values and needs as regards scientific cooperation, whether within the formal exchange program or more broadly.[419]

No firm response has been received [from the Soviet Union in response to the Academy invitation for a second meeting] and the NAS therefore considers the question pending.[420]

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[416] "Report of the Foreign Secretary to the Annual Meeting of the NAS, Apr. 23, 1968," p. 4.

[417] Byrnes, op. cit., p. 3.

[418] National Academy of Sciences, Office of the Foreign Secretary, "Status Report of Scientific Exchanges under the Memoranda of Understanding Between The National Academy of Sciences and the Academies of Sciences of Eastern Europe, April 1, 1970–June 30, 1970," Report No. 17, July 1, 1970, p. 9.

[419] *International Cooperation in Science and Space: Hearings*, op. cit., p. 152.

[420] NAS Report of Exchange Activities, 1 May 1969–30 April 1970, p. 2. *In:* "Proposal for the Continuation of the Program for Exchange . . . ," May 28, 1970, op. cit.

VISA AND OTHER ADMINISTRATIVE RESTRICTIONS

Restrictions incorporated in visas and in regulations governing internal travel in the United States and the Soviet Union are one impediment to the free exchange of scientists. These are sometimes imposed by one government in retaliation to measures enforced by the other country.[421]

American restrictions are imposed by the State Department, which issues visas for exchanges from East European countries and approves itineraries;[422] and by the Soviet and Eastern European Exchanges Staff, NAS, which, in providing policy and procedural guidance for NAS-administered programs, approves Soviet attendance at scientific conferences and insures that Soviet exchange scientists are not security risks:

> [The staff] administers attendance at conferences, acting for the Government in deciding whether Soviet and Eastern European scientists may attend conferences in the United States, whether the United States should seek reciprocation if Soviet scientists are permitted to attend a specific conference. In addition, it passes along security considerations to American sponsors of conferences which Soviet nationals will be attending and to Americans attending conferences in this area.[423]

State Department restrictions, according to Byrnes, result from Department of Defense apprehensions over the military significance of planned research and also represent retaliation for restrictions the Soviets place on activities of American scholars:

> . . . The [State] Department controls admission to the United States and has on occasion denied visas to Soviet scholars nominated in fields which have military significance, such as microelectronics or new types of computers, or in subjects in which the Soviet Union has refused to accept American scholars. In addition, in retaliation for travel restrictions imposed on all Americans in the Soviet Union, Soviet participants in the United States must inform the Department of State of intended travel four days before they can leave their home campus.[424]

In like fashion, the Soviet Union places restrictions on the research activities of American exchange scientists. In addition to the typical restrictions on sensitive military research, the Soviet Union as noted above shows "little interest" in exchanging scientists "in the 'soft' sciences." [425] Barghoorn's summary observations of a survey he conducted of scientific, including social science, exchanges with the USSR during 1966 and 1967 describes some of the difficulties the social scientist faces in the USSR:

> . . . Work in Russia is frustrating and annoyingly controlled by government overseers—particularly for social scientists. . . . The more knowledgeable an exchangee is about a nonpolitical discipline, such as mathematics, the more likely

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[421] This point was made in a recent interchange between Representative Fuqua, then chairman of the Subcommittee on International Cooperation in Science and Space, House Committee on Science and Astronautics, and Mr. Herman Pollack, Director, Office of International Scientific and Technological Affairs, Department of State:

"Mr. Fuqua. In this cultural agreement, have our scientists been given free rein to go where they choose to or look at various matters that may be of concern from a scientific point of view?

"Mr. Pollack. On the whole the answer to that is 'No.' However they are being given access to more and more of the institutions and the activities that they are interested in. There are still closed areas, there are still facilities we do not see and we, in turn, impose a comparable condition upon the Soviets in an effort to maintain a sufficient degree of reciprocity so as to keep the pressure on them to open up their facilities that our people are interested in seeing."

(*International Cooperation in Science and Space: Hearings*, op. cit., p. 9).

[422] *1970 NSF Authorization, Hearings*, Vol. 1, op. cit., p. 455.

[423] *The Participation of Federal Agencies in International Scientific Programs*, op. cit., p. 38.

[424] Byrnes, op. cit., p. 9. The NAS Advisory Committee on Eastern Europe has reported an instance of DoD objections to exchanges based on the sensitivity of planned research. See: "Summary Minutes of Meeting of Advisory Committee on Eastern Europe." November 17, 1962, p. 4.

[425] "A Decade of Scholarly Exchanges with the Soviet Union," *FAR Horizons* (July 1968), p. 2.

he is to be able to compare notes with his Soviet colleagues. Knowledge of socio-political subjects, on the other hand, is likely to make it difficult to establish and maintain useful relations with Soviet counterparts.[426]

A quantitative indication of mutual restrictions is the number of rejections made by each country for scientific visitors proposed by the other. Apparently, more Americans than Soviets have been rejected since initiation of the exchange program. Rejected Americans generally have planned to conduct activities in the areas of physics and mathematics. The same pattern is reflected in American rejections of Soviet visitors. According to the National Academy of Sciences, "Rarely have we been informed of the basis for rejection of American applicants . . . .[427] During periods of 1959–1963, 1963–1967, and 1967–1970, Soviet visitors rejected by the United States numbered respectively 2, 7, and 0; comparable Soviet rejections of American visitors were 0, 12, and 5.[428]

Although scientific exchange programs do not appear to be unduly influenced by clandestine information gathering activities, it is obvious that these activities may influence the restrictions the host places on the activities of the foreign visitor and on the host country's attitudes toward foreign scientific visitors. In his recent review of Soviet-American exchange programs, Byrnes did not establish a link between intelligence activities and the activities of American scholars in the Soviet Union. However, he remarked: "The CIA and FBI, which have important national responsibilities, are interested in information concerning Soviet strengths and weaknesses."[429] One possible motive behind FBI efforts in this area, according to a news report, is to survey Americans who have gone to the U.S.S.R. in an attempt to obtain information about whether they might have been approached for recruitment by Soviet Intelligence Services.[430]

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[426] Frederick Barghoorn, "U.S. Scientists in Russia," *Science News* 98, no. 12, p. 250. There is almost no detailed information available on Soviet formal and informal restrictions applicable to exchange programs. General sources are: U.S., Department of State, Bureau of Intelligence and Research, *Sino-Soviet Bloc Exchanges with the Free World in 1960*, 1961, (Intelligence Report No. 8401), 39 pp. Reprinted in: U.S., Congress, Senate, Committee on Foreign Relations, *Mutual Educational and Cultural Exchange Act: Hearings*, 87th Cong., 1st sess., 1961, pp. 165–209. See also: "Soviet Programs in International Education (Washington: U.S. Government Printing Office), 1971, 41 pp.

[427] Philip Handler, "The Moscow Agreements and U.S.-Soviet Scientific Relationships," op. cit., p. 8. Dr. John Hardt reports that rejections are made especially of Russian-speaking American economists and social scientists who specialize in Soviet studies. (Interview.)

[428] Data extrapolated from details list provided by NAS.

[429] Americans who apply for U.S. Soviet exchange programs are evaluated, according to Lawrence Mitchell, Director, U.S. Soviet Eastern European Staff, NAS, solely on the basis of their scientific qualifications are not subject to any ideological or political screening. (Interview March 16, 1971). In fact although they are encouraged to have a language capability, competence in Russian is not a requirement for exchange. (Ibid.) American exchange applicants are required to submit three confidential reference forms in support of their application. No questions are asked on the form relating to political or ideological convictions of the applicants. However, they are evaluated on their ability to work in the foreign culture. According to the Confidential Reference form: "The special pressures and responsibilities imposed by the Soviet or Eastern European environment require that the exchange participant be an exceptionally mature and emotionally stable person. In these respects, do you consider the applicant (and any dependents who might accompany him) completely qualified for an extended stay?"

[430] Morton Mintz, "U.S. Visitors to Soviet Union Probed by FBI," *Washington Post* (April 1, 1972), p. A-2. Mintz's account of FBI surveillance of Americans who have gone to the USSR is based upon information contained in an internal FBI memo, dated Nov. 17, 1969 that was stolen from the FBI office in Media, Pa., 1971. Mintz reports in part: "The FBI investigates students, teachers, and scientists who spend a month or longer in the Soviet Union. The purpose of the investigations 'Is to identify them and determine whether any of them have been approached for recruitment by the Soviet Intelligence Services.' . . . In some cases, at least, the FBI is known to attempt to learn from returned travelers such information as the identity of Russians they met and the nature of their relationships (a Russian's request for a book could be the nucleus of a recruitment effort, as the FBI is understood to see it), and whether the visitors while in Russia, may have been entrapped in some embarassing situation that the Soviet intelligence might try to exploit some day. . . . A cursory check by *The Washington Post* showed that if such investigations are in fact made, it is rare for the subject to be interviewed or for him to learn of the investigation."

Soviet restrictions on American exchanges, according to Byrnes, relate to obtaining archival information, travel, "bugging" of living quarters, mail searches, and impact on interpersonal relations:

American scholars . . . have great difficulties obtaining access to archives, to living sources, and to some kinds of publications. . . . Americans are seriously restricted in their opportunities to travel for study or study-related purposes from Moscow and Leningrad, and they ordinarily travel only in groups and accompanied by . . . guides.

Americans have come to consider the Soviet postal system as "the opened mail" and to realize that diaries have official readers. They are never certain who their Soviet friends are and which are involuntary informers or agents provocateurs. Some had close friends regretfully discontinue relationships because the friends were frightened by the police. . . . Some were followed . . . and all of them, and their Soviet friends came to believe that the rooms in which they lived . . . had listening devices . . . and that their telephone conversations were monitored. Many became justifiably suspicious of officials in the university . . . some of whom . . . had responsibilities to the KGB, the Soviet Secret Police. . . .[431]

Dr. Philip Handler, president of the Academy, recently summarized NAS perspectives on the need to remove political constraints to the exchanges programs:

The ultimate goal must be the normalization of . . . exchanges with Russian and American scientists free to move back and forth working in laboratories, of their own choice without the need for formal mechanisms. . . .[432]

Pessimistically he continued: "There is no provision among the various [recently] signed [1972] agreements . . . designed to promote progress in this direction." [433] Harrison Brown has called, for instance, for removal of barriers to participation in activities privately sponsored by American universities:

The problems of free circulation of scientists continue to vex us. In 1968 two Soviet physicists were denied entry to the United States to present papers at the Fifth Symposium on Remote Sensing of the Environment, held at the University of Michigan. The meeting was open and international, and the proceedings are readily available; however, it was organized by the University of Michigan and other sponsors in this country and not by an international body.[434]

Also, according to Brown, the Departments of State and Defense should remove travel restrictions:

We discovered that whole counties were put on the banned list by the Department of Defense, not by the Department of State. It was done on the following basis, that if there happened to be a criticial installation which the Defense Department did not wish Soviet scientists to get near, they would restrict access to the entire county. As a result, we could not take scientists to Muir Woods or on a hike up to Mount Tamalpais just outside of Berkeley, California. It turned out that our national observatory at Kitt Peak was not restricted, but the road going up to Kitt Peak was, so couldn't get them there. All of Martha's Vineyard was restricted and we couldn't take them there. All of San Diego was restricted and that sort of thing makes life very complex.[435]

Another NAS objective is to facilitate Soviet entry by amending the Immigration and Nationality Act to remove requirements that American institutions assume responsibility for Soviet visitors. "Such a change in law," according to Harrison Brown, "would reduce bureaucratic red tape and perhaps even hasten American visa-issuing capabilities without sacrificing legitimate considerations of national security." [436]

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[431] Byrnes, op. cit., pp. 10, 13, 14.
[432] "The Moscow Agreement and U.S.-Soviet Scientific Relationships," op. cit., p. 8.
[433] Idem.
[434] "Report of the Foreign Secretary to the Annual Meeting of the National Academy of Sciences, April 29, 1969," p. 4.
[435] *International Cooperation in Science and Space: Hearings*, op. cit., pp. 160–61.
[436] Ibid., p. 154.

In summing up the constraints imposed by diplomatic barriers, Brown sees no prospect of radical improvement in exchange programs with the Soviet and East European academies:

> . . . We do not foresee marked changes in the political relationships which determine the ground rules for scientific contacts. Therefore we believe that our best interests are served by seeking as normal and fruitful scientific relations in this region as are possible and . . . expanding programs gradually in accord with needs and desires of our scientists and those of the USSR and Eastern Europe.[437]

Contributions of Soviet and Eastern European Exchanges to Science

An objective evaluation of the impacts of Soviet and Eastern European exchange programs on the advancement of science and on international cooperative scientific relations between the United States and the Communist-bloc countries would require a comprehensive survey of the specific activities undertaken by exchangees in the laboratory and of the quality and quantity of scientific publications resulting from exchange visits. Such an undertaking is beyond the scope of this paper. And apparently no agency of the Government has ever conducted a comprehensive survey along these lines.[438] Unlike some of the bilateral scientific agreements administered by NSF, the Soviet and Eastern European bilaterals do not require separate or joint annual reports on activities. The Soviet and Eastern European Exchanges Staff, NAS, requires its grantees to report on activities undertaken while in the Soviet bloc countries. No specific reporting forms are required; thus the content and quality of these reports probably varies, with most being limited to narrative descriptions of activities pursued and statements of problems relating to housing, accommodations, access to laboratory facilities, and the like. In view of the personal information included in these reports they are not generally made available to the public, and apparently the Academy has never published a comprehensive report on the scientific aspects of the programs.[439]

The only information available on the scientific benefits of the program comes from public statements made by the President or the Foreign Secretary of the National Academy of Sciences. Summing up the general progress of the program, Dr. Handler reports: "This exchange experience to date," he remarked to the Congress, "should be regarded as an only slightly qualified success scientifically, but may also be regarded as one of the ice-breakers that paved the way for the Moscow accords." [440]

The "qualified scientific success" of the programs is elaborated upon in annual reports of the Office of the Foreign Secretary. According to the Academy, the "purpose of these programs is to enable American scientists to visit and conduct research in institutes of the respective Acadèmies abroad and in other research institutions and to facilitate visits to the United States by scientists of countries whose presence is particularly desired by their American colleagues." [441] "It is hard to recall in 1971 how little most of our scientists—with notable exception

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[437] Ibid., p. 171.

[438] The President's Science Adviser reviewed U.S.-Soviet scientific and technical exchange activities in an unpublished report prepared in 1972. No effort was made to systematically evaluate the inter-Academy exchanges along these lines. (Interview, SCI, Department of State, July, 1973.)

[439] Information on NAS reports required obtained in interview, Mr. Lawrence Mitchell, March 16, 1971.

[440] "The Moscow Agreements and U.S.-Soviet Scientific Relationships," op. cit., p. 8.

Harvey, et al., suggest that Soviet participation in bilateral scientific and technological agreements are designed, almost solely, to provide foreign scientific and technical information, and are of little benefit to the other country. (*Science and Technology as an Instrument of Soviet Policy*, op. cit. Chap. 5.)

[441] "Proposal for Continuation of the Program for Exchange of Scientists," op. cit., p. 1. May 28, 1970.

of mathematicians and astronomers—knew about work going on in their fields in the U.S.S.R. in the year ending in 1959," Dr. Brown reports. As a result of the exchange programs, "The American and Soviet exchange scientists of today would hardly recognize their counterparts of a decade earlier, so much have important segments of each society become familiar with the science and society of the other country." [442]

Brown continues that "The effectiveness of the program is difficult to judge in any quantitative sense." But one measure of success is the development of fruitful personal and working relationships between scientists and staff of the two academies:

> There are clearly identifiable professional and personal relations established between a limited number of scientists of the two countries. [But] in considering the benefits derived from the exchange programs with the Soviet and East European academies, one should go beyond the profit to the individual scientist who participates. We find that the very existence of a day-to-day working relationship between our own academy and the individual ones in the U.S.S.R. and Eastern Europe has developed a kind of familiarity and rapport which is useful in other ways.[443]

Especially useful in this regard are the Academy visits to survey the state of science in Eastern European countries during the period 1964–1969:

> The NAS delegations surveyed current scientific research, identified institutions in which Americans might profitably carry out research, identified scientists of the other country who might profitably be invited to the United States, and consulted with appropriate officials about conditions under which the respective Academies might foster increased contacts of scientists.[444]

In addition to providing background information used to initiate the exchange programs with the Soviet Union, these surveys have undoubtedly proved useful to the operations of the Academy's Advisory Committee on the U.S.S.R. and Eastern Europe. This Committee, which is composed of eminent professionals in the physical, natural, and social sciences, "provides policy guidance to the administrative staff of the Section on the Soviet Union and Eastern Europe through its annual meeting; it selects American scientists for participation in the exchange programs; and addresses itself to particular problems of a more general nature regarding the conduct of exchanges and provides general facilitative services to scientists seeking to go to the Warsaw Pact countries.[445]

Another beneficial product of the working relationship established by the Soviet-American bilateral agreements, according to Brown, is support for the conduct of other professional and international cooperative scientific activities not specifically provided for in the original bilateral agreement:

> We find that we are able to obtain the good offices of our partner academies on behalf of American scientists traveling privately to those countries, so that they are able to enjoy access to scientists and institutions which might otherwise not be readily available to them. The relationships are useful and effective also in our international nongovernmental scientific organizations and activities. In short, our interacademy working relationships have broken down cultural and other barriers and engendered trust on all our parts so that we were able to conduct our international business with greater assurance and effectiveness. We all know with whom we are dealing.[446]

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[442] *International Cooperation in Science and Space: Hearings*, op. cit., pp. 151, 152.
[443] Ibid., p. 152–4.
[444] "Proposed for the Continuation for the Program for Exchange of Scientists, May 28, 1970," op. cit., p. .
[445] NAS, "Report of Exchange Activities, May 1, 1969–April 30, 1970," op. cit., p. 4.
[446] "Proposal for the Continuation of the Program for Exchange, May 28, 1970," op. cit., p. 2.

There is little detailed information available about the scientific merits of the U.S.-U.S.S.R. exchange program.[447] However, there have been a few "breakthroughs" in the opening up of access to American scientists of some new and old scientific areas formerly out of bounds. Brown is especially gratified by the placing of U.S. scientists:

> . . . In the important Science City of the Soviet Academy near Novosibirsk and [accorded] the same professional and personal privileges as Soviet scientists, including freedom from procedural amenities that exist in older centers to the West.[448]

In addition to the individual visits, the exchange agreements with the Soviet Academy have provided for joint scientific symposia. Four of these have been held since inception of the exchange agreements:

> The first . . . was organized in the United States in the field of radio astronomy in 1961. The second, on the initiative of the Soviet Academy in the field of partial differential equations, was held in . . . 1963. A third, on the electron theory of metals . . . was . . . held in Moscow at the Soviet Academy's request in 1968. . . . This symposium generated such enthusiasm in a rapidly moving field that the participants decided to hold a successor meeting . . . in New York in early 1970. We are now in the organizational phase of the next in the series, which is to be on the subject of extraterrestrial intelligence and held at the Byurakan Astrophysical Observatory in the Armenian SST next September.[449]

Other important byproducts of these Academy-to-Academy agreements, undoutedly, are the cultural and political ramifications of exposing Soviet scientists and technical personnel to an energetic, but pluralistic, scientific R & D support pattern.

As a final illustration of the benefits of the scientific exchanges Harrison Brown has speculated that they have helped to ease international tensions by facilitating efforts to slow the arms race:

> . . . As a result of contacts between Soviet scientists and American scientists there have been some rather extraordinary foreign policy changes. I have seen attitudes of the scientists of one country change enormously as a result of these contacts. I have seen people come to the United States who had preconceived concepts . . . which were dramatically changed during their visit. I would say that if it had not been for these contracts we would not today have a Test Ban Treaty . . . nor would we be as far along the path toward the eventual signing of the Nonproliferation Treaty; nor would we have the SALT talks . . .[450]

It seems clear that the U.S. and Soviet and Eastern European inter-Academy exchange programs have contributed to an exchange of scientific information, have strengthened the establishment of cooperative scientific relationships, and have supported the easing of tensions by laying a groundwork for enlarged exchange activities. However,

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[447] Barghoorn's summary of responses he obtained from American scientists who participated in exchange programs, however, does provide some illustration of the general benefits and handicaps of the program as seen by participants: "Many exchangees presented a carefully qualified evaluation of the professional training and information benefits of exchanges. On the whole, the natural scientists appeared to think that they could learn relatively little professionally from experience in the U.S.S.R., although mathematicians were perhaps more enthusiastic, as a rule than were physicists, chemists, and biologists. However, in terms of values other than narrowly professional ones, our natural scientists were for the most part, glowingly positive in their evaluation of the benefits of U.S.-Soviet contacts. Among other things, many of our scientists and mathematicians pointed to the usefulness of establishing personal links with Soviet colleagues, among the results of which . . . were a more intimate understanding of the latter's work and the inauguration of useful correspondence and exchanges of publications." ("The Special Case of U.S.-U.S.S.R. Exchanges," op. cit., p. 38.) Barghoorn's study is based on evaluation of the dimensions of communications and perceptions involved in American-Soviet exchanges of persons. Data consist of questionnaire responses from 180 persons sent abroad by the NAS and Government agencies.

[448] *Report to the Academy*, April 29, 1969, op. cit., p. 6.

[449] Brown, *In: International Cooperation in Science and Space: Hearings*, op. cit., p. 152. For a report on the Conference on Communication with Extraterrestrial Intelligence, See: "Soviet-American Conference Urges Search for Other Worlds," *Science* (October 8, 1971), pp. 131–2.

[450] Brown, *International Cooperation in Science and Space*, op. cit., p. 162.

several major obstacles remain to more fruitful exchange. These include the needs for: more joint cooperative research,[451] closer continuing relationships between American and Soviet scientists, continued negotiations to provide subjects and conditions for exchange which are conducive to participation by American scientific and technical personnel, and increased competence by American scientists and technicians in Russian and Eastern European languages.[452]

Some Concluding Observations on Scientific Exchanges With Communist Countries

The Office of the Foreign Secretary, National Academy of Sciences-National Research Council, administers the program of nongovernmental scientific exchanges with the Soviet Union and the countries of Eastern Europe. These activities are formalized in a series of bilateral agreements for scientific and technical exchange provided for under biennially renewed cultural relations agreements with the Soviet Union and the countries of Eastern Europe. This program, different from other NSF-funded and administered bilateral agreements, which supplement on-going exchanges, is the only mechanism which has permitted continuous exchanges of nongovernmental scientific personnel between two political adversaries.

The factual, financial, and administrative history of the slow growth in exchanges between these countries illustrates several issues of the interaction between science and diplomacy in exchange programs with political adversaries:

> The constraints imposed by conflicting political objectives and the resulting need for continuous negotiation between quasi-governmental and prestigious scientists (the Academy staff) to supplement and assist diplomats to insure smooth program operations and expansion;[453]
>
> The relationship between both by international political events and U.S. and Soviet domestic and foreign policies on receptivity to continued and expanded exchange;
>
> Utilization of exchange agreements in forging cultural and functional scientific links between ideologically disparate states;
>
> The political and diplomatic barriers to expanding program operations with respect to: subject content, especially the social sciences; to removing defense-related geographic limitations on the conduct of research in the host country; and the need to further implement bilateral provisions for joint cooperative research and lecturing;

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[451] The last several agreements have provided for terms of joint cooperative research to be worked out. Difficulties in ironing out details persist. See: *Annual Report of the Foreign Secretary to the NAS*, April 28, 1970, op. cit., p. 6.

[452] On this point Dr. Handler reported to the Congress: "I cannot help but digress to note that there is a simple but serious deterrent to . . . amicable progress—the general ignorance of the Russian language among the American scientific and technical community. In the last two decades we have, perhaps arrogantly, come to assume that English is the current lingua franca of educated individuals and that our tongues will suffice in international discourse. The expanded relationships with the Soviet Union envisioned in the Moscow agreements cannot reasonably be effected on that basis alone and it will become imperative that some fraction of our young scientists acquire some reasonable degree of fluency in Russian." (*U.S.-U.S.S.R. Cooperative Agreements, Hearings*, op. cit., p. 80.)

[453] Commenting on giving responsibility to governmental units for administration of the new scientific accords, Dr. Handler reports: "Patently some such formality is all that could possibly be provided . . . . But I hope that this does not mean that the potential harshness of such negotiations was avoided in the Kremlin [and in Washington] by transfer to the commission room. Further, I hope that, for our part, this will not have generated a pattern in which only government directed and initiated research programs will find support. . . . It is hoped that there will be room within the arrangements . . . for . . . the judgments of the scientific, industrial, and academic communities and that these programs will . . . be responsive to the individual genius of our scientific communities." (Handler, *NAS-NRC News Report*, op. cit., p. 8.)

The high costs involved in maintaining a smooth exchange program; and

Evidences that scientific exchanges may lay the groundwork for closer bilateral cooperation in science and in solving political disputes.

It is also observed that little information is made public about these programs. Were better information provided, program administrators and the Congress might be better able to assist in establishing the appropriate priorities needed to advance both short- and long-range cooperation and in advising the executive branch as to the appropriate mix between programs for governmental vs. nongovernmental scientific exchange and cooperation.[454] Commenting on this point with respect to the new bilateral accords, the Hon. McGeorge Bundy noted to the Congress that:

If these agreements are to fulfill their promise, they will need the understanding and support of the public and the Congress, as well as the executive branch . . . which will necessarily and closely engage both [the House Science and Astronautics Committee—specifically the Subcommittee on International Cooperation in Science and Space] and others with responsibilities for authorization and appropriations. . . . Active cooperation is much more expensive than technical and cultural exchanges, and where there is a new level of cost there must be a new level of congressional engagement. . . . The more serious and substantial these processes of cooperation become the more there is the requirement for effective engagement of appropriate Members or committees of Congress, so that they know what is going on in time to have an input, and they're not simply confronted with a fait accompli at what might be an inconvenient point.[455]

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[454] Another study in this series contained similar observations with respect to the need for closer collaboration between the executive and legislative branches, but with respect to trade agreements; ". . . As knowledge of which of the alternatives will prevail may not be evident for several years, very careful official and public scrutiny of each step in the progress of the Joint U.S.-U.S.S.R. Commercial Commission discussions would appear to be in order for *both* the executive and legislative branches." (Italics in original.) (From: *U.S.-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer, and Diplomacy*, op. cit. See vol. I, p. 606.

[455] *U.S.-U.S.S.R. Cooperative Agreements: Report*, op. cit., p. 12.

V. Scientific Exchanges With the People's Republic of China

Upon completion of President Richard M. Nixon's visit to the People's Republic of China (PRC), in February 1972, the President and Premier Chou En Lai issued a communique which included a general agreement to facilitate the development of scientific, technical, and cultural exchange and communication. This action has evoked widespread hope that the two countries would begin regular exchanges of scientific and technical personnel.[456] Dr. Edward David, Jr., then the President's science adviser, was reported to have "welcomed the agreement as 'an important step,'" because, he said, "scientific, technological, and cultural exchanges can be important in creating understanding." [457]

During the year and a half since the President's visit, small Chinese and American scientific and technical delegations have been exchanged. And recently, the Chinese Scientific and Technical Association and a nongovernmental American group concluded an agreement for additional exchanges.

Despite these precedent-breaking steps, much doubt remains as to the possible initiation of a large, regular, Government-sponsored movement of scientists between the United States and the PRC. Similar to the history of early exchange activities with the Soviet Union and the countries of Eastern Europe, current trends suggest that exchanges with the PRC will evolve slowly and first become formalized under the auspices of nongovernmental scientists working through the National Academy of Sciences. More formal official exchanges of Government agency personnel will then follow, but probably in a slowly evolving pattern, again, similar to that established with the Soviet Union and the Eastern European countries. A number of factors support this observation: political differences, issues surrounding the failure of recent attempts to establish continuing exchange, and the organization and conduct of research in the PRC.

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[456] Several news articles appearing in connection with the President's visit described high priority interests of American scientists who wanted to research and study in the People's Republic of China. For example it was reported that social scientists wanted to study "the Maoist man . . . decentralization of industry, communal life, part-work, part-study regimen for students and scholars . . . ." (Victor Cohn, "U.S. Scholars Welcome Exchange Agreement", *Washington Post* (February 28, 1972), p. A-5.) Health and medical topics reported were of special interest: "Jerold F. Lucey, Professor of pediatrics at the University of Vermont, wants to investigate reports the Red Chinese have dropped their premature-birth rate below that in the United States by introducing some simple innovations in prenatal care. . . . Stanley R. Dean, a Miami psychiatrist and member of the American Psychiatric Association's task force on transcultural psychiatry, would like to know more about mental-health activities in Red China." . . . Other researchers want to study the use of medicinal herbs, which the Chinese say can successfully treat 70 percent of man's frequently occurring diseases; public health campaigns that have reduced the incidence of a number of ailments; pollution-control efforts that include recycling gas, liquid, and slag wastes . . . . (Patrick Young, "Science and Peking; Will Nixon Visit Lead to Exchanges with U.S.?", *National Observer* (February 26, 1972), p. 18) Biology, acupunture, and the study of virology in relationship to origins of the Asian flu, were of special interest to some researchers. (Attributed to Arthur Galston, *In* Victor Cohn, "U.S. May Ask China For Scientific Ties," *Washington Post* (January 24, 1972), p. A-5.)

Other articles describing scientific interest with the People's Republic of China were: Victor Cohn, "U.S. Professors' Travel Bids Flood New China Embassy," *Washington Post* (May 12, 1971), p. A-9; Douglas P. Murray, "Exchanges With China?" Reprint from *Exchange*, journal of U.S. Advisory Commission on International Educational and Cultural Affairs (Winter 1972), *In* "Exchange with China?," Remarks of the Honorable John Brademas on the floor of the House, *Congressional Record* (February 24, 1972), pp. H 1470–72.

[457] Cohn, February 28, 1972, op. cit., p. A-5.

Obstacles to Systematic Government-Sponsored Exchange

In a study prepared in 1970 for the Subcommittee on National Security and International Operations of the Senate Committee on Government Operations, Professor Robert F. Byrnes, an authority on exchange programs with both the Soviet Union and the PRC, identified some of the political difficulties which had hindered exchanges between the two countries until that time. He attributed these to basic political differences and deep-seated nationalistic views.[458] Exchange programs with the People's Republic of China, Byrnes continued, would be characterized—like the U.S.-Soviet programs, but even more notably—by policy and ideological constraints:

> . . . The Chinese Communist style of negotiating and the Chinese sense of time . . . will present Americans with even more recalcitrant and baffling difficulties than has the Russian-Soviet system . . . . The impact of the past twenty-five years of basic isolation from most of the world, especially of the years of the Cultural Revolution, must be profound, even though we cannot evaluate it with any confidence.[459]

Byrnes foresaw that the Chinese would oppose the establishment of formal exchange programs in the absence of regular diplomatic recognition and relations between the two countries.[460] And again as in the case of the early exchange programs between the United States and the Soviet Union,[461] he predicted that in their initial exchange visits, ". . . the Chinese will . . . no doubt concentrate upon sending scientists and engineers to the United States in order to benefit in those areas of study in which we have a clear superiority and in which they have direct technical needs." [462] He also predicted that the first American scholars to win acceptance for visits to China would have both ideologically acceptable pacifist views and expertise in subjects especially germane to Chinese scientific and technical needs. He envisoned a two-step sequence:

> [First] invitation to individual American scholars by the Chinese Communist government, which would identify and select scholars whom it considered friendly or malleable or of value in fields of study it considered especially significant, such as medicine and public health, computer technology, or genetics; and, [second], a formal exchange of a small group of scholars, who would visit specific cities and institutions under conditions carefully defined in advance by the two governments. At the same time, or probably even prior to such actions, American political, religious, or pacifist groups might visit the People's Republic of China . . . with the approval of the Chinese government.[463]

The history of recent scientific exchanges with the PRC reflects many of the considerations Byrnes described in his study for the Senate. The first pre-summit U.S. scientists to visit China in 20 years were Drs. Arthur Galston and Ethan Singer, biologists who strongly opposed U.S. defoliation in Vietnam. News accounts credit Chinese reception of these U.S. visitors with the fact that they were ideologically acceptable, reflecting the pacific stance Byrnes predicted would characterize early American scientific visitors to China.[464] It

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[458] U.S., Congress, Senate, Committee on Government Operations, Subcommittee on National Security and International Operations, *International Negotiations: When the Academic Door to Peking Opens:* Memorandum, 1970, p. 3 (Committee Print).
[459] Ibid., p. 4.
[460] Ibid., p. 2.
[461] See Chapter IV of this study.
[462] Byrnes, op. cit., pp. 13–14.
[463] Ibid., p. 10.
[464] Cohn (January 24, 1972), op. cit., p. A–1.

has also been reported that some dozen other American researchers were admitted to China for short visits designed by the Chinese to publicize and familiarize foreigners with unique medical developments.

Further support of Byrne's predictions is illustrated in reports that the Sino-American Exchange Committee of the Federation of American Scientists, an informal group of scientists given to criticizing some governmental policies especially in Indochina, "received a warm response from the official Chinese Academy of Sciences to its request to set up exchanges between the two nations." [465] Significant also in this respect is that the first multidisciplinary Chinese scientific delegation received in the United States, after President Nixon's visit, came upon invitation of both the Federation of American Scientists and the National Academy of Sciencies. [466]

Moves Toward the Establishment of Regular Exchanges

In 1966, a special "Committee on Scholarly Communication with Mainland China" was established in the NAS, under advisory guidance of the Academy, the Social Science Research Council, and the American Council of Learned Societies. In an attempt to coordinate and to lend prestige and give guidance to U.S. efforts to forge better scientific communication with China, the Committee began "to explore the possibilities of direct communications with the Chinese scientific community and to encourage official attitudes and practices conducive to interchange of scientific materials and persons interested in scholarly communication."[467] In support of providing U.S. scientists with reliable information on Chinese scientific activities, the Committee prepared special bibliographies of translations of scientific and technological materials published in China,[468] and initiated publication of a review periodical on scientific activities in China, *China Science Notes*. The Committee notified American scientists that it wished to encourage direct scientist-to-scientist exchange of scientific information and that it would assist American researchers by funding, reprinting, and forwarding periodical reprints to 20 Chinese scientific institutions which might be interested in seeing the materials.[469] In 1973 the Committee began publication of *China Exchange Newsletter*, replacing *China Science Notes*. Its declared objective was to "keep American scholars informed of the progress in scholarly exchange with the People's Republic of China [and to] serve as a channel for communication of ideas on that subject."

The Committee took two additional steps to solidify relations. Apropos of the growing rapprochement between the United States and China, the Committee, in January 1970, changed its name to the Committee on Scholarly Communication with the People's Republic of China (CSCPRC)[470] and, reportedly, Dr. Philip Handler [471] sent a

[465] Stuart Auerbach, "Scientists Vie for Peking Trip," *Washington Post* (November 18, 1971), p. A-23; "FAS Serving as Link to China," *Science and Government Report* (November 25, 1971), p. 3.

[466] "Scholarly Exchange with the People's Republic of China, 1971-1972." *China Exchange Newsletter* I, No. 1 (Spring 1973), p. 2.

[467] "Annual Report of the Foreign Secretary to the National Academy of Sciences," April 23, 1968, p. 10.

[468] "A Bibliography of Translations from Mainland Chinese Periodicals in Chemistry, General Science and Technology". Described in "Annual Report of the Foreign Secretary to the National Academy of Sciences," April 23, 1968, op. cit., p. 10.

[469] "Annual Report of the Foreign Secretary to the National Academy of Sciences", April 23, 1968, op. cit. p. 10.

[470] "Annual Report of the Foreign Secretary to the National Academy of Sciences," April 1971, *In International Cooperation in Science and Space: Hearings*, op. cit., p. 232.

[471] "Returning U.S. Biologists Say Peking Scientific Door Ajar, *Christian Science Monitor* (May 27, 1971), p. 10. The report that Dr. Wald hand-carried this letter is provided by Cohn (February 28, 1972), op. cit., p. A-5.

letter, carried by Dr. George Wald, an American scientist visiting in China, to the President of the Chinese Academy of Sciences listing scientific meetings scheduled in the United States that might be of interest to the Chinese.

However, the Committee reported difficulty in achieving its objectives. For instance, in 1969 the Foreign Secretary stated:

> The Committee on Scholarly Communications with Mainland China continues unsuccessfully to seek means to develop U.S. scientific and other scholarly exchanges with the scientists of the People's Republic of China and their institutions.[472]

Furthermore, it was reported that the Chinese never answered Handler's letter.[473] Several reports attributed the lack of direct Chinese response to the absence of formal, normalized diplomatic relations between the two countries. For example,

> The Chinese have insisted so far that they will not begin formal exchanges even with the non-governmental National Academy of Sciences, as long as there are U.S.-Taiwanese scientific relations.[474]

Several other activities, portending the shape and thrust of future scientific exchange, occurred simultaneously with these overtures to systematize exchanges. The most important was the commencement of a series of privately arranged visits between Chinese and American scientific and technical personnel.

During the period 1971–1972, two Chinese scientific delegations visited the United States. The first, a group consisting of 11 physicians representing the Chinese Medical Association, visited the United States during October and November 1972 on invitation from the President of the Institute of Medicine of the National Academy of Sciences. The second, a 7-member multidisciplinary group representing the Chinese Academy of Sciences and the Scientific and Technical Association, toured the United States during November and December 1972 as guests of the Federation of American Scientists and the Committee on Scholarly Communication with the People's Republic of China.[475] Three additional delegations, totaling approximately 30 additional Chinese scientists, engineers, and physicians visited the United States during early 1973.[476]

During the 1971–1972 period, according to the CSCPRC, approximately 120 nonofficial American scientific and technical personnel participated in scholarly visits to China. Most of these persons were exchanged as individuals supported neither by the CSCPRC nor by any other group. Social scientists and scholars in the humanities comprised approximately two-fifths of the group, with the rest evenly divided among physical, engineering, medical, and biological scientists. Approximately two fifths of the American visitors were of Chinese descent.[477] A few of the American visitors were permitted to stay on in China for longer visits, totaling a maximum of 3–4 months; most of these were Chinese-Americans.[478]

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[472] "Annual Report of the Foreign Secretary to the National Academy of Sciences," April 28, 1969, op. cit., p. 9.
[473] Young, op. cit. (February 26, 1972).
[474] Cohn (January 24, 1972), op. cit., p. A-1.
[475] "Scholarly Exchange with the People's Republic of China, 1971–1972," op. cit., p. 2.
[476] "U.S.-China Scientific Exchange to Widen," *Chemical and Engineering News* 51 (July 9, 1973), p. 11.
[477] "Scholarly Exchange with the People's Republic of China, 1971–1972," op. cit., pp. 2–3.
[478] Interview, CSCPRC, July 1973.

Individual visits of this nature, according to a number of Government officials,[479] were permitted by the Chinese under what has since come to be called their emphasis on allowing exchange arrangements on a "people-to-people" rather than Government-to-Government basis.

While individual American visits of this nature continued, efforts to systematize exchanges moved ahead slowly.

After continued diplomatic negotiations between the United States and China in Paris, Dr. Henry Kissinger, then the President's foreign policy assistant, visited China in February 1973 to work out further details of arrangements the President initially made in 1972. Following his visit to Peking, Dr. Kissinger announced that among American groups invited to China would be " . . . a medical group during the spring [of 1973 and] a scientific group during the summer. . . ." The People's Republic of China agreed also to send to the United States ". . . the archeological exhibit from the Forbidden City . . . , a group of water-conservation experts, insect-hormone specialists, [and] high-energy physicists. . . ." [480]

U.S. response to the Chinese emphasis on "people-to-people" exchange led presumably to informal delegation of responsibility for formalizing these arrangements to the NAS-affiliated CSCPRC, similar to precedents established in the cases of early Soviet and Eastern European exchanges.[481] During May 1973, a prestigious 9-member delegation of the CSCPRC visited China.[482]

At the conclusion of the visit, the group announced that it had reached agreement with the Chinese Scientific and Technical Association for exchanges during 1973 and 1974 of seven Chinese and nine U.S. groups. American scientists were to be exchanged in the areas of plant studies, earthquake prediction, pharmacology, schistosomiasis, acupuncture, archaeology, early man, early childhood development, and linguistics. The Chinese groups coming to the United States would cover the following areas: English language teaching (September 1973); computer sciences (August 1973); medicine (October 1973); library sciences (September 1973); and seismology, laser research, and photosynthesis (late 1973 or early 1974).[483]

The agreement concluded between the CSCPRC and the Chinese Scientific and Technical Association was very general and specified neither size, duration, nor location of the visit. Moreover, according to the Committee, it did not detail activities to be pursued under each category. According to another Government official, there was a general understanding that between 6 and 12 people would be exchanged in each group for visits lasting between 1 and 2 months.[484]

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[479] Interviews, Dr. Max Hellmann, NSF, July 1973, and Mr. William Cunningham, Bureau of Educational and Cultural Affairs, Department of State, July 1973.

[480] "Presidential Assistant Kissinger Visits Asia: Transcript of News Conference," *Department of State Bulletin* LXVIII, No. 1760 (March 19, 1973), p. 315.

[481] The Department of State is continuing to handle official diplomatic activities in support of exchanges.

[482] The nine-member CSCPRC delegation was headed by Dr. Emil L. Smith, committee chairman and chairman of the department of biological chemistry, University of California, Los Angeles, medical school. Other members included Dr. Frederick Burkhardt, president of the American Council of Learned Societies; Dr. Eleanor Sheldon, president of the Social Science Research Council; Dr. Harrison Brown, foreign secretary of the National Academy of Sciences; Dr. Victor F. Weisskopf of Massachusetts Institute of Technology; and Anne Keatley, executive secretary of CSCPRC. Traveling with the delegation were several noted U.S. scientists, including Dr. Glenn T. Seaborg, former head of the Atomic Energy Commission, and Dr. Robert G. Sachs, director of Argonne National Laboratory. ("U.S.-China Scientific Exchanges to Widen," op. cit.)

[483] "U.S.-China Scientific Exchanges to Widen," op. cit., and Interview, CSCPRC, July 1973.

[484] Interview, Dr. Max Hellmann, NSF, July 1973.

This exchange agreement appears to represent a significant first step toward the beginning of scientific and technical exchange activities with the PRC. First, it indicates that the PRC is making conscious efforts to expose its scientific and technical personnel to Western activities even in the absence of diplomatic relations.[485] Related to this new emphasis in Chinese policy is the fact that the Chinese signed an agreement with the CSCPRC despite its NAS affiliation, and did not require the Academy to sever its relations with Taiwan, as previously desired. A spokesman for the Committee reports that the Chinese attitude toward this obstacle had softened considerably in recent months

A second important implication of the agreement is the absence of a requirement for reciprocity in subjects for exchange, a requirement which the Soviets and Eastern Europeans have insisted upon in their inter-Academy agreements with the United States. The absence of such a requirement has two ramifications. It may represent a diplomatic precedent applicable to future exchange agreements. But probably more important, it represents recognition by the scientists who concluded the agreement of (1) the different types and levels of scientific excellence in the two nations and (2) the Chinese emphasis on applied science and technology, rather than basic research and development.[486]

Another implication of the agreement is the importance of the diplomatic role played by the National Academy of Sciences, which is serving, in effect, as a semi-official agent of the U.S. Government, while at the same time representing the American scientific community, in establishing initial exchange agreements with the PRC. Here again, this arrangement reflects political and scientific conditions in both countries. The quasi-governmental nature of the arrangements on the American side is indicated since the bulk of the funding for the CSCPRC comes from Government sources The Office of International Programs of the National Science Foundation awarded the CSCPRC $350,000 during the fiscal year 1973.[487] The Bureau of Educational and Cultural Affairs of the Department of State, provided additional support for the Committee, with private sources also contributing funds.

With respect to the governmental nature of the agreement on the Chinese side, a CSCPRC official reported that while negotiations behind the agreement were enhanced by the prestigious and nongovernmental character of the American delegation, the Chinese appeared to have no reservations about sponsoring or receiving Government-agency personnel on either side. (However all American agency personnel who have been exchanged thus far, have gone in a private rather than an official capacity.) This reflects, in part, the conditions of scientific activity and governance in China. The Chinese signatory to the agreement, the Chinese Scientific and Technical Association, is composed of a variety of scientific and technical professional groups. Although there is little basic research in China, the locus of most "hard" science and technology is in the Chinese

[485] For an assessment of the significance of this objective before, during and after the cultural revolution, see: Leo A. Orleans, "Research and Development in Communist China," *Science* 14, no. 157 (July 28, 1967), pp. 392–400. Also: Leo A. Orleans, "China's Science and Technology: Continuity and Innovation," *In* U.S., Congress, Joint Economic Committee, *People's Republic of China: An Economic Assessment: A Compendium of Papers*, 92d Cong 2d sess., May 18, 1972, pp. 185–219.

[486] See the two items by Orleans, op. cit.

[487] Interview, Dr. Max Hellmann, NSF, op. cit.

Academy of Sciences,[488] which is under the jurisdiction of the Association. Similarly, it appears as if the Association also encompasses under its jurisdiction other significant R & D activities, which are carried out in China under close links among scientists, industrialists, workers, and political cadres.[489]

For the United States, at least, the establishment of initial scientific and technical exchange activities between the United States and the People's Republic of China is probably more significant in a diplomatic than in a scientific sense. Some American scientific and technical personnel who have visited China report that thus far the exchange activities constitute little more than "scientific tourism." It seems that several additional steps will be necessary before such exchanges become fruitful in a scientific sense to the American scientific and technical community and before such exchanges become formalized on a continuing, officially funded Government-to-Government basis. Prerequisites of this nature, on the American side, probably include diplomatic recognition of and establishment of regular relations with the People's Republic of China. Other prerequisites, which were discussed at the August 1973 meeting of the International Committee of the Federal Council for Science and Technology, are better understanding by Americans of how they can profit from scientific and technical communication with their Chinese colleagues, and development by Americans—especially Federal agency personnel—of priorities for exchange. In this connection it may be useful for the CSCPRC and the Academy to undertake informal surveys of the state of science and technology in China, as the Academy did in the Soviet and Eastern European exchange agreements. It may be useful also for the Government to undertake systematic efforts to familiarize American scientific and technical personnel with available translated Chinese scientific and technical materials, and to increase support of translation activities where warranted. Also, more attention may have to be given to familiarizing American scientists with the Chinese culture and language.

[488] "Chinese Science: What the China Watchers Watch," *Science* (August 13, 1971), p. 615: "The [Chinese] Academy [of Sciences] is the most important single center for scientific research and development. It is divided into five departments that oversee more than 100 research institutes, each specializing in a different discipline. In addition, there are regional branch institutes. Research, particularly, the production-oriented type . . . that now predominates in China, is probably still carried out by numerous educational and industrial institutions . . . and also by the Academy of Medical Sciences, the Academy of Agricultural Sciences, and the Military Science Academy."

[489] Anthony Wedgwood Benn, "China—Land of Struggle, Criticism, and Transformation," *New Scientist* (January 6, 1972), pp. 10–12, and Walter Sullivan, "Peking Aiming Research At China's Special Needs," *New York Times* (June 7, 1971), pp. 1, 14.

VI. Issues Surrounding U.S. Programs For Nongovernmental Scientific and Technical Personnel Abroad

At the beginning of this study it was hypothesized that in a world free of national and political differences, scientists would travel freely from one country to another to study, conduct research, attend meetings, and exchange information. The information presented indicates, however, that achievement of this ideal is precluded by political and scientific factors which undermine formation of a transnational scientific community. These include competition between nations, visa restrictions, geographic and subject limitations, information-exchange related restrictions, language differences, scarcity of funds for foreign travel and research, preferences of scientists themselves in choosing where and how to use funds tenable abroad, and the realization of candidate scientists that scientific rewards vary considerably from country to country.

The U.S. Government has established a number of programs and mechanisms to fund and encourage the exchange of nongovernmental scientific and technical personnel. However, the establishment of these programs has not created, nor were they intended to create, a genuine nongovernmental "world scientific community," with scientists freely exchanging information and visits with colleagues in all countries and in all subject areas on an equal basis.

The programs of three agencies were treated in the study: the Fulbright-Hays program of the Department of State; the programs of the National Science Foundation; and the Soviet and Eastern European exchange activities administered by the National Academy of Sciences. Some attention was given also to evolving exchange activities with the People's Republic of China. An attempt was made to describe their characteristics with respect to their origins, purpose, evolution, and effectiveness.

The data presented were structured to answer questions at several different levels of analysis essential to evaluating U.S. exchange programs for nongovernmental scientific and technical personnel: the role of the scientist; the administrative underpinning, both scientific and diplomatic; the impacts of the program on science and on particular scientific disciplines; and the relationship of the program to the design and promotion of U.S. foreign policies, both scientific and political. Several of the issues raised cannot be fully explored for want of relevant data. However, one recurring theme emerges: U.S. programs for nongovernmental scientific and technical exchange have supported scientific and foreign policy objectives (such as information exchange, support of economic growth and trade, cultural and educational communication, and scientific cooperation); but the administration of most of these programs seems to warrant improvement. If they are to meet more effectively requirements of a world increasingly dependent upon science and technology, and especially if they are to help significantly in reconciling the often incompatible requirements of science and diplomacy, better direction, coordination, and review will be needed.

The Government maintains a vast array of programs with varying origins and purposes. Americans are sent abroad for information exchange and the advancement of scientific knowledge; to meet goals of prestige; to support the development of a science infrastructure in the developing countries; and to meet the terms of bilateral and multilateral agreements for cooperation—agreements which serve both science and foreign policy goals. Scientific and technical exchanges are the largest part of U.S.-sponsored exchange programs. More than half of the exchanges sponsored in 1970 by the Government in a majority of countries involved scientific and technical personnel. Little precise information is available on the cost of these activities. However, the available data indicate that they are expensive. NSF estimates for support of scientific activities with international implications total $118 million for the fiscal year 1974; much of this outlay undoubtedly supports exchange activities. That exchanges are becoming an increasingly important tool of U.S foreign policy is evidenced by the recent proliferation of bilateral scientific and technical agreements signed by the United States. Most of these provide almost exclusively for exchange. These developments foreshadow the future importance of related considerations: an enhanced desire by other nations to share in the benefits of U.S. scientific and technical excellence, an ever-accelerating requirement for the United States to recognize and share the technical knowledge and breakthroughs of its technologically advantaged neighbors, and the enlargement of the scope and objectives of foreign policy to include consideration of more substantive scientific and technological issues.

Multiple Purposes of Programs

Bilateral agreements, which are almost wholly political in origin, provide explicitly for foreign scientific exchange. The activities conducted under these agreements demonstrate the criteria which must be satisfied in conducting exchanges beneficial to both science and diplomacy. These activities also illustrate the difficulties of meeting the required qualifications. The rest of the exchange programs for Americans abroad, which constitute the bulk of the programs surveyed (the Fulbright-Hays program, and education- and research-oriented NSF activities), were not designed initially to meet the objectives of foreign scientific exchange. These programs are basically an extension of activities to support other missions, either enhancement of domestic science, in the case of NSF activities, or the promotion of cultural cooperation or technical assistance, as exemplified by the Fulbright-Hays program. Very little attention is given in most of these programs to determining priorities systematically or to relating programs to the objectives of U.S. foreign science and technology, as outlined by the Department of State.[490]

Wider and more public scientific/diplomatic and executive/legislative interfaces seem to be required of all programs to cope with the differences between the means and ends of science and diplomacy, to determine appropriate program priorities, and to correct program inadequacies.

The Need To Meet the Requirements of Science

A number of scientific factors which impact on these programs underscore the need for a broader scientific/diplomatic interface. All

[490] See section 1 of this chapter.

of these programs contain at least one administrative element which recognizes the scientific nature of the programs. Each has a scientific peer evaluation mechanism to assist in selecting grantees competent in a particular scientific field. However, a mechanism to resolve other conflicts deriving from the scientific nature of the programs is often lacking. These conflicts have several sources: the need to meet geographic distribution requirements governing the award of scientific research and education grants; the need to deal with domestic and overseas funding exigencies which influence the quantity and quality of awards; the problems of providing adequate remuneration for scientists to serve overseas; and the need to work more closely with the host country in designing science programs which satisfy both the needs of the American scientist and the technical assistance objectives of the other country.

The history of bilateral scientific. agreements evidences a major difficulty: undersubscribed rates of participation by U.S. scientists or lower quality scientific participation than is exhibited in other types of awards for research abroad which do not have the political connotation of bilateral agreements. The data presented illustrate that bilateral scientific and technical agreements are becoming an increasingly important device in U.S. programs and policies. Questions were raised as to steps the administering agencies could take, either through negotiations or on a programmatic basis, to create conditions to insure wider scientific participation and fulfillment of these foreign commitments.

Also important is the fact that most of these programs do not incorporate effective provisions for continuous collection, analysis, and dissemination to the public of data required to evaluate the contributions of the program to the advancement of the sciences or to promotion of cooperative international scientific activities. Public support of science for its intrinsic merits is an appropriate Government function. However, more consideration could be given to determining priorities for science programs which are increasingly coming to serve a wider range of foreign policy purposes.

The Need To Meet the Requirements of Diplomacy

The program descriptions also support the observation that effective scientific exchange programs require a well-functioning diplomatic advisory mechanism. Many of these programs were either initiated in response to a particular political event or will themselves lead to additional political and scientific cooperation between the United States and a foreign nation. In many cases, diplomatic agreement is required to establish the formalities needed to ensure scientific exchange. American scientists in such cases, and even in less formally sanctioned programs, serve in effect as ambassadors of U.S. science. However, many programs suffer from poor participation rates by U.S. scientists, and few require that the scientist possess language fluency or familiarity with the foreign culture in which he will conduct his activities. Also, most programs, reflecting their separate statutory authorities, tend to be governed and administered—both in Washington and overseas—independently of similar programs administered by other agencies. Partly as a result, exchange activities sometimes fall short of meeting both scientific and diplomatic goals.

Issues Related To Fashioning a More Effective Scientific/Diplomatic Interface

The information presented in this study suggests a number of possible actions which could help to bring about improvement in the scientific/diplomatic underpinning required for these programs. One might be a more systematic and searching congressional review of the overseas science attache program. Another could be the establishment of coordinated scientific/diplomatic advisory units for each of the exchange programs. For instance, program continuity and recruitment of scientists in the Fulbright-Hays program might be facilitated if the administering unit, the Committee on the International Exchange of Persons, established a special mechanism to recruit scientific personnel. This mechanism might also be charged with developing programs and policies to enhance correspondence between scientists' expectations and the "real" cultural conditions of overseas science activity. Moreover, since over 50 percent of the Fulbright-Hays awards annually are in scientific and technical areas, the Department of State's administration of the program might profit from establishment of a scientific advisory apparatus in the Bureau of Educational and Cultural Affairs, similar to the advisory committees the Bureau has created for assisting in programming other types of exchanges conducted under the cultural exchange programs. NSF programs for nongovernmental foreign and international scientific exchange might be strengthened by closer coordination among all of the Agency's scientific exchange activities (the majority of which are administered by units other than the Office of International Programs), and if the Foundation revived the Advisory Committee on Foreign Scientific Affairs.

Interagency Coordination

Another issue can be developed in assessing ways to improve the scientific/diplomatic interface of scientific and technical exchange programs. This is the issue of domestic and overseas interagency coordination. Interagency coordination is a complex topic; several factors should be considered in evaluating its merits. They include the pros and cons of increased centralization, the failures of coordination to date, and emerging international scientific and technological imperatives and opportunities.

A case can be made against centralization of the grounds that U.S. scientific exchange programs now serve a variety of purposes and that centralization or interagency coordination would invite charges from both scientists and foreign observers of undue governmental interference in science and technology. These objections should be weighed against the aforementioned administrative problems within each program and the important fact that science and technology are an increasingly salient commodity in international relations. Many U.S. programs for nongovernmental scientists and technical personnel are a response to diplomatic agreements for enhanced cooperation. At the same time, many of the activities undertaken in bilateral agreements, and even in international cooperative programs and meetings, eventually lead to more formal programs. It would seem that opportunities for further cooperation of this nature will increase commensurately with recent converging trends in international scientific and political relations. Reference is made to such developments as the

relaxation of bipolar tensions; the increasing need for concerted bilateral and multilateral cooperation to solve global problems of technology; increasing interdependencies in discovering and exploiting the fruits of science and technology; the need for the United States to share in the scientific and technical advances of other nations, and the desires of the less developed nations to share in the benefits of U.S. scientific excellence and technological know-how.[491]

OBSTACLES TO INTERAGENCY COORDINATION

A number of factors militate against coordinated program planning. One of these is that U.S. international science programs and policies have not been fully recognized as part of either foreign policy or science policy.[492] A second is that while each program has a number of overlapping purposes, each is carried out under its own statutory authority and is reported to different congressional committees.[493] A third is that some bilateral agreements provide for funding and program commitments which are rarely brought to the attention of Congress until they are a *fait accompli*.[494]

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[491] These themes are developed in R. L. Keohane and J. S. Nye, Jr. eds. *Transnational Relations and World Politics* (Cambridge: Harvard University Press, 1972), 428 pp.

[492] Most U.S. scientific exchange programs proliferated in response to specific opportunities presented by either diplomacy or science. Only a few were established under explicit congressional mandate. The latter include, for instance, the international health activities of the National Institutes of Health, authorized by the International Health Act of 1960 (Public Law 86–610); and the exchange programs of NASA and AEC sanctioned by formal intergovernmental agreements, some with congressionally mandated authorities. The Fulbright-Hays program was established under a mandate for advancement of cultural and educational cooperation; NSF and NAS programs were fully established and functioning long before the Congress gave the Foundation an explicit authority to support foreign and international science for their own merits rather than primarily to enhance the domestic science base.

On the need for more explicit legislative statement of international science policy goals, Herman Pollack, director, Bureau of International Scientific and Technological Affairs, has "advocated a 'more adequate statement of national policy and legislative authority for international scientific ventures.' " (U.S., Congress, House, Committee on Science and Astronautics, *Toward a Science Policy for the U.S.: Report*, October 15, 1970, p. 50, citing Pollack's testimony in hearings on National Science Policy.)

Dr. Edward E. David, Jr., as President Nixon's science adviser, suggested ". . . that we need an international science policy just as it has been suggested that we need a national science policy and that can only be enunciated with the aid of the Congress. If such a policy were put forward strongly, I believe it would have a major impact on the agencies of Government, in that they would then see it as part of their mission. I think today, because of the way our programs are structured or not structured, very often the mission agencies do not see their role in international science cooperation as being on a par with their domestic mission." (*A General Review of International Cooperation in Science and Space: Hearings*, op. cit., p. 7.)

[493] Herman Pollack in 1965 summed up the effects of this fragmentation:

". . . The budgets of the various departments and agencies that carry scientific and technical programs are . . . built around the . . . domestic missions . . . . They are in the process of putting together an annual or a projected plan over several years . . . in terms of priorities that are developed essentially from their perspective of the domestic considerations . . . . Each of these departments . . . is . . . concerned with its own responsibilities. . . . It protects its own budget . . . and there is . . . a mutual diffidence about not getting into the other fellow's territory.

. . . There are opportunities and . . . requirements . . . where it will be desirable for the United States to pursue a scientific relationship, . . . that is neither related, per se, . . . to the priorities that have been established . . . for the pursuit of domestic purposes or that do not fit the jurisdictional territories and boundaries that have been established by the nature of the U.S. Government organization. . . . Agencies don't feel . . . that they are authorized to spend funds available to them for this kind of activity. [And] it hadn't been anticipated in the development of their budgetary program. They have their own congressional committees to deal with, their own constituencies in the United States to take into account.

. . . . If it involves more than one agency, it immediately gives rise to coordination and division of responsibility, and when you get to three or four you have all the complications and problems of committee management. (*Government and Science: Review of the National Science Foundation, Hearing: Vol. 1, 1965*, 89th Cong., 1st sess., 1965, pp. 469–470.)

[494] Legislative recognition of this problem was indicated in the passage of Public Law 92–403, August 22, 1972, which required that the Secretary of State transmit to both the Senate Foreign Relations Committee and the House Foreign Affairs Committee copies of all international agreements, other than treaties, entered into by the United States. However, these agreements are to be transmitted after the fact within 60 days after their signing; thus, intensive congressional consideration is likely to occur only in the most unusual circumstances involving severe legislative-executive differences. Also, the sheer number of such agreements militates against their in-depth consideration by the Congress. See the extensive listing of such agreements *in:* U.S., Congress, Senate, Committee on the Judiciary, Subcommittee on Separation of Powers, *Congressional Oversight of Executive Agreements: Hearings on S. 3475*, 92d Cong. 2d sess., April and May 1972, 668 pp.

A fourth consideration which must minimize expectations of effective coordination is the unsuccessful history of actual attempts to provide this function. Two agencies have had responsibility in the past for coordinating, on a government-wide basis, international science policies and exchange policies. These are the International Committee of the Federal Council for Science and Technology and the Bureau of International Scientific and Technological Affairs, Department of State.

THE BUREAU OF INTERNATIONAL SCIENTIFIC AND TECHNOLOGICAL AFFAIRS

The Bureau of International Scientific and Technological Affairs, Department of State (SCI), was established as the Office of International Scientific and Technological Affairs in 1958 on recommendation of the President's Science Advisory Committee. The Director of the Bureau ranks as an Assistant Secretary of State. SCI has several basic responsibilities:

—formulation and implementation of some of the Department of State's international and foreign scientific policies and programs;

—provision of diplomatic advice and liaison to other Federal agencies with international scientific and technological programs, either directly or through its membership in (and usually chairmanship of) the International Committee of the Federal Council for Science and Technology; and

—direction of the U.S. science attaché program.[495]

Activities of the Bureau have been described to the Congress only in passing in House and Senate Committee hearings on appropriations for the Department of State and in testimony before the Subcommittee on Science, Research and Development, House Committee on Science and Astronautics. Although no substantial in-depth evaluation has been made of the Bureau, several critiques indicate that because of political and organizational constraints, SCI has been less than effective in coordinating U.S. science policies abroad. For instance, according to Roger Revelle, a widely traveled U.S. scientist, the Department of State is constrained from making initiatives in designing policies for science and technology. He continues: "one reason for this deficiency may be a feeling among the leaders of the Department that the changes brought about by these developments will be slow to take effect and can be brought into account as they emerge by conventional diplomatic means." [496] As another weakness, Revelle notes that frequently, in the past, the holder of the Office has not been a scientist who could command credibility from scientists or who could effectively relate science to foreign policy.[497]

As a second problem, the Organisation for Economic Co-operation and Development faults the Bureau with concern for minor tasks and deferring responsibility for guiding major international scientific and technological policies and programs to the White House, the center of effective power in foreign policymaking:

> The Office . . . is said to be too concerned with minor tasks, to the detriment of its more fundamental functions, and to rely too much on the technical skills

[495] U.S., Department of State, Bureau of Educational and Cultural Affairs, *A Guide to U.S. Government Agencies Involved in International Educational and Cultural Affairs*, September 1968, p. 9.
[496] Revelle, "International Cooperation and the Two Faces of Science," op. cit., pp. 169–170.
[497] Ibid., pp. 170–171.

of specialized agencies such as NASA or DoD. This dependence is alleged to limit its field of choice and compromise its authority over other agencies. Since 1957, the White House Executive Office has been responsible for the main political initiatives taken in questions of international relations of science and technology (foreign aid, disarmament, non-proliferation of nuclear weapons, international co-operation).[498]

The Department of State recently moved to broaden the basis of formulating of policies for foreign and international science and technology. The Department established a group of scientific advisers to the Department in 1968 when Dr. Gordon J. F. MacDonald was Adviser-at-Large to the Bureau of International Scientific and Technological Affairs and Dr. Thomas F. Malone had responsibility for providing advice on weather modification.[499] This activity was dormant until 1972 when the Secretary of State announced establishment of an Advisory Committee on Science and Foreign Affairs. Members were not named however, until April 1973; the delay was attributed, during an election year, to "several prospective members [who] said they feared acceptance might be interpreted as an indication of support for the Nixon candidacy." [500] The group is composed of journalists, scientists, and industrial researchers.[501]

THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

The Federal Council for Science and Technology, composed of representatives of all Government agencies, was established in 1959 ". . . to promote closer cooperation among Federal agencies, to facilitate resolution of common problems, . . . to improve planning and management in science and technology, and to advise and assist the President regarding Federal programs affecting more than one agency." [502]

The International Committee of the FCST (IC, FCST) was established also in 1959 to recommend "measures to promote and enhance U.S. participation in and support for international scientific activities compatible with our foreign policy." From its inception the Committee made several attempts to support interagency coordination of executive branch activities for the exchange of American scientific and technical personnel; most of these have been unsuccessful.

In 1973, President Nixon, under Reorganization Plan No. 1, disbanded the Committee's parent organization, the Office of Science and Technology (OST), and transferred many OST functions to the National Science Foundation, while at the same time designating the Director of the Foundation the President's Science Adviser. It has been reported that the Director of the Foundation reviewed FCST activities to determine which should be retained.[503] The International

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[498] Organization for Economic Cooperation and Development, *Reviews of National Science Policy; United States* (Paris: Organization for Economic Co-operation and Development, 1968), p. 80, Citing Eugene B. Skolnikoff, *Science, Technology, and American Foreign Policy* (Cambridge: MIT Press, 1967).

[499] "Appointment of Science Advisers to the Department of State," *Department of State Press Release 200* (September 6, 1968).

[500] "State Department Sets Up Science Panel," *Science and Government Report* (April 15, 1973), p. 6.

[501] They are: The chairman will be Herman Pollack, the State Department's Director of International Scientific and Technical Affairs. The other members are:

Dean Rusk, former Secretary of State; Simon Ramo, vice chairman of TRW; John Hightower, former Associated Press State Department correspondent and now professor of journalism, University of New Mexico; Gordon J. F. MacDonald, professor of environmental studies, Dartmouth College, and chairman of the National Academy of Sciences Environmental Studies Board; Kenneth Davis, Bechtel Corp.; John Leddy, former Assistant Secretary of State for European Affairs; Eugene Skolnikoff, professor of political science, and head of MIT's Center for International Studies; and Lewis Branscomb, vice president, IBM.

[502] *U.S. Government Organization Manual, 1970-1971* (1971), p. 543.

[503] "Transfer of OST Functions to Director of NSF," *NSF Press Release* (January 26, 1973), 3 pp. (NSF 73-104). For additional details see: Chap. II. of this study.

Committee was continued, with the SCI in the Department of State given lead agency responsibility. The Director also established several support bodies which may provide some of the functions previously performed by the OST. These include an interagency Science Policy Council and the Science and Technology Policy Office within the Foundation to provide for some determination and coordination of Federal science policies.[504]

The problems encountered by the International Committee, FSCT, in providing for interagency coordination of programs and policies for the exchange of scientists will be elaborated upon below. It should be noted that in view of these difficulties, it remains to be seen whether the National Science Foundation and the Department of State can and will establish units to deal effectively with these same international science activities on an interagency basis.

The difficulties encountered by the IC, FCST, involve general problems related to interagency coordination,[505] as well as specific constraints imposed by interagency coordination of foreign science activities. For instance, a report reviewing the operations of the Office of Science and Technology, of which the IC, FCST was a part, cited lack of authority vis-a-vis the White House foreign policy apparatus, and the difficulties of using an interagency device to establish policies for agency programs:

> In 1964 W. Murray Todd, Executive Secretary, Office of the Secretary, National Academy of Sciences, wrote in the Bulletin of the Atomic Scientists, that the International Committee had accomplished "precious little," and that none of its chairmen had been able to make it work. In his opinion, until the Federal Council gave it some meaningful tasks, the Committee probably would continue to be a "rather blunt instrument."
>
> Another observer of science and technology in American foreign policy, Prof. Eugene Skolnikoff of Massachusetts Institute of Technology, suggests that expectations for the International Committee have not been met. He sees the Committee as a useful device for exchanging information on agency programs (which can be an appreciable achievement when Federal agencies operating in the same foreign country in similar scientific fields may know nothing of each other's programs) and for developing policies for a few problems. But through 1964 he believes the Committee has not been notably productive. The problems facing the Committee in achieving substantial coordination of agency programs, or in bringing up ideas for new programs to serve foreign policy objectives, or to halt or change existing international programs, are the same as those facing the Federal Council itself with the added disadvantage that Committee members have less individual authority to reach agreements or make commitments for their agencies than the principals of the Federal Council. Moreover, Professor Skolnikoff believes that the potential performance of this Committee is limited by the ability of the State Department to monitor and oversee the international and foreign scientific activities of other Government agencies.[506]

The IC, FCST has made several abortive attempts to improve and coordinate governmental activities relating to foreign and international exchanges. For instance, in 1959, shortly after the committee was created, the National Science Foundation and the Federal Council for Science and Technology prepared a codification in condensed form

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[504] "Stever Sets Up Science, Technology Policy Office," *Science and Government Report* (July 15, 1973) p. 7.

[505] These points were discussed in a report issued by the House Committee on Science and Astronautics. Citing FCST annual reports and critiques, the Committee noted the following difficulties: obstacles to reconciling priorities of different agencies; fragmentation of congressional oversight; staffing; and the problems of determining policy on an interagency basis. The Committee also noted that ". . . Interdepartmental groups are generally more effective in ensuring more efficient use of funds at a given level than they are in developing or expanding activities or in contributing to decisions on distribution of missions among agencies." (U.S., Congress, House, Committee on Sciences and Astronautics, Subcommittee on Science, Research, and Development, *Centralization of Federal Science Activities: Report*, 91st Cong. 1st sess. May 29, 1969, pp. 73–75.

[506] U.S., Congress, House, Committee on Science and Astronautics, *The Office of Science and Technology: Report*, 1967, pp. 178–179.

of past NSF recommendations or positions of a government-wide character.[507] One section of that report concerned international scientific activities and exchanges:

International Scientific Activities:

1. East-West Exchanges of Scientific Information.
2. Establishment of Machinery for Scientific Representation and Liaison at U.S. Embassies Abroad.
3. Exchanges of Scientists.
4. Expansion of Existing "College Contract" Programs of ICA.
5. Increased U.S. Participation in the Financial Contributions to International Scientific Organizations.
6. Increased U.S. Support of Research Overseas.
7. Admission of Alien Scientists and Science Students.
8. Foreign Science Fellowships.
9. Export of Unclassified Scientific Information.
10. U.S. Participation in the International Geophysical Year.

It is difficult to determine whether these efforts at coordination had any impact on NSF or other agency programs for sending Americans abroad. The 1966 report, *The National Science Foundation: A General Review of its First Fifteen Years*, said: "No further summary of national science policies has been prepared by either NSF or OST." [508]

In 1961 the IC, FCST at the request of the President's science adviser, George Kistiakowksky, "undertook to review the international scientific activities of [Federal] agencies." The resulting report, *International Scientific and Technological Activities*,[509] included a section on "The Exchange of Scientists and Engineers" which, stressing the importance and the need for dispersed authority for these programs, recommended that neverless they meet five criteria. Central to the committee's oversight of these activities was a call for NSF and the State Department to provide better information on exchange activities:

> Coordination of exchange activities: While central direction of the exchange program is undesirable, coordination is essential. The National Science Foundation should assist the State Department by collecting, analyzing, and disseminating data on exchange for the purpose of improving the effectiveness of the programs.[510]

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[507] "Science Policies of a Government-Wide or National Character Which Have Been Recommended by the National Science Foundation," NSF unnumbered report of April 1959.

[508] Op. cit., pp. 211-13.

[509] A report to FCST by Its International Committee, June 20, 1961, 25 p. The report covered support of international research and development by Federal agencies, reasons for U.S. involvement in international science, and guidelines for policy and action. Its recommendations included further steps toward: (1) better information on U.S. science activities overseas, (2) evaluation of U.S. foreign science programs, (3) evaluation of scientific and technological aspects of foreign activities of U.S. agencies, (4) establishing U.S. scientific missions, (5) science and technology in technical assistance, (6) the international role of the National Science Foundation, (7) providing a non-Federal advisory input to the Federal Council, and (8) greater responsibilities for the State Department's Science Adviser.

[510] The other points were:

In order to improve the process of exchange of scientists and engineers the following guidelines are proposed:

General.—Exchanges where the primary purpose is furtherance of scientific communication and personal understanding should be vigorously cultivated as a significant factor in furthering the concept of an "Open World." Interference for short-term political reasons should be minimized.

Exchanges for technical assistance purposes.—U.S. contributions of educational and scientific assistance to the lesser developed nations must be greatly increased. Exchanges of scientists and engineers should be guided by policies which involve the political and economic considerations pertinent to the area.

Need for competence and adequate duration of stay.—A primary consideration in the selection of individuals who will be encouraged to participate in exchange programs is to secure persons with the highest levels of competence for the tasks involved. Programing should provide for exchange of adequate duration to maximize the likelihood of significant and lasting results.

Action by Federal agencies.—Federal departments and agencies should stimulate increased participation of U.S. scientists in international exchange programs related to their technical areas of interest for the purpose of providing U.S. scientists with a firsthand acquaintance, knowledge, and understanding of foreign problems and peoples.

Report reprinted in: *Federal Foreign Research Spending and the Dollar Drain: Hearings*, op. cit., pp. 180–181.

The National Science Foundation never responded to the recommendation that it assist in the collection, coordination, and dissemination of information about international scientific exchanges.

Three years later, in 1964, the IC, FCST assisted the Department of State by developing a paper entitled *U.S. Scientific and Technological Representation Overseas*, to engender more effective organization of the representation of U.S. technical activities in foreign countries.[511] These guidelines were designed to encourage international scientific and technological exchange programs and institute an annual review of agency programs by the Committee. The IC, FCST, has not been able to supply any information on whether the annual review was ever conducted. Another set of guidelines was prepared in 1968 in cooperation with the Bureau of Educational and Cultural Affairs, Department of State.[512] This set of guidelines recommended:

—a systematic exchange of foreign and U.S. faculty through establishment of a program of "sister institutions" to strengthen the development of foreign faculty (p. 2);

—that "the exchange visitor" be given "background and experience pertinent to his professional activities in his country"; and

—that "each agency concerned provide the IC, FCST, with an annual overall report on its exchange programs and the steps which are consistent with these Guidelines" (p. 3).

The existence of these guidelines was placed on the agenda of the IC, FCST, in 1971. Herman Pollack, chairman of the committee, reported on the failure of agencies to respond:

> In collaboration with the Cultural Affairs Bureau (CU) of the Department of State, the International Committee established a requirement that each member agency submit an annual report on its compliance with certain guidelines for international scientific exchange programs. Since the requirement was instituted in September 1968, there has been only one such report which was made to the IC in August 1969.[513]

Mr. Pollack then recommended cancellation of the study, and suggested that its purposes would be served by the Department of State's then ongoing exchanges study:

> The Guidelines Report does not seem as useful as originally conceived. Moreover it is made somewhat redundant by the ongoing comprehensive exchange study. For these reasons, I have proposed to CU and they have concurred that the requirement be cancelled.
>
> Unless I hear objections from the IC members, the subject requirement is herewith cancelled.[514]

The CU exchanges study is classified, but reportedly its treatment of scientific exchanges was confined to the suggestion that they be reoriented to serve the political objectives of promoting the development of "leaders" favorably inclined to the United States in foreign countries, an objective which diverges considerably from scientific communication and cooperation.[515]

The Committee has been unsuccessful also in coordinating international science activities of a general character to assist agencies in

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[511] U.S., Executive Office of the President, Office of Science and Technology, *The Role of the Federal Council for Science and Technology, Report for 1963 and 1964*, 1965, p. 48.

[512] Federal Council for Science and Technology, "Policy Guidance for International Scientific Exchange Programs," Guidelines for Participating U.S. Agencies, June 1968, 4 pp.

[513] Memorandum For: Members of the Federal Council for Science and Technology International Committee. Subject. Requirement for Annual Report on Guidelines. From Herman Pollack, Chairman, Department of State, April 27, 1971.

[514] Idem.

[515] See section I of this chapter.

designing and implementing improved exchange programs, For example, in 1966 the FCST, stating that "a base of information on U.S. scientific and technological relationships abroad is needed," requested the IC to study the possibility of establishing a regular reporting mechanism.[516] However, the next year the Committee reported that a central information file on international activities was infeasible because of the many varied activities and types of data it would have to include.[517]

The IC, FCST, made another attempt beginning in 1970 to catalog U.S. Government relationships in international science and technology, including "an interagency review of the Federal Government's activities in international science." The objective was to inventory programs and their funding. The Committee requested agencies to supply it with:

> (a) Brief description of agency's international scientific programs and projects.
> (b) Their relation to past size during the 1960's and to the vigor, need and demand for programs.
> (c) . . . Missed opportunities which might have been developed under more favorable circumstances.
> (d) Legislative authorities and restrictions within which programs-projects are carried forward.
> (e) The agency [view of the] programs' utility. Identification of specific instances in which the cooperative programs with other nations have resulted in savings of time or money or in other direct benefits to the U.S.; and
> (f) Observations which may serve to clarify the data given.[518]

The general purposes of the study were to provide the Federal Council for Science and Technology with data:

> (1) to assess the current health and vigor of the Federal agencies' international science activities;
> (2) to examine the assumptions under which they engage in international relationships;
> (3) to consider the adequacy of their present budgets in relation to U.S. international program obligations;
> (4) to consider the question of whether a different or better management system for USG's international science activities is required; and
> (5) to judge whether more explicit Presidential guidance will be needed in the area.[519]

This review was never completed. According to the IC, FCST, "preparation of the report has posed far more difficulties than had been foreseen. Among the difficulties . . . were the lack of comparability between the submissions of various agencies and the strain on . . . time." Further commenting on these efforts, Pollack said:

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[516] U.S., Executive Office of the President, Office of Science and Technology, *Federal Council for Science and Technology: 1967 Annual Report*, 1968, p. 23.

[517] Idem.

[518] Agenda, Meeting of International Committee of the Federal Council for Science and Technology, July 16, 1970, Point A. Discussion of FCST's request for interagency review of Federal Government's activities in international science. Prepared by Bureau of International Scientific and Technological Affairs, Department of State, July 2, 1970, pp. 1-2.

[519] Ibid., p. 1.

"It would provide a useful first cut [at such information] or perhaps prove the entire effort impossible." [520] On July 27, 1971, the study was reported to have gone by the wayside.

The IC, FCST, also made another more recent effort to improve design and implementation of the many bilateral science agreements providing for U.S. exchange of scientists with other countries. The Committee, in January 1972, issued a catalogue of bilateral agreements and a set of "Guidelines for Executive and Participating Agencies in Bilateral Agreements for S and T Cooperation." These guidelines, like others that have come before it, stress the need for executive agencies to prepare annual reports on activities conducted under bilaterals and for other agencies participating in the agreement to inform the executive agency regularly of activities carried out to support these agreements. It is not known whether the agencies involved have made any systematic efforts to respond to these guidelines.[521]

A Multilateral Alternative

A number of programs described above for sending abroad American nongovernment scientific personnel are authorized under bilateral scientific agreements or are oriented to technical assistance (such as the Fulbright-Hays program in the developing countries; the AID-funded, NSF-administered science education program in India; and several other NSF-administered bilateral agreements). Unlike other scientific exchange programs which are designed primarily to benefit or advance the course of American science, these are subject to operational constraints, resulting from scientists' unwillingness to partici-

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[520] "Summary Minutes of International Committee Meeting, held, March 3, 1971," Memo to members of the International Committee from Executive Secretary, Edward Malloy, Bureau of International Scientific Technological Affairs, Department of State, March 18, 1971, 5 pp.

[521] The guidelines referred to follow:

GUIDELINES FOR EXECUTIVE AND PARTICIPATING AGENCIES IN BILATERAL AGREEMENTS FOR S. & T. COOPERATION

Introduction

At the time it is decided to negotiate a bilateral agreement, the Department of State, after appropriate consultation and prior agreement, will arrange for and designate an appropriate agency to be the Executive Agency responsible for the implementation of the agreement. The following responsibilities will be assigned to the Executive Agency.

Responsibilities of the Executive Agency

1. The Executive Agency participates with the Department of State in the negotiation of the agreement and provides the technical and program guidance in its drafting and execution.
2. In conjunction with other interested agencies and organizations the Executive Agency plans U.S. participation and activities in implementation of the agreement.
3. The Executive Agency provides broad coordination of the activities of participating agencies and other organizations so that agency program objectives and priorities will be consistent with the terms of the agreement.
4. The Executive Agency serves as the focal point for communication with its foreign Executive Agency counterpart, and helps facilitate counterpart agency approval of program activities undertaken by participating agencies and other organizations.
5. The Executive Agency makes a reasonable attempt to arrange financial support required for an appropriate level of U.S. participation and will, insofar as possible, seek funds to provide core support for the program. When necessary, the Executive Agency will, insofar as possible, provide "seed money" for the planning and initiation of participating agency activities.
6. With the cooperation of the participating agencies and other organizations, the Executive Agency submits an annual report to the Department of State on activities carried out under the agreement, and periodically evaluates these activities and the agreement. The Department of State will consult with the Executive Agency on courses of action to be taken, including recommending termination or continuation of the agreement.

Responsibilities of the Participating Agencies

1. Participating agencies will develop and provide to the Executive Agency in a timely manner program plans for participation in the agreement within the scope of their mission responsibilities.
2. Coordinating with the Executive Agency, participating agencies will develop and implement agreement activities with counterpart organizations. They will keep the Executive Agency regularly informed about the status of such activities, and will furnish the Executive Agency with such information as it may require for the purpose of preparing reports and making evaluations.
3. Participating agencies will, where possible, provide the financial support and staff needed to inaugurate their activities under the agreement. Subsequently they will budget for continued participation in the agreement.

pate in technical assistance cooperative programs or in distinctly politically motivated programs devoid of a potentially fruitful scientific outcome. Another difficulty is that scientists do not possess language fluency, or cannot find the time to spend learning a foreign language well enough to work with their colleagues in other countries.[522]

The United States has no clearly defined international science policy. Nevertheless, recent and expanded encouragement of bilateral scientific agreements indicates that the executive branch views such agreements as a significant policy device and as a useful mechanism for fashioning diplomatically and scientifically useful relationships between the United States and other countries, particularly those which are technologically disadvantaged.[523]

However, the history of recent programmatic activities for foreign and international science and technology exchanges, as developed in this study, and scholarly documents reviewing the general topic of international technological relations,[524] suggest that achievement of the complex scientific and diplomatic goals behind some of these programs might be served better by a multilateral alternative. A variety of factors, in addition to those cited above regarding the uneven quality of scientific participation in these programs, support this view. Most important is the fact that bilateral scientific and technological links alone may no longer be sufficient in a world increasingly interdependent in harnessing the fruits of science and technology and in solving the problems they generate.

For instance, Victor Basiuk recently reviewed U.S. scientific programs in Europe, especially with respect to their contributions to strengthening transatlantic economic, technological, and military cooperation. He concluded that bilateral programs, notably in Western Europe, do not effectively meet present requirements:

> Present American scientific and technological policy . . . is largely *ad hoc* and unfocused. There is concentration on individual countries and programs, on 'targets of opportunity.' But there is no over-all view which would take into consideration the nature and requirements of upcoming technologies, especially their large scale and high cost. As a result, the United States has been drifting in the direction of bilateral cooperation with European nations . . . . This course is not adequate. To meet the requirements of the large-scale technology of the future and of the immense costs associated with it, Western Europe must develop a large market and cohesive internal institution. Compartmentalized bilateral relationships between the United States and individual Western European nations bypass this objective.[525]

"A wiser American policy," Basiuk continues, would place high priority on initiating cooperative scientific and technological programs with Western Europe as a whole, rather than with individual countries."[526] Basiuk concluded by saying that the absence of multi-

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[522] The U.S. General Accounting Office recently released a study on the need for improved foreign language competence among U.S. officials who serve abroad. See: U.S., Comptroller General, *Need to Improve Language Training Programs and Assignments for U.S. Government Personnel Overseas* (Washington, January 22, 1973), Report B-176049.

[523] The Department of State's list of bilateral or intergovernmental interagency agreements for scientific and technical cooperation, released December 6, 1971, numbers 23. This does not include some of the more recently concluded agreements administered by the National Science Foundation. An extensive list of other U.S. agreements for scientific and technical cooperation is included in: *Congressional Oversight of Executive Agreements: Hearings*, op. cit.

[524] For instance see: Eugene B. Skolnikoff, *The International Imperatives of Technology: Technological Development and the International Political System*, (University of California Press, Research Series No. 16, 1972), passim.

[525] Victor Basiuk, "Perils of the New Technology," *Foreign Policy*, 2 (Spring 1972), p. 67.

[526] Ibid., p. 66.

lateral cooperative scientific relationships with Europe imperils transatlantic security:

If Washington does not soon develop a concerted science and technology policy, it is foreclosing options for the late 1970's and early 1980's in a way that almost guarantees insecurity in Europe. The enormous complexity of the task is no excuse for not addressing it. Small-scale, bilateral cooperation may postpone the peril, but it cannot in the end avert it.[527]

The Honorable Emilio Q. Daddario, former chairman of the Subcommittee on Science, Research and Development, House Committee on Science and Astronautics, has addressed the same theme, but on a broader basis:

. . . It has become evident that the concept of sovereignty and the traditional means of conducting relations between nations are no longer sufficient. The reason for this is that technology has largely changed the world, and in doing so it has rendered the old framework very vulnerable. Today, we are witnessing an increasingly rapid compression of both time and space. . . . This has led to the contemporary paradox whereby the human race is simultaneously becoming more unified and more fragmented. We now seem to have a dichotomy on our hands—either lasting cooperation or complete political dissolution—the potential for either being greater than in any previous period in human history.[528]

Mr. Daddario suggested that the development of individual national science policies is no longer sufficient to meet today's foreign policy needs. A consensus must be reached on developing policies to meet the needs of a technologically interdependent world:

. . . Before there will be any real global cooperation, there must be far greater consensus on its purposes. What are these? Is it to enhance material well-being and intellectual development? Is it economic growth or a massive educational effort? Is it limited arms control or an international peace-keeping mechanisms? Is it expanded medical health care or more adequate housing? And what are the priorities? . . . How do we reach some balance between near-term localized problems and long-term global problems? [529]

He then went on to suggest that formulation of a consensus on international science policies might be achieved by developing a cooperative international science policy committee to provide for exchange of information and views between developing and developed nations and to assist in formulating and broadening collaborative scientific activities. A similar proposal, which has received consideration by the National Academy of Sciences and funding from the National Science Foundation, is to establish an International Foundation for Science to award funds for cooperative international scientific research on a multilateral basis.

In both his second and third foreign policy addresses, President Richard M. Nixon identified international cooperation to solve global problems posed by science and technology as a major new dimension in American diplomacy. In his second address, the President stated in part:

Along with its vast contribution to our well-being, technology has given us the common capability to pollute the earth's ocean and air. It has increased the incentives for nations to assert, and attempt to enforce, territorial claims to the oceans so immoderate as to endanger the ancient right to freedom of the seas. It has brought the ability to tap—or to ravage—the resources of the seas and the ocean floor, to the vast benefit—or to the huge harm—of mankind.

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[527] Ibid., p. 68.

[528] Emilio Q. Daddario, "National Science Policy—Preclude to Global Cooperation," *Bulletin of the Atomic Scientists* (June 1971), pp. 21–24. This statement was presented to the House Committee on Science and Astronautics at its 12th meeting with the Panel on Science and Technology, January 1971.

[529] Ibid., p. 22.

These are examples of problems in which every country has a deep national interest, but which, as a practical matter, are simply not subject to satisfactory resolution by national means. They are matters on which the nations of the world must subsume their narrower interests in a broad and generous concept of the world interest.[530]

In these contexts the President outlined the merits of increased bilateral cooperative relationships, as well as of current multilateral diplomatic undertakings to deal, especially with the problems of environmental quality, in such bodies as the Organisation for Economic Co-operation and Development, the United Nations, and UNESCO. The material presented in this paper suggests that it may be to the common advantage of science, of U.S foreign policy, and of international cooperative science policy for policymakers to consider incorporating some U.S science and technology exchange programs into these same cooperative international mechanisms.

[530] President Richard M. Nixon, "Second Annual Report to the Congress on United States Foreign Policy, February 25, 1971," *In* U.S., President, *Public Papers of the Presidents of the United States: Richard Nixon, 1971* (Washington: U.S. Government Printing Office 1972), p. 331.

Chapter 13—Brain Drain: A Study of the Persistent Issue of International Scientific Mobility

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CHAPTER 13—BRAIN DRAIN: A STUDY OF THE PERSISTENT ISSUE OF INTERNATIONAL SCIENTIFIC MOBILITY

I. Introduction

The purpose of this study is to show the interaction of American diplomacy with science and technology respecting the problem of the brain drain. The approach is to examine the various aspects of the issue, show its complexities, and assess its importance as a continuing, but largely unperceived, problem in American diplomacy.

Attention is focused mainly on the "less developed countries" (LDCs), the greatest losers of educated talent to the advanced countries, particularly to the United States. Loss of this talent, widely regarded as essential for the long-term needs of national development, constitutes a "brain drain."

Extensive materials on brain drain have been examined in the preparation of this study, notably those published by the U.S. Congress, the various agencies of the U.S. Government, the United Nations, and numerous independent scholars and research groups.

Though brain drain is an historical phenomenon dating back to the ancient Greeks, in its present form it has become a problem unique to the modern era of science and technology. It has been in the immediate past, and remains (though less visibly), a troubling issue in this Nation's diplomacy.

An Evolving International Issue

On May 12, 1964, President Mwalimu Julius K. Nyerere of Tanganyika told the Parliament on the occasion of introducing his development plan to the nation:

> Some of our citizens will have large amounts of money spent on their education, while others have none. Those who receive the privilege therefore have a duty to repay the sacrifices which others have made. They are like the man who has been given all the food available in a starving village in order that he may have strength to bring supplies back from a distant place. If he takes this food and does not bring help to his brothers, he is a traitor. Similarly, if any of the young men and women who are given education by the people of this Republic adopt attitudes of superiority, or fail to use their knowledge to help the development of this country, then they are betraying our Union.[1]

In a speech at the Fourth Rehovoth Conference in August 1967, Israeli Minister of Health Yissrael Barzilai publicly agreed with the statement of Britain's Health Minister Sir Kenneth Robinson that he was not prepared to "invest thousands of pounds sterling in a medical student only to increase the membership of the American Medical Association."[2]

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[1] Quoted in, Frederick Harbison, "Problems of Developing Higher Education in the Newly Developing Countries," U.S. Congress, House, Committee on Education and Labor, *International Education: Past, Present, Problems and Prospects*. Prepared by the Task Force on International Education, 89th Cong., 2d sess., 1966, pp. 471–472. (Hereafter cited as, *Selected Readings on International Education*, House Committee on Education and Labor, 1966.)

[2] Harold Margulies, M.D. and Lucille Stephenson Bloch, *Foreign Medical Graduates in the United States* (Cambridge, Mass.; Harvard University Press, 1969), pp. vii–viii.

NOTE: This chapter was prepared in 1974 by Joseph G. Whelan.

Referring to the loss of physicians from the less developed to the developed countries, one Pennsylvania educator wrote in 1968: "This country is simply stealing talent, and stealing it from countries that can least afford it." [3]

And on January 31, 1969, *The Christian Science Monitor* editorialized: "With one hand the United States is giving [foreign] countries millions to develop themselves. And with the other it is casually taking away the seed corn of future leaders in natural science, health, and technical knowledge. These are even more precious to the country than food or machinery." [4]

These selected statements refer to what has become commonly termed the "brain drain." This issue, according to Herbert G. Grubel, a student of the brain drain, had "penetrated public and official consciousness in many parts of the world more quickly and deeply than most other problems in the post-war world." [5] Grubel's statement appears to be no exaggeration.

By the mid-1960's, the brain drain had indeed become a dominant problem in international relations. Serious concern had been manifested among the donor nations of Western Europe and in the underdeveloped areas, that is, the losers of professional manpower, and in the United States, the principal gainer. Highly charged with emotion, the brain drain issue became the subject of sharp discussion in the United Nations, in other international and regional organizations, and throughout the world scientific community. Much of the criticism was directed against the United States. Such criticism provoked searching inquiries into the problem by the U.S. Congress, the executive branch, and many professional scientific organizations such as the National Science Foundation. Subsequent commentary and debate produced a vast literature on the brain drain.

General Characteristics of Brain Drain Issue

In large measure the brain drain issue is three-dimensional: It is a manpower problem in that it deals with the migration of talented people, and, therefore, affects patterns of growth in both advanced and developing countries; it is a development problem in that it deprives the developing nations of much needed human capital for achieving their major national goal, namely, modernization; finally, it is a problem in science and technology in that it relates directly to the management of resources and the building of infrastructure for modern industrial societies.

In brief, the brain drain is a manpower problem within the context of international development, national growth, and national technological culture. As such it represents something of a unity of forces in which education, science, and technology converge in the processes of national development and in the general course of economic and social progress. Critical to national growth in both advanced and de-

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[3] Quoted in U.S. Congress, House, Committee on Government Operations, Research and Technical Programs Subcommittee, *The Brain Drain of Scientists, Engineers, and Physicians from the Developing Countries into the United States.* Hearings, 90th Cong., 2d sess., Jan. 23, 1968, p. 39. (Hereafter cited as, Hearings, House Government Operations Committee, *Brain Drain,* 1968.)

[4] Quoted in, Walter Adams, "Talent That Won't Stay Put," *Population Bulletin* 25, No. 3 (June 1969), p. 60.

[5] Herbert G. Grubel, "The Reduction of the Brain Drain: Problems and Policies," *Minerva,* 6, No. 4 (Summer 1968), p. 541.

veloping countries are the size and quality of a nation's stock of trained specialists and high-level scientific manpower and its capacity to enlarge this supply to satisfy demand. Accordingly, the principal concerns of the advanced countries, like the United States, are not economic development per se but rather rates of growth and innovation, assurances of a large and expanding supply of skilled people, and assistance in launching and sustaining the technology-intensive enterprises upon which national standing and power increasingly depend.

In contrast, the principal concern of developing nations is of the most elemental type that hinges upon resolving the human resources problem and closing the gap between national goals and the supply of skilled manpower. The manpower needs of both developed and developing countries conflict on this vital and fundamental issue.[6]

Thus the brain drain deals with the migration of people, attitudes of nations and governments, the status of development in the preindustrial and postindustrial stages of national growth, and science and technology as instrumentalities for modernization. It impinges on foreign policy not so much as a specific issue in state-to-state relations but rather as a generalized, all-embracing problem that affects the growth and maturation, or retardation and decline of nations.

Inherent Difficulties and Limitations: Magnitude and Complexity of the Problem

The magnitude and complexity of the brain drain issue inevitably create many difficulties and impose many limitations. This is a global problem. It concerns Asia, Africa, Latin America, and Europe. It is also a sociological problem. It concerns man and society in varying stages of development. Both are strung out upon a chain of human advancement reaching from the economic and social level of primitive Africa to that of the advanced level of the industrial West.[7] It concerns the interaction of traditional cultures with the forces of modernization and the effect of that interaction upon changing values in changing societies. It is also a problem in human psychology. It concerns people moving within and between changing national environments. Movement of persons into modern industrial societies from those less developed raises questions about individual goals and expectations in life, the value of loyalty to the nation and its culture, and the extent of one's personal interests and life goals paralleling those of the nation-state. Speaking of an approach to solving the brain drain problem, Dr. Charles V. Kidd, a long-time student of science policy and science advisor to President Lyndon B. Johnson, characterized the issue as ". . . not a problem to be solved, but a situation to be adapted to. And we are dealing with a process, I think, and not an event." [8]

Much of the difficulty in dealing with the brain drain stems from the elements of controversy that it has provoked. There are first of all disagreements as to the relative harm or loss which developing coun-

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[6] The Council on International Educational and Cultural Affairs of the U.S. Government, *The International Migration of Talent and Skills.* Proceedings of a workshop and conference, Charles Frankel, Assistant Secretary of State, Chairman, Washington, U.S. Department of State, October 1966, pp. 1–2. (Hereafter cited as, *Proceedings of Workshop on the International Migration of Talent and Skills,* October 1966.)

[7] James A. Perkins elaborates on this aspect of the brain drain problem in, "Foreign Aid and the Brain Drain," *Foreign Affairs* (July 1966), pp. 608–612.

[8] Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 81.

tries may suffer when a number of their educated elite migrate. Then there is the matter of equity among nations, or even by implication the moral question, if the wealthier nations of the world appear to be capitalizing on the scarce human resources of the underprivileged nations. Many Americans responded to this problem from a sense of national guilt. There are also the political implications of whether to permit the free movement of persons throughout the world, or whether to restrict such movement to some degree. This question raises such key issues as those of national loyalties, world-mindedness, and the uses of knowledge, all of which impinge directly upon the universal perspective of the modern man of science.[9]

DEFICIENCY OF STATISTICAL DATA

The complexity of the brain drain issue is compounded by the lack of accurate, comprehensive, and rationally structured statistics on the flow of professional and highly skilled manpower. Nearly every discussion of the brain drain published and examined during the past decade stressed the absence of reliable statistics. The U.S. Immigration Service and the National Science Foundation are unique in providing data allowing some qualified judgments on the flow of professional manpower into the United States. Among the LDCs reliable and comprehensive statistics are virtually nonexistent.[10] In George B. Baldwin's view, they ranged from "unsatisfactory to hopeless."[11] Except for the United States, the advanced countries have also been remiss. "Even a country which claims to be badly hurt by the brain drain, the United Kingdom," wrote Alessandro Silj, "has virtually no statistics to offer except those furnished by the American immigration service."[12]

PROBLEMS OF INTERPRETATION

Varying interpretations given to available statistics add to the complexity—indeed confusion—in attempting to analyze the brain drain problem. Students of the brain drain are divided on the meaning of the available data. "Nothing is more central to the study of professional migration and its presumed values," wrote Gregory Henderson in his UNITAR study, "than the determination of what the available statistics mean and what they do not mean. Agreement on this determination is not wide."[13]

Problems arise from the nature of immigration statistics. Migration is not a static phenomenon. Men move in and out, but statistics

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[9] Steven E. Deutsch, *International Education and Exchange: A Sociological Analysis* (Cleveland: Case Western Reserve University Press, 1970), p. 27.

[10] Hla Myint of the London School of Economics gave the following appraisal of statistics on migration from the LDCs: "Although some attempts have been made to assess the magnitude of the brain drain from the underdeveloped countries into the United States, it is fair to say we have no reliable statistical information about the total numbers involved in the brain drain from the underdeveloped countries to the advanced countries as a whole." (Hla Myint, "The Underdeveloped Countries: A Less Alarmist View." *In* Walter Adams, *The Brain Drain* (New York: Macmillan, 1968), p. 233.

[11] George B. Baldwin, "Brain drain or overflow?" *Foreign Affairs* (January 1970), p. 359.

[12] Alessandro Silj, "Should Europe Recall Its Scientists?" *European Community*, no. 127 (September 1969), p. 6.

[13] Gregory Henderson. *Emigration of Highly-Skilled Manpower from the Developing Countries.* United Nations Institute for Training and Research (UNITAR), New York, 1970, p. 10.

often freeze movement without recording return flows. Definitions of professional categories differ. Statistics do not express the exactitudes which they purport, according to Henderson, but rather indicate general orders of magnitude and trends. These and many other factors add to the difficulty of interpreting migration statistics.

Faced with the uncertainties of statistical data some students of the brain drain fall back upon general impressions derived from a variety of sources. Hla Myint thus explained his position: "All we can do is to try to piece together a general picture from the sketchy and impressionistic information available on the subject." [14] Others like George B. Baldwin degrade the value of statistics, deny that there is a brain drain, and argue a case for semantics. "But even good statistics are of little use," he said, "unless one knows what one is trying to measure. And in the brain-drain debate there is much ambiguity as to who is a 'brain' and what is a 'drain.'" [15]

NEED FOR RESEARCH

To fill the gaps of information, students of the brain drain have universally stressed the need for more research. Social scientists customarily admit ignorance and plead for additional research, wrote Steven Deutsch. "When it comes to the 'brain drain,'" he said, "there is indeed a great deal of ignorance and a real need for research." [16] "We do need more facts about the brain drain," Dr. Donald F. Hornig, science adviser to President Johnson, told members of the Senate Immigration and Naturalization Subcommittee. "It is not so much detailed statistics, but a better picture of what the problem is." [17]

Much has been published in the past decade, improving somewhat on the insufficiency of data. This may have illuminated certain aspects of the problem, but it has not appreciably reduced its complexities. The observations of Dr. Charles Frankel, Assistant Secretary of State in the Johnson Administration and professor of philosophy at Columbia

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[14] Myint, op. cit., p. 233.

[15] Baldwin, op. cit., pp. 359–360. Writing in 1970, Mr. Baldwin declared that "today we know much more about the international migration of professional manpower than we did five, four or even three years ago. But the 'more' we know is mainly facts, and not all that many; men still have difficulty saying what the facts mean and deciding whether or not the brain drain constitutes a problem of 'disturbing dimensions'—as the Pearson Commission called it." (p. 358.)

In Senate hearings on the migration of talent, Senator Hiram L. Fong (D-Hawaii), observing that Americans go abroad for a temporary purpose and then return whereas people coming to America usually remain, asked Under Secretary of State Eugene V. Rostow whether "statistically it has been proven that we have taken too many of these skilled people from these countries." Mr. Rostow replied: "I don't think so. I haven't seen that case yet, either for the developed countries or for the less developed countries. There is a much bigger bulge from some of the countries than from others, at least in the less developed parts of the world. But I don't think the case can be made that we have taken too many. . . ." (U.S. Congress, Senate, Committee on the Judiciary, Subcommittee on Immigration and Naturalization, *International Migration of Talent and Skills*, hearings, 90th Cong., 1st sess., 1967, p. 12. (Hereafter cited as, Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1967.)

[16] Deutsch, op. cit., p. 31.

[17] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1967, p. 110. Dr. Hornig said: "Better information on the international movement of highly trained people is badly needed. It is ironic that we have kept detailed statistics for decades on shipments of coffee, cocoa beans, steel and cotton, but we have only general approximations to the current flows of human beings." He felt that the reason for this paucity of data is the fact that only recently have science and technology been recognized as major factors affecting national development and international trade. Also there has been a corresponding tardy recognition of the significance of scientists and engineers to national well-being. Finally, the significance of the quality of the work force has until recently not been sufficiently recognized by economists. (p. 106.)

University, are instructive. Referring to a report on the brain drain by the Interagency Council on International Educational and Cultural Affairs of which he was chairman, Dr. Frankel explained that it contained "as many questions as answers. It suggests some ideas about how to think about the problem; it does not offer any grand formula for solving the problem easily or quickly." And he added: "To my mind, any reasonable man who devotes time to thinking about the issues raised by the so-called 'brain drain' will discover that they are thorny and difficult." [18]

Scope and Design of the Study

This study is not a history of the brain drain nor a statistical analysis of talent migration. Neither is it a history of U.S. foreign policy, administrative action, and institutional involvement, nor a detailed commentary on the conduct of American diplomacy concerning this problem. Rather, it is an attempt to determine the larger meaning of the brain drain issue, and to explore its many facets as a problem that on the surface appears to have only an indirect bearing on American foreign policy, but in the long term could prove to be a matter of significant national concern. One result of the exploration is to show how a nation whose strength, power, prestige, and authority derive largely from the successful application of science and technology can have an unintended disrupting effect upon those less privileged nations which are striving toward modernity. Every effort has been made in this study to simplify the complexities of this problem, illuminate its obscurities, and create at least an understanding of its interacting role between American diplomacy and science and technology.

This study minimizes statistical compilations. Where possible statistics showing patterns of migration are given to suggest the existence of this problem and to indicate in a general way its parameters. It seeks to answer such questions as: What is the brain drain? Is this a problem peculiar to contemporary society or does it have roots in history? What are the trends and patterns in the brain drain since the end of World War II? How does the United States fit into this evolving phenomenon? What are the causes of the brain drain? What are the "push" factors in countries of origin and the "pull" factors in countries of destination? What are the effects of the brain drain in both the losing and gaining countries? Does it impair development processes among the LDCs? What are the implications of the brain drain for American foreign policy? Does it work at cross-purposes with American programs of international development? What are the areas of institutional involvement? Are there remedies for the brain drain? And, finally, what are the trends for the future? Is this a durable problem for the United States, or is it only transitory?

In attempting to respond to these questions, concrete examples are cited to illustrate the particular points under discussion. Yet caution has been exercised in not generalizing too broadly from specific cases. Admittedly, questions bearing directly on stages of development, on the "effective demand" rather than just the "need" for skills, and on divers manpower and education policies, all on a global scale, com-

[18] Ibid., p. 13.

plicate this problem and render generalization difficult; but acceptable risks must be taken if the data are to be at all relevant and meaningful.

EMPHASIS ON LESS DEVELOPED COUNTRIES

This study emphasizes brain drain as it affects the "Less Developed Countries" (LDCs); only in a tangential way does it deal with the impact of brain drain upon losers among the advanced nations. In the LDCs the brain drain issue has its most serious consequences; here the intervention of science, technology, and diplomacy is most viable.[19] Advanced nations have the infrastructure and national base for replenishing the supply of lost scientists and engineers and the resources, political and economic, for counteracting their outflow. Theirs is a bearable loss; it is potentially recoverable. Such is not the case with LDCs. Their loss is sometimes irreparable. As a preliminary report of UNESCO on the problem of talent migration observed, "While many developed countries are also affected by the 'brain drain,' it is the developing countries which are hardest hit by its consequences." [20] For the United States this aspect of the problem has special relevance because this Nation has become the primary force attracting talent from the LDCs. "The United States has become a graduate school for much of the developing world," wrote John R. Niland in his study on the Asian engineering brain drain, "but as growing numbers of foreign students seek higher degrees at American universities, so too do growing numbers of them avoid or postpone return to the home country." [21]

It is not surprising, therefore, that the adverse effects of the brain drain provoked sharp criticism among the LDCs, most of whom had only in recent years emerged from their colonial relationship with the West. In the General Assembly of the United Nations they accused the West of transferring its exploitive urges from physical to human resources. The representative from Dahomey called it an "odious bleeding" of Africa, a continuation of the slave trade. The Assembly

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[19] The report of the State Department's workshop and conference on international migration of skills explained its priority interest in the LDCs in this way: "Finally, as some noted, a concern with the 'brain drain' and nonreturn should be restricted to migration from underdeveloped countries to the developed ones; it is here that the enormous existing disparities in rewards and resources between the two make cooperative actions both vital and defensible in terms of the developed countries' own long-range interests." (*Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 9.)

[20] United Nations Educational, Scientific and Cultural Organization, *The Problem of Emigration of Scientists and Technologists, General Appraisal of the Phenomenon.* Preliminary report. Prepared at the request of the Advisory Committee of the Economic and Social Council on the Application of Science and Technology to Development, Paris, Feb. 29, 1968, p. 11. (Hereafter cited as, UNESCO, *Preliminary Report on Emigration of Scientists and Technologists*, 1968.)

Senator Walter F. Mondale gave this explanation of the imbalance of effects: "From some European countries, particularly Britain, the brain drain is very substantial. But is well within the means of these countries to provide the incentives which would reduce the flow, or at least compete for talent, particularly in the strengthened European Common Market nations." "But developing nations," he continued, "cannot compete in salaries and material benefits. And any student or trainee in this country soon learns to appreciate those rewards. . . ." The Senator explained the essence of the problem for the LDCs in these words: "Furthermore, these nations cannot now create the kinds of institutions and the kinds of opportunities which will attract and retain the very best of their native talent. They cannot, that is, unless they have outside help." (A speech delivered by Senator Mondale at the University of Minnesota on Apr. 14, 1967, in *Congressional Record*, May 15, 1967, p. S6858.)

[21] John R. Niland. *The Asian Engineering Brain Drain* (Lexington, Mass.: Heath, 1970), p. xiii.

responded by passing a resolution conceding the seriousness of the problem and expressing grave concern.[22]

Certain Assumptions

The complexities of the brain drain make it a nebulous subject upon which to base a study. To give some structure to the problem, certain assumptions have to be made, and the first is, that the problem exists.

BRAIN DRAIN: REALITY OF PROBLEM

Such an assumption needs to be made explicit because some students of the brain drain deny that it does exist. If this were the case, then the purposes of this study would be meaningless. George Baldwin asserts, for example, that professional migration from the LDCs appears not to be a drain but an overflow.[23] Howard J. Caquelin believes that the problem has been exaggerated. "The hullabaloo about the 'brain drain' is getting rather threadbare," he said. "Only the centers of attraction have changed from ancient Takahasila in India to the Middle East to Rennaissance Europe, and, more recently to the United States . . . the drained have always complained."[24] Henry Fairlie states categorically, "There is no brain drain."[25]

Others disagree. H. V. Hodson, Provost of the Ditchley Foundation which sponsored a conference on the brain drain and the LDCs, prefaced the report of the conference with the conclusion that there are two things about the brain drain "that are reasonably certain in the contemporary world. They are, first that its scale alone now makes it a substantial economic and social issue for many countries, both as importers and as exporters of 'brains,' and that in the over-all balance a net export lies with the less-developed and a net import with the most-advanced countries."[26]

Philip H. Coombs, Director of UNESCO's International Institute for Educational Planning in Paris, acknowledged the absence of sufficient data to see the whole brain drain picture clearly, but he asserted, "There is enough indicative evidence to warrant serious concern."[27] George Seltzer, Professor of Economics at the University of Minnesota, conceded the vast divergencies of views dictated by subjective considerations, but he considered the brain drain a "problem" because:

1. It is creating international ill-will;
2. It is perverting specific international programs for aid and technical assistance;

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[22] Nuri Eren, "Supply, Demand, and the Brain Drain," *Saturday Review*, (Aug. 2, 1969), p. 10. Anwar Koraltem and Midhat Hamdi, officials in the UAR's Ministry of Education, gave the following interpretation of the brain drain: "The United Arab Republic is of the opinion that the 'brain drain' processes are immoral processes which impair nation-building efforts in developing countries by depriving them of the required human experience and thus hamper their march towards progress. The United Arab Republic also has the conviction that the 'brain drain' policy adopted by certain advanced countries to drain qualified elements from developing countries is against the principles and purposes of international cooperation." (Quoted in, UNESCO, *Preliminary Report on Emigration of Scientists and Technologists*, 1968, p. 8, ff. 1.)

[23] Baldwin, op. cit., p. 359.

[24] Quoted in, George Seltzer, "Brain Drain: What Should and Can Be Done?" International Development. 1966. Edited by, H. W. Singer, Nicolas de Kun and Abbas Oroobadi (Dobbs Ferry, N.Y.: Oceana, 1967), p. 55.

[25] Ibid.

[26] Ditchley Foundation. Report of a Conference at Ditchley Park, Feb. 16–19, 1968. *International Migration of Talent From and to the Less Developed Countries*. Rapporteur, C. H. G. Oldham. Ditchley Park, England, 1968, p. 5.

[27] Philip H. Coombs, "Brain Drain from Developing Countries," *International Development* (1966), p. 60.

3. It is a barrier to socio-economic development in selected areas;
4. It is diverting attention—when used as a self-serving slogan—from conditions that require urgent action.[28]

Similar recognition of the problem is apparent in the 1968 report of the House Government Operations Committee on the "Scientific Brain Drain from the Developing Countries." Among its findings was this: "While the immigration may not harm development in the short run, it will have serious adverse consequences in the long run." [29]

Finally, the most current assessment by the United Nations (January 18, 1974) contained an outright statement that brain drain is a problem. Secretary General Kurt Waldheim acknowledged in his report the difficulties in measuring the precise magnitude of the outflow. And immigration statistics of the United States, the United Kingdom, and Canada, he said, provide only minimum figures for evaluating the brain-drain. But even "these minimum figures indicate that the net outflow of trained personnel from developing to developed countries is significant enough to justify the international concern and to warrant the formulation and implementation of policies to reduce, if not to stop, this net outflow." [30]

POSITIVE VALUE OF SCIENCE, TECHNOLOGY, AND EDUCATION IN MODERN CIVILIZATION

A second assumption is acceptance of the belief that modern industrial civilization based on science and technology, as it has developed in the United States and other industrial areas of the world, is generally a positive good, thus a desirable value, and accordingly a desirable goal for a nation to achieve.

Inherent in this view is the further assumption as to the positive value of education as an essential instrument for development and achieving modernity. Commentators on the brain drain like Dr. Frankel recognize the dilemma of the United States, being at once a "graduate school for the LDCs" and a magnet attracting the educated elite as nonreturnees, but assuming the overriding value of education, they maintain, like Dr. Kidd, that "it would be out of perspective to view the training of students in this country as anything but a large, positive gain to the world." [31]

Accordingly, it is further assumed that the educated class in the LDCs represents a national elite and as such represents an investment

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[28] Seltzer, op. cit., p. 56.

[29] U.S. Congress, House, Committee on Government Operations, Scientific Brain Drain from the Developing Countries. Twenty-third report, 90th Cong., 2d sess., 1968, p. 5. (Hereafter cited as, Report, House Government Operations Committee, *Scientific Brain Drain from the LDCs*, 1968.)

[30] United Nations, Committee on Science and Technology for Development, *Outflow of Trained Personnel from Developing to Developed Countries*, Report of the Secretary General. New York, United Nations, 1974, p. 6.15. (United Nations. E/C. 8/21. Jan. 18, 1974.)

In introducing the Secretary General's report to the Committee on Science and Technology for Development, Rajnikant C. Desai, acting Director of the Office for Science and Technology, noted that the United Nations had been dealing with the brain drain problem for a number of years. The subject, he said, had caused understandable anxiety among the developing countries which feared the loss of their professional manpower to the advanced countries. Accordingly, the subject had aroused concern within the United Nations legislative bodies.

Debate on this matter within the Committee elicited varying degrees of attitudes, but the Canadian delegate expressed a common theme when he said that brain drain was "a real problem for developing countries." (United Nations, Office of Public Information, Press Section, *Committee on Science and Technology, . . . Begins Debate on "Brain Drain,"* New York, United Nations, 1974, 6 p. United Nations Document, Press Release TEC/233, Mar. 25, 1974.)

[31] Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 44.

in a country's natural resources. Thus, whether or not a trained professional may be a surplus commodity in his field and leaves the country does not alter the fundamental fact that his emigration represents a loss. This assumption takes on a more general view of trained manpower in that the lost contribution of the departed professional to a nation is judged to be much broader than just his contribution in the particular area of his speciality. He is part of a larger developing infrastructure of a national elite, a vital human resource, that is necessary for development.

Without these assumptions on the positive value and desirability of science, technology, and education, the LDCs would be assigned to perpetual underdevelopment, the advanced nations would accordingly be divested of any responsibility, and the brain drain would be a nonsubject for study.

INEVITABILITY OF CHANGE AS POSITIVE VALUE

The inevitability of change as a positive good in development—a force to be harnessed to constructive ends—is a final assumption in this study. In its project on the international migration of high-level manpower and the impact on development, the Committee on International Migration of Talent (CIMT) described this concept of change in the developmental process as a commitment to the idea—an "immensely powerful force," it said—". . . that people are not fated to live and die as their ancestors have lived and died, the idea that nature can be controlled and used, the idea that physical suffering and early death are not the inevitable lot of humans."[32]

Costs of change in the LDCs can be high, as CIMT wrote, "in terms of conflict within and among individuals and in terms of the loss of traditional values that tend to elevate the individual and hold society together."[33]

But poorer countries of the world appear to have opted for modernization, whatever values may be eroded and whatever the difficulties encountered. Gunnar Myrdal described the process this way as it applied to Asia: "The South Asian countries, and particularly the poorer among them, have passed the point of no return. Given the present and foreseeable rate of population growth, the choice of remaining traditional societies is no longer open."[34]

What is implied in this assumption on the inevitability and desirability of change is a furthering of the 19th century idea of progress and the advancement of the 20th century spirit of scientism; for this type of change projects an outlook that accents the positive in the expectations of man and society. In this process, the economic and social development, including the institutions, values, and cultural traits that are necessary to and a part of development toward modernity, seem more likely to occur as a consequence of examples set by the advanced countries.[35] It is this interaction between the developing and advanced countries so central to the development process that generates the idea

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[32] The Committee on the International Migration of Talent. *The International Migration of High-Level Manpower: Its Impact on the Development Process.* Published in cooperation with Education and World Affairs (New York: Praeger, 1970), p. 679. (Hereafter cited as CIMT study.)

[33] Ibid, p. 679.

[34] Ibid., p. 680.

[35] Ibid., p. 679.

of progress among the LDCs but ironically produces conditions for brain drain.

Definition of Brain Drain

The phenomenon known as "brain drain" is rooted in antiquity, but the phrase itself was coined in a 1962 report by the British Royal Society which inquired into the emigration of engineers, scientists, and technicians from Britain to North America.[36] The term has been widely used in the United States, particularly in the 1960's, to refer to immigration into the United States of highly trained scientists and professionals from all countries. Migration of talent seems to embrace an idea that is common in all variant definitions.

Though students of the brain drain problem disagree widely on its definition, they generally concur on the emotionalism that it generates. The term is "loaded and pejorative," wrote Dr. Walter Adams, Economics Professor at Michigan State University and a prominent scholar of the brain drain, "leading those who use it to think automatically of a loss of vital resources without compensation." Illustrations reinforce this mental habit, purporting to show that "human capital is flowing out of economies where it can make the greatest contribution and into economies already well-stocked with trained scientific and administrative personnel." In such a melodramatic view, he noted, the United States is characterized as "the greatest villain." Overlooked is the fact that large numbers of skilled people migrate to countries other than the United States.[37]

INTERNATIONALIST AND NATIONALIST THEORY OF BRAIN DRAIN

In general, students of the brain drain define the problem from either the internationalist or the nationalist perspective. Harry G. Johnson of the London School of Economics professes to adopt "a cosmopolitan liberal position," that is, the internationalist stance. He regards nationalism as "one of the less pleasant vices in which mankind indulges itself, or as one of the characteristics of childish immaturity out of which I hope the people of the world will ultimately grow." Accordingly, he begins with the assumptions, (1) that the international circulation of human capital is a beneficial process since it reflects "the free choices of the individuals who choose to migrate," and (2) that "any argument to the contrary needs very careful scrutiny and documentation before it can be accepted." [38]

Advocates of the internationalist view tend to downgrade the negative effects on development of the migration of highly skilled professional manpower, and as evidence to buttress their case point to the pioneering work of such "immigrants" to America as Einstein and Fermi that benefited all mankind. Henry Fairlie expressed this point of view in a comment on the British brain drain: "There is no brain

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[36] Walter Adams, "Talent That Won't Stay Put," p. 59.

[37] Ibid., pp. 61–62.

In describing the emotionalism generated by this problem Philip H. Coombs wrote: "The 'brain drain' label itself, . . . is emotionally loaded—like piracy, theft and rape—and thus carries its own answer. It implies that the failure of any student from a developing country to go home when his studies are finished is *ipso facto* a bad thing and somehow is immoral. Many people in fact believe this. Their writings encourage us to approach the matter with a large guilt complex." (Op. cit., p. 59.)

[38] Harry G. Johnson, "In Search of an Analytical Framework: An 'Internationalist Model,'" *In* Adams, *The Brain Drain*, p. 70.

drain. There *are* a number of scientists who are taking what appear to them to be better jobs that do not happen to be in the United Kingdom. The first thing to realize is that it is quite legitimate for them to do this . . . it is also proper. . . . The world of scholarship is the last which should allow social, political or nationalist considerations to be paramount." [39]

The internationalists' criterion in defining brain drain is whether the individual scientist performs a greater service to humanity by leaving his native country or in remaining or returning home. Ultimately, they argue, the losing country can gain if he has greater opportunity abroad for exercising his skills and talents and realizing his professional goals. Germany, for example—as indeed all of mankind—has benefited from the work of Wernher von Braun and the other German space scientists who came to the United States after World War II. Their contributions virtually assured America's success in space exploration.

In contrast, the nationalist view defines brain drain from a far more narrowly circumscribed perspective. The principal criterion is service to the nation. When Sir Kenneth Robinson complained of the medical brain drain to the United States, he was more concerned with satisfying Britain's health needs than either "swelling the membership" of the American Medical Association (AMA) or conceivably serving the larger interests of humanity. The nationalist view, however, has greater relevance for the LDCs, for it is many of them who pay the highest social cost for the loss of skilled manpower. Accordingly, they perceive this problem more directly in terms of how it impairs their national welfare and development and not how it serves the aggregate welfare of the world. The nonreturn of a single Nigerian medical graduate from postgraduate training in an advanced country is considered a serious loss to the health needs of that much deprived nation and accordingly constitutes a drain on its high-level manpower resources.[40]

VARIATIONS ON DEFINITION

There are perhaps as many variations on the definition of brain drain as there are situations to which it is applied. It is a term, wrote Dr. Harold Margulies and Lucille Stephenson Bloch in their study on foreign medical graduates (FMGs), which "time has proved to be more convenient than descriptive. It implies more than it says and disguises what should be made more apparent." [41] For them, a "relatively tasteless" translation of brain drain is "loss of human capital investments," and a less inclusive term is "migration of talented or highly skilled individuals." A brief economic definition is "rational allocation of scarce resources," that is, the most economically efficient use of manpower. For those deeply, and at times emotionally, concerned about the issues provoked by brain drain, Margulies and Bloch write, "it is the unwarranted and undesirable loss of urgently needed, highly educated individuals from poor countries to more fortunate countries like ours which could get along very well without them." [42]

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[39] Quoted in, Seltzer, op. cit., p. 55.

[40] For a discussion of the nationalist view, see, Don Patinkin, "A 'Nationalist' Model," *In* Adams, *The Brain Drain*, pp. 92–108.

[41] Margulies and Bloch, op. cit., p. 78.

[42] Ibid.

Dr. Frankel defined brain drain as "the flow of skilled and talented people to our country from other countries," and as "the circulation of brains." [43] "It is a contemporary manifestation of a phenomenon common to all modernization," he said, "—the movement of people away from the poorer and more isolated places towards the metropolitan centers of the world." [44]

Dr. Kidd defined brain drain as "an index of the structural maladjustments in both the 'sending' and 'receiving' countries." For the latter it indicates an inelastic supply of certain talents and skills "based in part on the monopolistic entry restrictions which are allowed to operate in the professional sector of the economy." For the "sending" nations, it may be the index of retarded development or underdevelopment. "In all cases," he continued, "the brain drain is simply the symptom of the disease rather than the disease itself. . . ." [45]

Claire Nader, a political scientist at Oak Ridge National Laboratory, defined brain drain in terms of crises in technical leadership; as she said, it "refers to damage to a nation's brain power and potential leadership resources." Developing countries, whose trained elite such as scientists, engineers, and physicians migrate to the advanced nations of the West, face a situation, she explained, "which is intensified by unused, underused, misused, or missing talent and skills within these countries." Both the consequences of migratory phenomena and the pattern of using specialized talents within a country, she concluded, contribute to "maturing crises in technical leadership." [46]

SOME CHARACTERISTICS OF BRAIN DRAIN DEFINITIONS

Difficulty in defining "brain drain" adds to the complexities referred to above in analyzing this problem. Yet, as the variations on definitions suggest, characteristics in the problem magnify the task of definition.

Diversity in stages of development among the LDCs creates differing criteria for defining what is meant by brain drain. Critics have charged the United States with drawing off from poor countries human resources urgently needed for their development. Simplistic, dramatic, easily understood, and politically appealing, this stereotyped description of talent migration is inapplicable to many disadvantaged LDC's and oversimplified with respect to all. Both the Philippines Republic and Nigeria are considered developing countries; yet the pace and character of development in each of them differ widely. Diversity rather than uniformity seems to be the rule rather than the exception. Perhaps one of the most comprehensive statements on di-

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[43] Abdul Said. *Brain Drain: The Developing Countries—Causes, Ramifications, and Prospects.* (Lawrence, Kansas: University of Kansas, June 1970), pp. 1–2.

[44] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills,* 1967, p. 22.

[45] Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 61.

[46] Claire Nader, *"Technical Experts in Developing Countries," In Science and Technology in Developing Countries.* Proceedings of a Conference held at the American University of Beirut, Lebanon, November 27–December 2, 1967. Claire Nader and A. B. Zahlan, eds. (London: Cambridge University Press, 1969), p. 447.

According to Professor V. M. Dandekar from Gokhali Institute of Politics and Economics in India, the brain drain is "the flight of scientific, technical, administrative, and managerial personnel from the developing countries to the developed countries." And according to Dr. M. H. Nashar, the acting President of the University of Asyout, U.A.R., it is "the process of brain and thought attrition of the developing countries." (Quoted in, Said, op. cit., p. 1.)

versity among the LDCs was made by Dr. Kidd. After pointing out the risks of generalizing about the migration of skilled people from the LDCs, Dr. Kidd gave this description of the many interacting variables producing brain drain in the developing countries:

> The differences between the extent of and causes of migration from less-developed countries are so extreme that they cannot be considered as a homogenous group. Some very poor countries have no means of training people, and must depend on expatriates. They have no brain drain problem. Some are newly independent and are in the process of substituting their citizens for expatriates. They have no brain drain problem because well-paid government jobs with high prestige are available for all trained people—and more. Others encounter the well-known second generation problem, a stage of development at which all of the good government jobs are filled and there are few places for the newer graduates. Others have university systems which turn out more highly trained and well-trained people in some occupation than their economies can absorb now or in the foreseeable future. They therefore lose people. Others have relatively high standards of living, but have experienced political changes that lead people to migrate. This has been true of Cuba, Indonesia, and Argentina. Some countries, such as Barbados and the Philippines, deliberately train people for export.[47]

Intangibility is another characteristic of brain drain that impedes adequate definition. How is the loss of a man to his country to be judged if he lives and works elsewhere? The creative mathematician, nuclear physicist, or a specialist on cancer research from a small developing country who seeks intellectual contacts and research facilities available in a larger advanced nation in order to satisfy his professional ambitions may be making a greater contribution to his nation than if he remained home. "The results of his works," writes Frankel, "flow outward and benefit his country as well as the country where he works." The point being made was that "we are dealing with intangibles that are hard to measure." [48]

The intractable and multidimensional character of the brain drain problem adds to the difficulties of definition. How is it possible to record the flows and counterflows of mass migration and to calculate accurately the balance of exchange? Such a balance of human capital is by no means one sided. As George Seltzer observed, "The *net* factor may not be as adverse, or even negative, as the gross estimate may suggest when full account is given to the utilization of expatriate high-level manpower in the less-developed nations." [49] In all likelihood, the direction of migration is, moreover, not just a one-way stream from the undeveloped to the advanced countries. Reversible patterns are established by returnees. Frequently the process involves more than two countries as in the case of the migration of physicians from India and Pakistan which may have triggered or intensified the movement of British physicians to the United States, Canada, Australia, or elsewhere. The migratory process is dynamic, not static, particularly in the case of scientifically oriented professionals who by nature have a cosmopolitan outlook. It can involve the movement of large numbers of people in complex patterns of flow and counterflow in multiple directions. To plot the course of this interaction of peoples, much less

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[47] Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 45.

[48] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1967, p. 18. Dr. Frankel did not regard such cases as exceptional. "Cases of this sort are not infrequent," he said; "and they are the conspicuous cases which often generate the most discussion about the 'brain drain.' "

[49] Seltzer, op. cit., p. 57.

to interpret its meaning and formulate a definition with precision, seems next to impossible.

Another characteristic of brain drain that further complicates the problem of definition is determination of "need" and "demand" in estimating the value of lost professionals. George Baldwin gives this explanation. Where there is a general shortage of university graduates in the professional fields among the LDCs, then any loss through migration hurts. This is the case with sub-Sahara Africa, where professional graduates are "desperately short" in supply. But, for every LDC with an overall shortage of professional manpower today, there are probably two with surpluses, either present or impending. Baldwin applies the criteria of "human needs" and "effective demand" in measuring the degree of loss. Looking at pure "need" in the developing countries for physicians, engineers, agricultural scientists and technicians, economists, science teachers for secondary schools, and the like, he said, it is easy to see shortages. But, looking at the number of unfilled jobs, or the number of university graduates who have difficulty finding what they consider to be acceptable employment, then surpluses often appear. Thus, "part of the argument over whether or not a brain drain exists depends on whether one looks at a society's 'human needs' or an economy's 'effective demand'." Baldwin holds the view that the latter is a more relevant and realistic test to apply. (Others, arguing along lines of the chicken-and-the-egg proposition, may place primary stress on "need" as the correct criterion for judging loss through brain drain.) The real question, Baldwin says, is how rapidly "effective demand" for high-level manpower can be made to grow. "To ask this," he concludes, "is to ask the riddle of development." [50]

Difficulty in making qualitative judgments on the character of migrating talent complicates still further the problem of definition. Loss of the scientifically and technologically trained leadership talent which is needed in building a scientific-technological infrastructure can impede development and accordingly meets the criteria for what constitutes brain drain. But how can this loss be determined accurately? This small class of "key men," as George Baldwin refers to the vital component of the technological elite, while not in the genius category, constitute only a small fraction (5–10 percent) of all professional migrants. Gifted, educated, experienced leaders of this type are scarce almost everywhere, including in the United States. They are, in Baldwin's words, "the brains that really count" because "they have such high leverage." Outstanding individuals, they are unlikely to be replaced satisfactorily, even if a country has dozens of men with the same educational qualifications waiting to step into their vacated post. Loss of such "key men" does not show up in migration statistics, and the only way to judge the impact of loss is through detailed qualitative studies on important institutions, field by field and country by country. According to Baldwin, "No one has made such studies on more than a casual basis and it seems very improbable that anyone will." Accordingly, students of the brain drain problem fall back upon the imprecise assumption that migration of the critical elite would be approximately proportional to the total number of professional migrants.[51]

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[50] Baldwin, op. cit., p. 362.
[51] Baldwin, op. cit., pp. 362–363.

Even considerations on the critical elite deal only with part of the definitional problem. Another part, not quite as dramatic but significant nonetheless for development in the LDCs, is the loss of middle-level personnel, that is, the electricians, welders, and other skilled craftsmen so important in building a modern society. While this study concentrates on high-level manpower, still the drain of middle-level talent constitutes a serious and virtually unaccountable loss.[52] Middle-level skills are in short supply nearly everywhere and existing secondary and vocational education still inadequately produce such skills.[53] Yet in the LDCs middle-level skills, vitally needed for any industrializing or institutionalizing initiative, quite often are in scarcer supply relative to demand than high-level skills. Developed countries appear to require about 50 percent more middle-level than high-level skills. Ironically, some ordinary middle-level skills are often relatively rare in the LDCs. India, overflowing with civil engineers, has a serious shortage of electricians.[54] Korea had a core-group of newly trained nuclear physicists for creating a scientific research base in the nation but lacked the welders to build the necessary scientific apparatus. Developed countries have more middle-level personnel and require more and at a faster rate than do the LDCs.[55] Thus the migration of middle-level talent, usually not considered in studies on brain drain, contributes to the drain and consequently can impair development.

AN APPROACH TO THE BRAIN DRAIN PROBLEM

Given the complexities and difficulties in defining talent migration, it is understandable why some students of this phenomenon take serious exception to the commonly applied term, "brain drain." Such a term, imprecise and emotional, tends to prejudge the issue. Use of this "descriptive shorthand," says Richard A. Humphrey, Director, Commission on International Education of the American Council on Education, is "unfortunate," because it implies "purposive exploitation." To the extent that it does, it casts an "emotional aura" over the search for facts.[56]

Acknowledging these attitudes and inherent definitional difficulties, this study makes no attempt to formulate a general, comprehensive definition of "brain drain" that can apply to all cases. It does, however, attempt a more narrowly circumscribed definition. Since the study focuses mainly on loss of professional manpower from the LDCs,

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[52] The high-level manpower category is generally defined to mean "professional, technical and kindred workers" (PTK). The International Labour Office gave this definition: "Workers in this major group conduct research and apply in a professional capacity scientific knowledge and methods to a variety of technological, economic, social, industrial and governmental problems, carry out technical tasks auxiliary to scientific research, development and practice, and perform religious, educational, legal, artistic and literary functions. Those classified in this major group perform tasks which usually require training in a specific scientific or other professional field, at a university, technical institute or similar establishment or which require creative ability in literature or art or talent in entertaining." Many countries make slight variations in this category. (International Labour Office. International standard classification of occupations. Geneva, 1958. In Henderson, *Emigration of High-Skilled Manpower from the Developing Countries*, UNITAR, pp. 4–5.)

[53] Ibid., p. 50.

[54] Ibid., pp. 50–51.

[55] Ibid., p. 52.

[56] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1967, p. 133.

"brain drain" is, therefore, generally intended to mean in this study the loss of an educated elite that is required to satisfy the needs for national development, particularly in the long-run. Beyond this, use of the term is a matter of convenient identification of a subject already widely known under that label. In describing the conditions of brain drain, the study attempts to provide a reasonable statistical basis on migration flows and patterns for analyzing the problem and where possible to support generalizations with specific cases. By necessity, certain assumptions have been made. Also by necessity the study relies upon what are at best impressionistic views derived from the many sources examined. Finally, international development is a vast and variegated subject embracing a wide range of problems and issues. This study, while acknowledging this diversity, examines the problem principally from the perspective of brain drain and the primary role of trained manpower in development.

II. Brain Drain in Historical Perspective

Human mobility is a fact of history, and for modern man, particularly in free societies, it is a way of life. Today's world is one of quickening movement, characterized by constantly shifting populations. At a time of technological change and rapid, inexpensive transportation, mobility has tended to become the rule rather than the exception, and to change one's home or even country is for many persons a commonplace event. The struggle for success, advancement, and even life itself is often inextricably woven into the reality of movement, whether in the sometimes frenetic atmosphere of today's Jet Set living and playing on several continents, or in the more sober sphere of the scientist responding to the allure of better research surroundings, or of the businessman operating in an enlarged global sphere of national and multinational corporations.

Migration in History

Since the beginning of time, man has been on the move, searching for many things—wealth, power, survival, adventure, freedom, peace, education, progress. Indeed, history is largely a record of human migration: the exodus of Hebrews from Egypt, the earliest recorded mass migration; the movement of Phoenicians, Greeks, and Etruscans into the Mediterranean basin establishing ancient civilization; the spreading influence of the Greeks, and Romans; the migration of Germanic peoples into the Roman Empire to form a new base for Western Civilization; the world of the 7th–8th century Arabs stretching from southern France in the West to the Indus Valley in the East; the overseas migration of some 60 million Europeans from the Age of Discovery to the eve of World War II, which had the effect of "Europeanizing" the Western and much of the Eastern Hemisphere—all massive movements of people that have constituted the historical record of mankind.

Within recorded history human migrations have transformed nations and continents and the racial, ethnic, linguistic, and cultural composition of their inhabitants. They have often sown the seeds of civilization and in many instances proved to be a primary source of human progress, for above all else man is a carrier of knowledge and potentially an instrument of positive and creative change.

Talent Migration in Ancient Times

Brain drain is a distinctive and inextricable part of the human migration process: it connotes the loss of an elite; it means talent migration. Lord Hailsham may have been the first contemporary person to bring prominence to the term when he used it some years ago in a statement to the House of Lords complaining about the drain of British brains to the United States. But its origins are rooted in antiquity, specifically around 150 A.D. when Atheneus, an ancient Greek writer, wrote of "the drain of Greek brains to Alexandria." [57]

[57] S[illegible]n Dedijer, "Early Migration," *In* Adams, *The Brain Drain*, p. 16.

The brain drain process, as distinct from the term, predates Atheneus' reference by several centuries. However, only the most indirect kind of historical evidence exists on the migration of scientists until the birth of Ionian science soon after 600 B.C. To be sure, science had developed in the ancient civilizations of Sumeria, Babylonia, and Egypt. But with the exception of the Egyptian Imhothep (c. 2500 B.C.) there are no recorded names of scientists. According to the practice of the time, scientists and scholars did not sign their tablets or papyri, nor did they reference the previous work of their colleagues. Furthermore, nothing is known of their scientific institutions, that is, their organizational structure, staffing, and support. Thus, the migration of scientists during these earlier civilizations cannot be substantiated by historical evidence.[58]

AMONG THE ANCIENT GREEKS

The mobility of scientists and other men of learning in classical Greece is recorded in written history. Plato, for example, had traveled extensively in Greece, Italy, and Egypt before settling down to open his Academy in Athens. A systematic analysis of selected samples of 60 foremost Greek scientists has shown that despite the difficulty of travel 45 of them migrated or were said to have migrated as students, teachers, scholars, and researchers.

Athens was the "pull" factor attracting scholars in the ancient world until about 300 B.C. Plato had established his academy in 388 B.C., and Aristotle the Lyceum in 335 B.C.[59] Both institutions, comparable in purpose and functions with the modern-day university and research institute, became the most eminent seats of learning in ancient Greece. A measure of the impact of Plato and his academy is seen by the fact that all of the most important mathematical works of the 4th century were done by professional colleagues or students of Plato. Moreover, Aristotle, along with Plato one of the world's greatest thinkers, was one of his students at the academy.[60]

GREEK PHYSICIANS, A SPECIAL CASE

A special case of mobility and talent migration in ancient Greece is that of the physicians. Most doctors were itinerant physicians who moved about the Greek world dispensing their professional skills much like any traveling American businessman of today. Larger communities were anxious to have a permanent resident physician of their own. In order to attract a doctor they particularly wanted, the community authorities created their own "pull" factor in a manner, at least in principle, similar to the bidding of American industry for the services of foreign scientists and technicians or the search of American hospitals for the services of foreign medical graduates (FMGs). They would offer the itinerant doctor an appointment as municipal physician; he would be paid an annual salary which was raised through a special tax; in addition to salary he was allowed to accept fees from patients of financial means. That the practice was commonplace rather

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[58] Ibid., pp. 12–13.
[59] Ibid., pp. 13–14.
[60] George Sarton, *Introduction to the History of Science*. Published for the Carnegie Institution of Washington. (Baltimore: Williams & Wilkins, 1927), chapters V and VI.

than exceptional is shown by the historical evidence that Democedes of Croton was the municipal doctor in Aegina and by the scholarly judgment of Dr. Henry E. Sigerist, an historian of medicine, that no doubt most of the larger Greek cities had their publicly appointed doctors from the sixth century B.C.[61]

From the fourth century B.C., Greek physicians began to immigrate into Rome. Most were adventurers, and at first were strongly resented by Romans. In Rome, the first physicians were slaves and the level of medical knowledge very primitive. The superior ability of the Greeks was soon recognized. As the special needs of the empire mounted, resentment softened and "pull" factors were created to increase the inflow of Greek doctors. Rome's frequent wars created an increasing demand for many army surgeons. Accordingly, the policy towards foreign physicians was moderated and eventually changed entirely. Special inducements were granted to attract as many Greek physicians as possible. In 46 B.C., Julius Caesar extended the highly valued right of Roman citizenship to all free-born Greek physicians residing on Roman territory. Doctors were free from taxation, spared the obligations of military service and public office, and were not required to accept lodgers. In brief, the Romans created powerful incentives to stimulate the immigration of doctors from Greece.[62]

ALEXANDRIA OF THE PTOLEMIES

Around 300 B.C., the center of learning and scholarship shifted from Athens to Alexandria. This transfer came about as the result of conscious government policy. Aware of the practical as well as the esthetic value of learning, the first king of the Ptolemaic dynasty and his successors determined to establish Hellenic culture in Egypt to surpass Athens itself. This policy was to be maintained by successive rulers for hundreds of years.[63]

As the location of this new center of learning the Ptolemies picked Alexandria, then a newly built city on the site of an Egyptian fishing village. Using the resources of the state, they set out to make Alexandria the center of science, philosophy, scholarship, and art of the known world. To accomplish this task, they used their great wealth and exerted their powerful influence in transferring from Athens to Alexandria everything that could advance their purposes: books, instruments, organizational and institutional patterns, and above all manpower.[64]

As brain drainers of the ancient world, the Ptolemies seemed to have outdistanced even the Greeks of Athens. Manpower problems for the new center were solved in the course of time by importing hundreds of scholars from abroad: philosophers, mathematicians, physicians, botanists, zoologists, astronomers, astrologers, philologists, historians of literature, geographers, artists, and poets. And these "in-house scholars" were supplemented by a constant stream of visiting scientists

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[61] Henry E. Sigerist, M.D. *A History of Medicine.* (New York: Oxford University Press, 1961), v. 2, pp. 306–311.
[62] Felix Martí-Ibanez, M.D., ed. *Henry E. Sigerist on the History of Medicine.* (New York: MD publications, 1960), p. 7.
[63] Dedijer, op. cit., p. 14.
[64] Ibid.

attracted, some historians say, even more by Ptolemaic gold and generosity than by the center's extensive research facilities.

In the beginning Ptolemy I persuaded Demetrios of Phaleron, a Greek statesman and student of Aristotle, and Straton, the physicist, to come to Alexandria. In addition to acting as advisors on government science policy, both held other prestigious posts: Demetrios became the first director of the newly formed library and museum, and Straton became the tutor of Ptolemy II. (Straton later returned to Athens, having been retrieved by the Greeks with an offer to head the Lyceum.)

The research facilities that the Ptolemies built were extraordinary for the time; apparently neither expense nor effort was spared. The museum and library resembled present day government research institutes or university graduate schools. The museum, built within the palace compound, consisted of astronomical observatories with bronze instruments, laboratories and dissecting rooms, botanical and zoological gardens, lecture and seminar rooms, dining halls, dormitories, temples, and library buildings. The entire complex represented an enormous investment in gold and human effort. The library, said to have been started with books Demetrios had brought from Aristotle's library in Athens, grew to an impressive collection of some 500,000 to 700,000 volumes, all classified and catalogued. Besides what has been described as the "congenial and stimulating atmosphere" and excellent research facilities, the Ptolemies underwrote the costs in room and board for their scholars as well as providing generous salaries.

What was produced in Alexandria is a matter of historical record. It is said that most of the best works in science and philosophy from 300 B.C. to 500 A.D., having a bearing on present developments in these fields, could be traced to Alexandria. Among the intellectual products of its institutions are the steam engine (Hero), the hydraulic screw (Archimedes), plane geometry (Euclid), conics (Apollonios), the Copernican theory of the solar system (Aristarchos), and the accurate measurement of the Earth's circumference (Eratosthenes).

But most important for the purposes of this study, as Stevan Dedijer wrote: "All the brains producing them in Alexandria seem to have come from somewhere else." Included among those scholars drained from other lands are eight directors of the library-museum who have been identified in the institution's 800-year history. Very few native Egyptians or even Alexandria-born Greeks are among the names of known scholars and scientists.[65]

Talent Migration in the Middle East and Medieval Europe

Historians of science record instances of government policies designed to attract foreign scientists in states contemporaneous with Alexandria, in late Antiquity, and during the golden age of Islam. King Husraw Anusirwan, a Persian King with pronounced pro-Greek tendencies, systematically gathered scholars, physicians, and scientists to the observatory, medical schools, and lecture halls of the university he had established at Gundi Sapur in East Persia. Constriction of in-

[65] Ibid., pp. 15–16. Xenophon Leon Messinesi makes this judgment on the value of these scholars and the museum: "The facilities offered by the Museum . . . and the inducement of higher emoluments offered by the Ptolemies gradually attracted the greatest scientists so that the Museum soon became the chief repository of knowledge and seat of learning of the ancient world." Xenophon Leon Messinesi, *Meet the Ancient Greeks*, (Caldwell, Idaho: Caxton Printers, 1959), p. 176.

tellectual freedom, historically a prime cause for the migration of scholars, provided a unique recruiting opportunity. A number of scholars emigrated at the King's invitation when in 529 A.D. Justinian, attempting to protect Christianity, forbade the teaching of non-Christian pagan philosophies at the Academy of Athens, closed its doors, and dispersed the staff. Best known among the emigrating scholars and scientists were Damasius and Simplicius.[66]

Science historians have also recorded instances of foreign recruitment by the great Caliphs from the Abbasid dynasty during the eighth and ninth centuries. As in so many cases before and since, the opening of a new center of learning provided the motivation for migration. The Caliphs, along with lesser royalty and other wealthy Arabs, vigorously supported the development of Arab science. In 766 A.D., Caliph Al-Mansur made Baghdad a center of Arab learning, immediately attracting Jewish, Syrian, and Persian scholars with his princely stipends. Mathematicians from Tashkent in Central Asia, astronomers from the Ganges valley in India; philosophers, architects, and physicians from Rome, Athens, and Alexandria were attracted by the offer of high honors and high salaries to work in the new city. Tabit ben Qurra and Al-Battani, two of the greatest Arab astronomers and mathematicians, left their star-worshipping sect of Sabians to join the Arab scholars at Baghdad. Hardly 10 years after the founding of Baghdad, a Hindu presented the Caliph an astronomical treatise entitled "A. Siddhanta" which was immediately translated into Arabic.[67]

IN MEDIEVAL EUROPE

Scattered evidence exists showing that the 8th to 11th century European scholars migrated and governing authorities established policies to attract them. A considerable literature is available to illustrate Charlemagne's interest in science and scholarship, his policies in education, and his efforts to attract scholars to his schools and court. The Benedictine Age, when the center of gravity in learning was shifting from the Arab countries to Southern Europe, is similarly rich in evidences of the mobility of intellectuals. Not until the rise of the great European universities, however, is there an abundance of direct evidence to be found in original state documents, contemporary writings and biographical data showing state policies either to encourage or frustrate talent migration.[68]

The universities were the principal centers for producing and transmitting science and scholarship between the end of the Benedictine Age and the scientific revolution of the 17th century. Newly formed scientific societies carried the major burden thereafter.

European universities flourished during the 12th to the 16th centuries. By mid-13th century there were nine in Italy, five in France, two in England, and four in Spain. By the end of the 15th century there were 80 major universities throughout Europe. Student bodies were drawn from Europe as a whole, and the best universities ranged in

[66] Dedijer, op. cit., p. 17.
[67] Ibid., pp. 17–18, and Eren, op. cit., p. 12.
[68] Dedijer, op. cit., p. 18.

enrollment from 6,000 to 7,000 for Paris and Bologna, 3,000 for Oxford, 1,500 for Prague, and 900 for Vienna. All developed within the framework of a commonly shared intellectual world: a common Latin language and Catholic faith, and a general cultural unity which created a universality that facilitated migration. The universities were truly cosmopolitan; students and scholars crossed political boundaries with no sense that they were compromising national loyalities. During this period preceding the political fragmentation of Europe, loyalties were city or regionally oriented and not directed towards a national state.[69]

In general, the migration of scholars and students during the Middle Ages was commonplace. At the Universities of Bologna and Paris, for example, foreigners seemed to constitute the majority of the student body. There were, however, extreme cases of migrations when whole or parts of university faculties with students would move from one city or region to another. The University of Bologna was the center of many conflicts with city authorities. Faculty and students, sometimes at the invitation of competing cities, departed to set up another university elsewhere. The universities of Arezzo (1215), Padua (1222), Vercelli (1228), Siena (1246), Pisa (1343), and Florence (1349) were founded as a result of migration or secession of the whole or parts of the faculty of the University of Bologna. All told, Bologna experienced 15 such migrations.[70]

Other great European universities such as Cambridge and Leipzig were founded under similar conditions of disaffection by faculty and students from the parent university.

Authorities in one city often negotiated directly with discontented faculty and students, offering alluring emoluments in order to effect a transfer. In 1321, the dissatisfied faculty at Bologna was the target for the appeals of authorities in all surrounding cities. Florence lost in its bidding to Siena.

Kingdoms made open invitations to discontented faculties. At the time of the "Great Dispersion" of the University of Paris in 1229, King Henry III of England published a letter inviting masters and scholars of the university "to transfer yourselves to our kingdom of England and to abide there for the sake of study." He pledged to assign them to "whatever boroughs and villages you choose and we will provide for your liberty and tranquillity in every convenient way pleasing to God and satisfactory to you." [71]

Authorities took punitive actions to prevent the migration of scholars and students. Laws were promulgated and decrees proclaimed barring migration, even in some cases under pain of death. Bologna authorities resorted to such drastic measures but none of the statutes proved effective.[72]

Causes for talent migration in the Middle Ages are similar in many respects to those causing brain drain today. Probably they can be summed up as follows: Offers of more money, better working conditions, greater intellectual freedom, and, in some cases, relief from restrictions by governing authorities; absence of barriers to mobility;

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[69] Ibid., pp. 19–21.
[70] Ibid., p. 23.
[71] Ibid., p. 25.
[72] Ibid., p. 23.

appeals of prestige and academic excellence: international character of science and scholarship; shared values among scholars and students.

Factors Producing Mobility in the Modern Age

The leap of Western man from the Medieval to the Modern Age was made possible by the impact of three major historical developments, namely, the Age of Discovery, the scientific revolution and rise of modern technology, and the Industrial Revolution.[73] All three developments, occurring more or less simultaneously and interacting in concert with one another, contributed to quickening the mobility of modern man.

AGE OF DISCOVERY

The Age of Discovery opened up the world to Western man. No longer were the horizons of his thought and activity confined to the narrow limits of the Mediterranean basin or the West European peninsula. Asia, Africa, the Americas, and Oceania now became new fields for absorbing his energies; and as discoverers, colonizers, or permanent emigrants, migrating Europeans covered the earth.

By the early 20th century the idea of Europe became globalized as the impress of European culture and civilization was made on virtually every corner of the earth and as imperial and colonial connections were established with Europe as the metropolitan center. A relationship had been created during the Age of Discovery that was to last for the next 500 years. As a result, Europe achieved a position of wealth, power, influence, progress, and preeminence heretofore unknown to man.

Thus, from the Age of Discovery came a new mobility for modern man. Unlike Aristotle, whose ancient world was bounded by the limits of the Greek city-state, and Abelard, who functioned within the narrow limits of Medieval Western Europe, the scientist and scholar of the Modern Age has had the world for his stage.

REVOLUTION IN SCIENCE AND TECHNOLOGY

The revolution in science and technology was another force contributing to the mobility of modern man. Expansion of scientific knowledge created a new world of learning. It expanded the horizons of his thought, opened up new areas of inquiry for his intellectual energies, and provided him new opportunities in the search for knowledge. As the study of science progressed, the parochialism of the medieval scholastic tradition gave way to a new universalism that fostered among scientists both a new spirit of freedom of inquiry and a spirit of internationalism. Taught by their profession to think in cosmic dimensions, scientists seemed better able to view the pursuit and accumulation of knowledge as a task of all men in all lands without the restraining influence of nationalism or national boundaries. Tycho Brahe, the Danish astronomer, well expressed these sentiments in 1597 when he said of the independence and universal outlook of the scien-

[73] See *The Evolution of International Technology*, an earlier study in the present series by Dr. Franklin P. Huddle, for an overview of this subject. (U.S. Congress, House, Committee on Foreign Affairs, *The Evolution of International Technology*, in the series, Science, Technology, and American Diplomacy, prepared for the Subcommittee on National Security Policy and Scientific Developments, by Dr. Franklin P. Huddle, Senior Specialist in Science and Technology, Science Policy Division, Congressional Research Service, Library of Congress, 1970, 70 pp. (See vol. II, pp. 607–680.)

tist: "And when statesmen or others worry him too much, then he should leave with his possessions. . . . With a firm and steadfast mind one should hold under all conditions that everywhere the earth is below and the sky above, and to the energetic man, every region is his fatherland."[74] As it will be seen in the course of this study, this cast of mind values the primacy of science and in its unique way has facilitated the mobility of scientists in the Modern Age.

Human mobility has been quickened by the practical achievements of modern technology. Science and technology have revolutionized communications and transportation. In the 19th century, Europeans immigrating to America could cross the Atlantic by ship in 1 to 2 weeks and at what was to them great expense. Time and costs of travel have now been reduced drastically. Once a privilege reserved for the wealthy, intercontinental travel in the Jet Age is within reach of most levels of society—European tours by high school seniors are now a commonplace; and what had once taken 1 to 2 weeks can be accomplished in a matter of hours. Distance and cost are thus no barriers to the Filipino doctor or Latin American engineer who may want to try his luck in America.

INDUSTRIAL REVOLUTION

The Industrial Revolution was more than a technological revolution; it was also a social revolution that contributed considerably to human mobility in the modern era. The Industrial Revolution produced, perhaps, the greatest "pull" factor of all for immigration by creating a labor market. It is axiomatic that agrarian societies tend to be static; industrial societies, dynamic. The catalyst for social change in the latter comes largely from the need for labor and the desire of restless masses of people to satisfy this need. Movement from farm to city, from south to north, has become a traditional pattern of human migration. Attracted by the "pull" of developing industry, millions of Europeans came to America in the 19th century. Similarly attracted by the "pull" of American aerospace industries, thousands of latter-day Europeans, scientists and technicians, made the same journey in the 1960's.

Immigration Into the United States

Historically, Colonial America, later the United States, combined the three developments of the Modern Age that accelerated human mobility: It was a most valued colonial possession in the Age of Discovery; it succeeded in establishing a civilization based essentially on science and technology during the "Age of Reason;" and it now epitomizes the Industrial Revolution at its most advanced stage. Human mobility is, therefore, at the roots of the American experience, and perhaps nowhere has its value been more persuasively expressed than by Alexander Hamilton, the ardent advocate of an industrial and mercantile America.

Adam Smith once observed that human baggage is the most immobile of all. Something must act upon that "baggage" to make it move. It has been held by many observers that migration is catalyzed by two forces moving in one direction, namely, an extraordinary "pull" from abroad or "push" from at home. The cause of mobility

[74] Quoted in, Margulies and Bloch, op. cit., p. 59.

lies in some structural maladjustment that creates an imbalance in equilibrium in the countries of emigration or immigration or both.[75]

HAMILTON AND THE AMERICAN IMMIGRATION TRADITION

Alexander Hamilton understood the interaction of these forces; and he understood particularly the "pull" factors existing in the newly independent United States, unencumbered by the restricting influences of the European guild system for attracting much-needed European labor. Accordingly, in his "Report on Manufactures," Hamilton made a strong case for officially promoting the immigration of professionals and skilled craftsmen from Europe. Acknowledging the innate conservatism of man, Hamilton echoed Adam Smith's theme on man's inclination toward immobility when he wrote: "Men reluctantly quit one course of occupation and livelihood for another, unless invited to it by very apparent and proximate advantages." Hamilton believed that America offered such "powerful inducements" in economic gain, political equality, and religious freedom that "manufacturers . . . would probably flock from Europe to the United States to pursue their own trades or professions, if they were once made sensible of the advantages they would enjoy, and were inspired with an assurance of encouragement and employment. . . ." This was the "natural inference" that Hamilton drew from an historical experience that encouraged emigration of "a large proportion of ingenious and valuable workmen, in different arts and trades, who, by expatriating from Europe, [had] improved their own condition, and added to the industry and wealth of the United States." [76]

In 1791, Hamilton was reaffirming in principle what had been a reality for almost 2 centuries. Since the 17th century, North America had been attracting some of Europe's most energetic and talented people—scholars, professionals, artisans, and farmers; the trans-Atlantic talent migration continues to this day. Immigration is a deep-rooted American tradition in a nation of immigrants. In one sense only time separates the Pilgrim Fathers from the most recent refugees from Cuba: Essentially, both shared common goals and purposes, hopes and expectations, failures and successes.

From the beginning the principle of immigration has been accepted by Americans as virtually a natural right of man, despite the periodic rise of popular anti-immigrant feeling in the Nation's history. This ideological conviction, combined with the desire for political and religious freedom and expectations of greater economic, cultural, and social prospects, created what Dr. Luis Giorgi, President of the Pan-American Federation of Engineering Societies, has termed a "permanent draw" of people from less advantaged societies.[77]

Dr. Frankel put the brain drain in the same perspective, describing it historically as a universal phenomenon, a movement from poor to

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[75] Walter Adams and Joel B. Dirlam, "An Agenda for Action," *In* Adams, *The Brain Drain*, p. 247.

[76] Jacob E. Cooke, ed., *The Reports of Alexander Hamilton: Report on Manufactures, Dec 5, 1791* (New York: Harper & Row, 1964), pp. 131–132, 143.

[77] Luis Giorgi, *Extent, Nature and Causes of the Loss of Scientists and Engineers in Latin America Through Migration to More Advanced Countries,* In, UNESCO. Final Report of the Conference on the Application of Science and Technology to the Development of Latin America, Santiago, Chile, Sept. 13–22, 1965, p. 174. (Document 2.2.9) (Guide lines for the Application of Science and Technology to Latin American Development.)

rich countries, from south to north, from traditional to industrial societies. Advanced industrial societies like those in Europe and the United States, he said, have recruited manpower to perform what he termed "the dirty work of society." Through the workings of the social process, particularly through education, the descendants of these immigrants in America "have regularly come to advance themselves." That was the background of most Americans, including his own: "the products of people—brainy people, obviously—who have been drained away from poorer sections of the world." "If there had been no brain drain in the past," Dr. Frankel declared, "we wouldn't be here, and the country wouldn't be what it is today. So it is not in this sense a new problem." [78]

TRENDS IN 19TH AND EARLY 20TH CENTURY AMERICAN IMMIGRATION

Perhaps Emma Lazarus' inscription on the Statue of Liberty describes as well as any historical source the general character of American immigration prior to the 1920's: "Give me your tired, your poor, your huddled masses . . . the wretched refuse of your teeming shore . . . the homeless, tempest-tost. . . ." For the immigrants of this period were by and large the economically poor, the socially outcast, and the politically deprived of Europe. And, they were overwhelmingly unskilled, that is, unskilled laborers as distinct from those who in recent decades would qualify as professional and technical workers.[79] As late as 1907–23, only 2.6 percent of 6,905,000 immigrants to the United States were in professional categories, an average of

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[78] *Proceedings of Workshop on the Talents and Skills* (October 1966), p. 78. Dr. Frankel's correlation of immigration with America's greatness reflected thoughts expressed by another New Yorker of a much earlier time, William Henry Seward. As a New York State Senator, a two-term Governor of New York, a U.S. Senator from New York for a decade, and Secretary of State during the Lincoln-Johnson Administrations, Seward observed four decades of American growth and well understood the role of immigration in that growth. Immigration was a basic ingredient in his philosophy of American expansionism: it provided free labor to contain the expanding slavocracy of the South and to build what he termed the "American empire." To Seward, immigration was "an important and rapidly-increasing element of national strength and greatness." He encouraged immigration as farsighted and humane, and "liberal naturalization" as "an element of empire." One of the greatest sources of "unappropriated wealth" to the Nation, he said, was the restless stream of immigrants, the "builders of nations," who were to provide the free labor for the developing American economy. According to Seward, "labor is constantly in demand" and the "incalculable surplus labor of the European states," together with European investment capital, brought wealth to the Nation and thus constitute "an element of national greatness." To develop this potential for empire to the fullest, he declared, "requires that we welcome immigrants among ourselves, or speed them on their way to a western destination." In Seward's social philosophy immigration, imperial greatness, civilization, and progress were inter-related. To him, immigration and expansion were "the main and inseparable elements of civilization on the American continent" and "all attempts will fail to suppress or stifle either of these invigorating forces." These were not idle philosophical speculations; Seward as Secretary of State pressed vigorously for the conclusion of naturalization treaties with the various European states during the post-Civil War period, and remarked in an instruction to the American Minister at Paris, then negotiating with the French for such a treaty, what was the core of his philosophy of immigration: "Freedom of emigration and of naturalization is one of the greatest elements of modern progress and civilization." (Joseph G. Whelan, *William Henry Seward, Expansionist* (Rochester, N.Y.: University of Rochester, 1959), pp. 24–27. Unpublished doctoral dissertation.)

[79] Dr. Franklin P. Huddle, the Director of this research series on science and diplomacy, expressed views on the matter of "unskilled" immigrants that deserve special attention. He wrote: "I think a distinction is needed here. The 19th Century immigrants were not so much unskilled as possessed of non-relevant skills. Granted they were not persons of letters. But the peasant skills in European agriculture were inappropriate to American ecology and abundance of land, as well as the emphasis on capital-intensive rather than labor-intensive agriculture. Similarly, European industry emphasized labor-intensive practices. Immigrants skilled in iron founding, shoe-making, and clothing manufacture according to European practice had to learn new kinds of skill here, in these same trades. Some immigrants, to be sure, may have been marginal labor. But the initiative required to emigrate provided a kind of test of superiority, especially when coupled with the push factor of a highly rigid socio-economic hierarchy precluding upward mobility in their homeland, against which the more dynamic members were likely to rebel."

10,560 per year, whereas 51 percent were industrial and agricultural laborers.[80] Characteristic of many of the immigrants in the 1890's among the unskilled was that of a young Irish boy who at 14 earned his passage (£5) by tarring an English Lord's deer park in County Kildare and upon landing at Castle Garden, N.Y., then the principal port of entry for European immigrants, headed for Coudersport, Pa., where he began life in America as a child laborer in a tannery.[81]

Unskilled workers were the norm of immigration during the 19th and early 20th centuries; not until after World War II, when the manpower needs of the Nation shifted, were restrictions placed on the unskilled and encouragement given to selected professionals in the professional, technical, and kindred (PTK) category.[82] And, not until then did the brain drain problem emerge as an international issue.

REVERSE TALENT MIGRATION

A feature of human mobility in the American experience later to be repeated elsewhere is scattered evidence of a reverse talent migration. Like the Saudi Arabian or African student of the 1960's, their counterparts from a rough-hewed, developing America were often tempted by the allure of a superior European cultural environment. Other Americans left for political reasons.

In its early history the Massachusetts Bay Colony experienced a severe loss of its Harvard graduates. Eleven of the first 20 alumni immigrated to England and remained there permanently.[83]

Perhaps the most drastic loss of a leadership elite occurred during the American Revolution when American Loyalists were dispossessed of their property and fled with their sympathies to British Canada or Mother England. It has been impossible to determine how many departed, but the number has been estimated as high as 100,000. That this represented a substantial brain drain was indicated by the colonial historians Barck and Lefler who observed that their departure deprived the United States of a "goodly percentage" of the wealthy and cultured classes.[84]

Students are particularly vulnerable to brain drain, as this study will later demonstrate, and American students of the past have not been immune to the temptation of benefits of living in a more advanced society. Dr. A. B. Zahlan, a physicist at the American University of Beirut in Lebanon, has been working on a study of students from the United States who went to Europe for their education between 1800 and 1900. The study remains in the primary stage, but Dr. Zahlan has accumulated sufficient evidence to conclude that "a significant fraction of these American students never returned home, but remained in Europe." From this past American and the current Arab experience, Dr. Zahlan generalized: "There is a perennial risk that anybody who

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[80] Henderson, op. cit., p. 2, and Brinley Thomas, "'Modern' Migration," *In* Adams, *The Brain Drain*, chapter 3 and p. 33.

[81] MS diary of Richard J. Whelan, October 1890.

[82] Ibid., pp. 29–33, and Henderson, op. cit., pp. 2–3.

[83] Thomas D. Dublin, "The Migration of Physicians to the United States," *The New England Journal of Medicine* (Apr. 20, 1972), p. 875.

[84] Oscar T. Barck, Jr., and Hugh Talmadge Lefler, *Colonial America* (New York: Macmillan, 1968), p. 651.

leaves his country to study in a more advanced community will never return to his country, and there is nothing we can do about it." [85]

Lessons of History

Migration is a natural phenomenon, and human history, as Dr. Adams wrote, "is inseparably bound up with migrations great and small." [86] And why it has been so was well described in a *London Journal* of 1722 in these few simple words: "Men will naturally fly from danger to security, from poverty to plenty, and from a life of misery to a life of felicity. . . ." [87]

Scientists and scholars are a mobile people, particularly in the Modern Age, and one of the salient features of migrations as an historical phenomenon is the frequency with which exceptional people, elites in any society, possessed of above average talents, strength and courage, suffering sometimes no more discontent than the stay-at-homes, had, in Dr. Adams' words, "the heart to brave new worlds." "From earliest times," he observed, "those with get-up-and-go got up and went." In a still more sprightly colloquial vein, nonetheless to the point, Robert C. Cook, a long-time student of demography, gave this succinct explanation of the historical process of migrating intellectuals: "Lots of bright people come from Ozark Junction—and the brighter they are the faster they come." [88]

HUMAN MOBILITY AND THE PRINCIPLE OF FREEDOM

Linkage between human mobility and the principle of freedom is another aspect of migration revealed in history that has particular relevance to the problems of migration today. Freedom of movement for the individual, whether it be a foreign student entering Plato's Academy, a dispossessed French scholar responding to King Henry's invitation to teach in England, or a skilled European craftsman immigrating to America in response to Hamilton's urgings, is the act of exercising one of the first principles of democracy, namely, the right of self-determination.

In explaining policy solutions to the contemporary brain drain problem, Under Secretary of State Eugene V. Rostow clearly linked mobility of scholars with the principle of freedom. Citing the historic example of Erasmus in the 16th century and that of Einstein, Fermi, and Whitehead in the 20th, all of whom chose to teach in other lands, and noting the 300-year-old tradition of Americans studying abroad and foreign students studying here, Dr. Rostow stated categorically, "these movements of students and scholars are an indispensable aspect of freedom." In one sense, he said, "the universities of the world constitute a single community, helping to bind the human family together." Arguing against solutions for brain drain that would "repudiate our own history," he urged that policies should be avoided that "would weaken that tradition, the yeast of the bread of liberty." [89]

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[85] Nader and Zahlan, op. cit., p. 490.
[86] Adams, "Talent That Won't Stay Put," p. 59.
[87] Ibid.
[88] Robert C. Cook, "The 'Brain Drain': Fact or Fiction?" *Population Bulletin*, v. 25 (June 1969), p. 1.
[89] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1967, p. 4.

STATE POLICIES ON MIGRATION OF SCHOLARS

Finally, history reveals that states have adopted policies in the past either to stimulate or prevent the migration of scholars. The social value that states placed on science is the index for determining the intensity with which such policies were applied.[90]

Science policy is not, therefore, a 20th century development. Nor is the relationship among science, diplomacy, and political power something new. During Islam's Golden Age the Caliphs clearly perceived this relationship when they established their empire, as most assuredly did Hamilton when he sketched out a design for American industrial strength as a vital component of its power and security.[91]

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[90] Dedijer, op. cit., p. 28.

[91] Hamilton wrote: "Not only the wealth, but the independence and security of a Country, appear to be materially connected with the prosperity of manufactures. Every nation, with a view to those great objects, ought to endeavour to possess within itself all the essentials of national supply. These comprise the means of *Subsistence, habitation, clothing,* and *defence.*" And he added: "The possession of these is necessary to the perfection of the body politic; to the safety as well as to the welfare of the society; the want of either is the want of an important Organ of political life and Motion; and in the various crises which await a state it must severely feel the effects of any such deficiency. The extreme embarrassments of the United States during the late War, from an incapacity of supplying themselves, are still matter of keen recollection: A future war might be expected again to exemplify the mischiefs and dangers of a situation to which that incapacity is still in too great a degree applicable, unless changed by timely and vigorous exertion. To effect this change, as fast as shall be prudent, merits all the attention and all the Zeal of our Public Councils; 'tis the next great work to be accomplished." (Cooke, *Hamilton's Report on Manufactures,* pp. 161–162.) Among the expedients he proposed to effect this grand design were the attracting of skilled labor and capital from Europe.

III. Brain Drain as a Contemporary International Problem

Brain drain, as a contemporary international problem, has its roots in the profound changes in the political structure of international relations that have been brought about as a consequence of World War II. These changes were to have a direct bearing on patterns of migration in the postwar era.

Trends in Migration Since World War II: A Changing World Environment

The distribution of world power shifted from the main actors in world affairs during the 1930's to those who had previously played only limited roles. Destruction of the wartime Axis Powers, combined with the voluntary and involuntary liquidation of the British, French, Dutch, and later Belgian imperial systems, created vast power vacuums in the world. New states and new constellations of power emerged to fill these power vacuums, radically changing the alignment of world forces. A new era of bipolarity and global confrontation between the Soviet Union and the United States was also an era in which through the processes of decolonization the LDCs in Asia and Africa were for the first time to play a prominent role in contemporary world affairs.

FORCED MIGRATIONS

Human mobility was a marked characteristic of this new era, but unfortunately much of this mobility was in the form of forced migrations. Programs of repatriation or settlement of those dislocated by World War II, and population transfers resulting from the creation of newly independent states or the outbreak of wars, involved millions of people. Migrations on this vast scale tended to overshadow the normal free movement of peoples. The turbulence of the era is seen in the statistics. After World War II, 18,000,000 people were uprooted by the partition of India and Pakistan; West Germany accepted 12,000,000 refugees dislocated during the war; Japan resettled 6,300,000; South Korea absorbed 4,000,000 and Hong Kong 1,300,000. In Israel, 1,000,000 Jews found refuge in a new homeland, while more than 1,000,000 Palestinian Arabs fled the country. Ultimately, the International Refugee Organization and Intergovernmental Committee for European Migration settled 1,300,000 refugees overseas. These statistics do not include the movement of people in the Soviet and Chinese areas, but even this limited survey produces a total of 45,000,000 forced emigrants. Thus in one decade the number of people compelled to move across frontiers was equal to the entire movement of free emigrants across the Atlantic in the century ending in 1913.[92]

[92] Encyclopaedia Britannica, 1973, v. 15, p. 422.

TENDENCY TOWARD A NEW INTERNATIONALISM AND ITS EFFECTS

Forced migrations, though a dominant and often dramatic development in the early postwar era, were followed by acceleratinog flows of free emigrants, smaller in number and different in kind. This new migration was responsive to an evolving tendency in the world toward a new internationalism.

In the political sphere, what has been called the "globalization" of politics proceeded as the Cold War expanded in dimension and as the United Nations gave organizational structure to world politics, contributing to this new feeling of internationalism. As never before, peoples began to think and act more consciously within a global context rather than strictly within one defined by narrowly circumscribed national borders. In some respects this newly acquired habit tended to facilitate the migration of free peoples.

In the economic sphere, the trend toward closer integration of the world economy fortified this tendency toward a new internationalism, which in turn had an effect on emigration. Proceeding rapidly since World War II, the integration of the world economy is now more evident in such developments as the reduction of barriers to international trade, increasing integration of national capital markets of the advanced countries into a world capital market, the growth of direct foreign investment in modern technology from country to country, the modernization of traditional class- and status-oriented societies into less personal, more mobile and flexible modes of interpersonal relationships conducive to economic efficiency. As a result, the market for educated professional people, like that for commodities, has become increasingly international rather than a national, with corresponding economic pressures toward the equalization of prices for professional work throughout the international economy.[93] In this way the economic aspects of the new internationalism helped create prime conditions for brain drain.

Contributing to the integration of the world economy which produced this special effect on emigration are two main forces in the modern world of today: the worldwide spread of the Industrial Revolution, and the movement of advanced Western societies into the post-industrial era. Both forces have created special needs, particularly a need for talent. Affecting this need have been such phenomena in the postwar era as:

—The great upsurge in world education, augmenting substantially the talent market;

—The movement, internally as well as externally, towards urban and metropolitan centers which industrialization has fed (in 1961–62, 80 percent of the world's researchers were concentrated in five countries: the United States, Soviet Union, Britain, Germany and France); [94]

—Far-reaching improvements in transportation and communications, facilitating mobility and making information on job opportunities readily available;

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[93] Johnson, op. cit., pp. 89–90.

[94] Charles Iffland and Henri Rieben, "The Multilateral Aspects: The U.S., Europe, and the 'Poorer' Nations," *In* Adams, *The Brain Drain*, chapter 4, p. 50.

—The standardization of professional training, easing lateral movement across national boundaries; and

—Official encouragement of preference provisions, work permits, and other provisions in state-regulated immigration laws designed to attract talent from this new world market.

With such phenomena in mind, Dr. Adams observed, "today, as never before, there is a 'common market' for brainpower which transcends national boundaries." [95] This "common market" of manpower is the seminal source for brain drain.

PROCESS OF DECOLONIZATION

Decolonization, a second major trend in the postwar world, has had a fundamental impact upon emigration during this period. Inadvertently, this process has had perhaps the most serious consequences for the brain drain problem.

Decolonization, spurred on by movements for national independence, formally broke the imperial link connecting the Afro-Asian colonial territories with the metropolitan states of Europe. The full dimension of this process can be seen by the statistical fact that during the 20 years from 1944 to early 1964, 52 nations of the world, almost entirely from the Afro-Asian area, established their independence. Numbering 1,005,931,000 people and occupying 11,537,599 square miles of territory, these nations constituted 31.63 percent of the world's population (at mid-1963) and 21.19 percent of the total area of the world, excluding Antarctica.[96] In a very real sense the emerging Afro-Asian nations constituted a "third world."

EFFECTS OF DECOLONIZATION AND BRAIN DRAIN

The brain drain problem, at least its most serious manifestations, has its roots largely in the emigration of professionals from the former colonial areas of Asia and Africa: here is where the majority of LDCs are located, and it is emigration from the LDCs that creates the most serious concern for brain drain.[97]

Independence proved to be only a formal act, because in practice the former colonial areas continued to maintain ties in varying degrees of closeness with the former imperial centers. In fact, a fairly well demarcated pattern of emigration has taken shape from the former colonial areas to the imperial centers. By virtue of the former colonial-imperial link the emigrant moves into what he believes to be familiar circles. This familiarity eases the burden of transition between two essentially different cultures. The imperial tradition may also engender a belief that by migrating to the imperial center, the former colonial is moving up into a superior and more exciting culture.[98] The attraction is often so alluring that the former colonial remains, to the loss of his developing native country.

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[95] Ibid., p. 3.

[96] U.S. Congress, Senate, Committee on Aeronautical and Space Sciences, Soviet Space Programs, 1962–65: Goals and Purposes, Achievements, Plans, and International Implications, 89th Cong., 2d sess., 1966, p. 21. (Committee print)

[97] Don Patinkin, "A 'Nationalist' Model," *In* Adams, *The Brain Drain*, pp. 92–93.

[98] Johnson, op. cit., p. 71.

This particular form of brain drain arises from apparent contradictions in policies among the former imperial powers. Through programs of foreign aid, they want to assist their former wards into modernity, but such efforts are often offset by the movement of "human capital" in the opposite direction. Concern for this problem has increased with a growing awareness that development cannot be effectively stimulated simply by the flow of money to the LDCs and that an equally vital role must be played by local people with skills and expertise to carry out development programs.[99] The United States becomes involved in this problem in that former colonials immigrate to the United States through the former imperial centers in Europe; they come directly from their native country; and the United States has been a long-time advocate and practitioner of foreign aid as a means of development. Thus, within the LDCs, brain drain and development conjoin and interact in what can be self-defeating ways.

What makes this matter particularly important for international relations today is that the LDCs constitute a vast configuration of political power; they have a voice; and they make known their complaints. No longer are they willing to remain silent while their interests are being ignored. As Prof. Don Patinkin of Jerusalem's Hebrew University has said: "They complain—and the international situation is such that their complaints are of concern to the major powers." [100]

REORDERING OF PRIORITIES IN IMMIGRATION: QUALITY OVER QUANTITY

A third component affecting general postwar trends in migrations is the reordering of priorities in immigration by establishing the criterion of quality over quantity for admission.

In the 19th century and through the early 1920's, international migration was relatively unrestricted. Scholars migrated largely as individuals; the movement was not then, as now, a continual flow. As noted in the preceding chapter, unskilled persons for the most part comprised this early migration, and generally the process was beneficial for both the sending and receiving countries. In the last half century, particularly during the last two decades, migration has been more rapid and widespread than in previous times. But the explosion in world population, the development of nationalism and ethnic consciousness in a number of countries and the impact of expanding world economies created a tendency to restrict migration with the result that the process has become more selective regarding levels of education and training of the immigrant. As a report of the U.N. Secretary General said on the outflow of trained personnel from the LDCs, "there is a universal preference for the highly trained, the elite immigrant. . . .[101]

In contrast with the early period of virtually open and unrestricted immigration, most receiving nations, like the United States (1952 and 1965), United Kingdom (1962 and 1965), Canada (1967), and Australia (1958 and 1966), have introduced laws or regulations establish-

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[99] Patinkin, op. cit., p. 93.

[100] Ibid.

[101] United Nations, General Assembly, *Outflow of Trained Personnel from Developing Countries*, Report of the Secretary General, New York, 1968, p. 7. (United Nations Document: A/7294, Nov. 5, 1968, 23d sess. General Assembly).

ing quality as the criterion. Preference in all categories is given to professionals and skilled craftsmen. The United States, Canada, and Australia have also relaxed restrictions on the immigration of non-Europeans who fall into the newly defined preferential categories.[102]

EFFECTS OF REORDERING IMMIGRATION PRIORITIES

As will be seen later on in the study, the effects of this reordering of immigration priorities have been far-reaching, particularly with respect to the brain drain problem as it has affected many LDCs. First of all, the elitist criteria of quality and selectivity invited emigration of the professionals, the intellectuals, and the skilled. "It is no longer the call to 'Give me your tired, your poor, your huddled masses,' " said Dr. James A. Perkins, President of Cornell University. "Now we ask for your alert, your privileged, your brainy, your talented. Our machines can do the menial work. Today the emphasis is on technical skill, sophisticated training and adaptability to modern society." [103]

These new criteria, along with the lowering of racial restrictions in the advanced countries, provided a special appeal to the LDCs. Paradoxically, attempts to right an injustice of discriminatory quota systems created a new and unintended problem: a powerful incentive was now given to the professionals in the LDCs to emigrate and thus deprive their developing countries of much needed professional manpower. A survey of professional emigration from Iran, Pakistan, and Turkey showed that 50 percent of all their scientists trained abroad did not return home. Another showed that Argentina lost 5,000 engineers through emigration in recent years.[104] And 58 percent of those emigrating from the United Arab Republic (U.A.R.) were scientists; 70 percent held Ph. D. degrees.[105]

Nonreturning students create the most serious professional manpower leakage. According to a United Nations manpower report, the number of foreign students studying in advanced countries has shown a "steep annual increase." In 1967, it said, 100,262 foreign students were enrolled in American institutions of higher learning; an estimated 70 percent were from the LDCs.[106] According to estimates by Prof. Robert Myers of the University of Chicago, described by Dr. John C. Shearer, Director, Manpower Research and Training Center at Oklahoma State University, as the "best overall measures of the foreign student brain drain," the overall nonreturn rate is between 15 and 25 percent rather than the semiofficial 8 to 10 percent frequently quoted.[107] Leakage among nonreturning doctoral students has ranged from a high of 90 percent for Taiwan to a low of 14 percent for Pakistan.[108]

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[102] Ibid., p. 9. Also, Brinley Thomas, "Modern Migration," *In* Adams, *The Brain Drain*, chapter 3, p. 29.
[103] Perkins, op. cit., p. 617.
[104] Eugene B. Skolnikoff, *Science, Technology, and American Foreign Policy* (Cambridge, Mass.: M.I.T. Press, 1967), p. 92.
[105] Said, op. cit., p. 6.
[106] Report of U.N. Secretary General, *Outflow of Trained Personnel from the LDCs*, Nov. 5, 1968, p. 30.
[107] Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 17.
[108] Ibid.

A second effect of the shifting immigration criteria was to generate competition among the advanced countries for professional and skilled manpower. Expansion of industry, particularly in the developed countries, created a particular need for professional manpower. Accordingly, the professional has become a new commodity sought competitively in the world market. With the demand increasing considerably and the supply often lagging behind, especially in the medical, engineering, and scientific professions, there was created, in the words of the U.N. brain drain study, "keen international competition" in these fields.[109] Secretary of State Dean Rusk expressed the American view this way: "We are in the international market of brains"; while Canada's Jean Marchand, Minister of Manpower and Immigration, explained his country's view: "The high cost of training professional and skilled people—engineers, doctors, skilled technicians, etc.—is a measure of the benefit derived upon [their] arrival in Canada. . . . Other countries are in competition with us for immigrants." [110]

Finally, the change in criteria has had the effect of inducing mobility among the professionals and immobility among the unskilled of the world. No longer an open invitation to any wishful immigrant, immigration today, having become an important and selective part of state policies to build and sustain economies, favors the talented and rejects the unskilled. Now the immigrant must be an immediate, tangible asset, not a burden. American immigration statistics bear out this tendency. Between 1900 and World War I, about 1 percent of immigrants were professionals; this percentage gradually increased to about 3 percent in the last 5 years before 1930. Before 1900 an even smaller proportion were professionals, usually well under 1 percent. (During the 5-year period 1891–1895, only 0.59 percent of the 2,123,879 immigrants, or 12,545, were professionals.) The proportion of immigrant professionals increased sharply from 3.12 percent in 1926–30 to 5.53 percent in 1931–35 and 8.47 percent in 1936–40. This was the period of great inflows of prominent scientists and scholars, men like Einstein and Fermi, fleeing the tyranny then engulfing Europe. Immediately after World War II the proportion of immigrant professionals decreased from a wartime level of 10.5 percent in 1941–45 to 7.4 percent in 1946–50. This percentage declined further to 6.66 percent in 1951–55 but began a sharp upward swing in 1956–60 that still continues. In 1956–60, 7.79 percent or 111,193 of the total 1,427,841 immigrants were professionals. In 1961–65, the percentage jumped to 9.01 percent or 130,641 of the total of 1,450,312. During 1966–70 the percentage increased to 11.06 percent or 207,022 of the total of 1,871,365 incoming immigrants. This period reflects the changes made in the 1965 Immigration and Nationality Act. The immediate effects were to increase the inflow of professionals from 9.7 percent in the fiscal year 1965 to 11.5 percent in the fiscal year 1967, the first year when the law came into effect. The second effect was the increase in Asian professionals from 7.2 percent in 1965 to 29.7 percent in 1967 and on to 52.9 percent in 1970. Concluding an analysis of these trends in immigrant professionals, Judith Fortney, a researcher with the Center for the

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[109] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 11.
[110] Quoted in, Ibid., p. 10.

Study of Aging and Human Development at Duke University, observed:

> Thus the present era is characterized by a sustained high level of immigration—between 350,000 and 400,000 a year, a relatively high proportion of which are professional and technical workers. The most unique characteristic of this period, however, is the high level of immigration from Asia and the high quality of immigrants from that region.
>
> Although in absolute numbers immigration from Africa remains small, its relative increase has been substantial, and its quality high. . . . more than one-fourth of Asian immigrants and more than one-third of African immigrants are professional workers, compared with less than one-tenth for other regions. . . . of the nine countries sending more than one thousand immigrants in the professional category, two-thirds are developing countries.[111]

Thus, professionals have become increasingly mobile, notably from the LDCs, while the common laborer has been increasingly reduced to immobility. As the U.N. brain drain study described human mobility in the postwar era, "the new migration is no longer characterized by the movement of talented persons as isolated individuals, but as a steadily increasing flow of highly trained persons." [112]

Brain Drain Flows to Western Europe

Chief responsibility for the brain drain had been placed solely upon the United States in the mid-1960's. Further studies revealed, however, new evidence that suggests what Nuri Eren, Turkey's deputy ambassador to the United Nations, termed, "universal culpability." All the great industrial powers of the West were shown to have been acting as centers of attraction for scientists, engineers, doctors, and other PTKs—not only the United States but Great Britain, France, Germany, Canada, and Australia.[113] In varying degrees these countries were the principal gainers in the brain drain, while such LDCs as India, Iran, Turkey, Pakistan, Philippine Islands, Taiwan, Korea, Columbia, and Argentina were prominent losers.[114] Thus the LDCs paid part of the price for manpower benefits accrued to the expanding industrial societies of the world.

MOVEMENT TO BRITAIN

Britain's former imperial connections acted as a conduit for the inflow of large-scale immigration from the Commonwealth.[115] Brain drain losses suffered by the departure of British professionals to North America were thus largely recouped by this counterflow from the former Asian and African colonies. According to an official British report, Britain lost 47,000 professionals during 1965, but 42,000 of these members of the managerial, professional, administrative, and technical elite were replaced from inflows elsewhere.[116] In 1967, the

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[111] Judith Fortney, "Immigrant Professionals—A Brief Historical Survey," *International Migration Review*, v. 6 (Spring 1972), p. 57. The data above are taken from this article, pp. 50–63.

[112] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, pp. 7–8.

[113] Eren, op. cit., p. 10.

[114] CIMT study, pp. 671–672. Dr. Adams divided brain drain countries in four categories. Advanced countries with a large net inflow (U.S. and Australia); advanced countries with a large net inflow (United Kingdom and Canada); advanced countries with a large net outflow (Norway, Netherlands and Switzerland); and LDCs with a large net outflow (Greece, Iran, Turkey, Taiwan, Korea, India and several others.) Adams, "Talent That Won't Stay Put," pp. 69–70.

[115] Johnson, op. cit., pp. 71–72.

[116] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1967, p. 75.

British Minister of Technology estimated that from 1958 to 1963, excluding students returning home, 19,000 British and Commonwealth scientists and engineers left the country, but the loss was nearly offset by a counterflow of 15,000 from abroad.[117] Significantly, nine-tenths of the members of the Commonwealth fall within the underdeveloped category.[118] What Britain has gained by this inflow from the developing Commonwealth countries is revealing. Dr. James A. Perkins states frankly that Britain was "inadvertently bleeding the Commonwealth of its most highly trained men." [119] Medicine was the major field for brain drain to Britain; fewer scientific and engineering personnel were absorbed by Britain compared with the United States and Canada.[120] According to Nuri Eren, socialized medicine "would have been impossible without the inflow of foreign trained doctors and nurses. The foreign-born and trained constituted more than one-third of the health personnel in Britain." [121] Official British statistics indicate that 43.9 percent of the junior medical staff of Britain's National Health Service was of foreign origin.[122] Moreover, despite programs of aid and technical cooperation to the Commonwealth, Britain has more specialists of all kinds from all the Commonwealth countries, including more than 4,000 doctors, than there are British specialists in those countries.[123] Another indicator of the high intensity of absorption from the Commonwealth is the immigration of nurses. Between 25 and 40 percent of all 256,000 nurses working in the British National Health Service were born outside the British Isles, almost 75 percent in the developing Commonwealth countries.[124]

Nonreturn of foreign students from the Commonwealth has added to the plus side of Britain's brain drain equation. In 1967, Britain had 73,000 foreign students of whom 54,000 came from the LDCs. Between the academic years 1959–60 and 1962–63, students from the new Commonwealth countries increased 40.6 percent; the following year students from East and West Africa alone numbered 15,000. How many of these students remained in Britain cannot be determined precisely, but it is estimated that students remaining permanently or semipermanently abroad following the end of their formal studies have been increasing at a compound rate of 20 percent per annum, and in the case of LDC students, at a rate still higher.[125]

MOVEMENT TO FRANCE

Statistics are inadequate to determine the extent of brain drain to France. It is known, however, that 6 million of France's 50 million population are foreign and that one-fourth of these come from the developing countries of the French Union. The foreign population rose 40 percent during the period 1962–67; that for France proper rose 6 percent. Most of the foreign population is unskilled. Among senior

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[117] Thomas, op. cit., p. 35.
[118] *The Christian Science Monitor,* Aug. 13, 1973, p. 3.
[119] Perkins, op. cit., p. 617.
[120] Henderson, op. cit., p. 28.
[121] Eren, op. cit., p. 11.
[122] Adams, op. cit., p. 2.
[123] Iffland and Rieben, op. cit., p. 50.
[124] Henderson, op. cit., pp. 58–59. This section of Mr. Henderson's study contains a wealth of statistics on all aspects of medical brain drain to Britain from the Commonwealth countries.
[125] Henderson, op. cit., p. 72.

professionals 3.6 percent or 27,320 are foreigners, and of these, nationals of former African colonies, Departments, and Mandated Territories (Algeria, Morocco, Tunisia, Africa and the Malagasy States, etc.) numbered 2,280 or 8.3 percent of the foreign total. Moreover, in 1962, 1,060 foreigners were recorded as occupying intermediate medical and social services positions.[126]

Almost all French statistics on migration are known to be, in Mr. Henderson's words, "severe understatements" since large proportions of professionals are from the former colonies and are not considered "foreigners" for statistical purposes. Statistics from individual organizations like the National Centre for Scientific Research, 42 percent of whose 631 foreign researchers came from the LDCs, give some indication of the actual size of talent migration to France.[127]

According to a special tabulation provided by *La Direction de la Population et des Migrations du Ministere des Affaires Sociales* of Paris, new working licenses issued to foreign professionals, that is, engineers, natural scientists, physicians, and professors, over the period 1962–66 totaled 1,869. Europe, including Greece and Turkey, contributed 285; Asia, 954; South America, 314; and Africa, 316. By far the greatest percentage of these professionals were engineers and all were from developing countries.[128] Mr. Henderson cautioned, however, that these figures represented a "considerable" understatement.[129]

Still, the statistics, however imperfect, reaffirm the generalizations that brain drain flows to Europe are often along the imperial-colonial pattern, though this pattern seems to apply less to France than to Britain, while the developing countries often pay the highest price. A measure of this price is evident in the case of Cameroon. Fifty of the 62 Cameroonian medical doctors practicing outside Cameroon were practicing in France. In 1965–66, there were 164 doctors practicing in Cameroon of whom 113 were expatriates or presumably nationals of other countries. Thus, there were more Cameroonian physicians practicing outside Cameroon than inside and as many practicing in France as in Cameroon. On the basis of the 1970 estimated population for the Republic of Cameroon of some 5,836,000, this would allow a ratio of one native Cameroonian doctor for every 115,000. Analogous situations can be found in Algeria: some 300 Algerian medical doctors are practicing in France, Morocco, and Togo.[130]

As in the case of the other major receiving countries, foreign students studying in France are also a potential source for brain drain. In the late 1960's, France had 40,000 foreign students, the largest enrollment on the European continent. Nearly 30,000 came from the LDCs.[131] Statistics provided by the French Ministery of Education indicated that in 1966–67 there were 24,410 foreign students in France. Of this total there were 11,824 from the LDCs in Asia (4,704), Africa (6,800), and South America (320).[132]

Statistics on nonreturnees are not available, but some surveys have been made that provide at least data for tentative judgments. A sur-

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[126] Henderson, op. cit., pp. 36–37.
[127] Ibid.
[128] Table V, ibid., pp. 173–174.
[129] Ibid., p. 37.
[130] Ibid., p. 38.
[131] Ibid. p. 37.
[132] Ibid., pp. 175–176.

vey in 1965 claimed that 12,000 sub-Saharan African students remained in France with their families; 11,000 more were still pursuing their studies.[133] According to one French researcher, it was generally known to be a considerable problem that 62 percent of the students from Africa, Asia, and the Antilles studied science, medicine, dentistry, and pharmacy, the occupations most susceptible to brain drain, while those from the more industrialized countries studied mostly French literature and culture in order to teach in their countries. Among 80 students interviewed at the Faculte des Sciences in Paris in 1967, 69 percent of Vietnamese wanted to remain in France; 25 percent were undecided. The North Africans were divided equally: half wanted to stay, half to return. Among Africans, 15 percent preferred France, 52 percent wanted to return home, and 33 percent were undecided. In another survey conducted by an African among African students, 61 percent indicated a wish to study in France even if their courses had been available in Africa. Expressions of this sort are not evidence of brain drain per se, but they are part of an attitude, reaffirmed in American surveys, that frequently lead to it.[134]

MOVEMENT TO WEST GERMANY

According to Baldwin, "In Europe many more countries have *not* suffered from a brain drain than have." He cites the examples of France, Denmark, Finland, Sweden, West Germany, Spain, Italy, and Yugoslavia. In the Far East, Japan has also been spared high-level talent losses. Norway and Switzerland, he declared, have lost "quite substantial proportions" of their annual output of professional talent to North America.[135] Special political and ideological conditions existing in the Soviet bloc have prevented it from being a contender in the world competition for professional manpower.

With regard to West Germany, Eugene B. Skolnikoff indicates that it has suffered brain drain losses. Some 5 percent of all German graduates in science, he wrote, emigrate each year.[136] Whatever losses West Germany may have suffered, apparently, they have been compensated in some measure by counterflows from other directions. According to Nuri Eren, Norway and Sweden have lost many of their "brightest stars" to Germany.[137] Mr. Eren acknowledged the absence of quantitative immigration data in estimating the weight of imported talent

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[133] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 32.

[134] Henderson, op. cit., pp. 37–38.

[135] Baldwin, op. cit., p. 359. Japan has not been entirely spared from high-level brain drain losses, as Baldwin indicates. On Apr. 11, 1974, the writer attended a meeting of the National Press Club where in conversation with Mr. Kinji Kawamura, Chief of the American General Bureau, The Asahi Shimbun Newspaper, the brain drain problem was discussed. Mr. Kawamura agreed that Japan may not be a prime loser of talent, but still it has lost key professionals. He cited the case of a Japanese scientist, Leona Ezaki, who had won a Nobel Prize for developing an advanced electronic element important in computer technology. It was discovered that Mr. Ezaki was in New York working for IBM where he preferred to remain rather than return to Japan. The principal reason for this decision, along with the high salary and prestige, was the desire to stay in research, having available the advanced computer facilities of IBM. In Japan, a man of his rank would have to move into management, and this he did not wish to do. Mr. Kawamura also indicated that there were a number of Japanese M.D.s at the National Institutes of Health who also did not want to return home. Again availability of advanced research facilities was the major reason for their decision. One of the medical scientists had made the important discovery of a cancer virus affecting the liver. Mr. Kawamura observed that Japan had lost "a national asset" when this scientist decided to stay in the United States.

[136] Skolnikoff, op. cit. p. 92.

[137] Eren, op. cit., p. 11.

in Western Europe, but he added: "We know indirectly that the great German expansion has attracted engineers and scientists from the Middle East." [138] Mr. Henderson supported this assertion with the statement that many foreign physicians and nurses "are known to be practising" in West Germany, though precise statistics were not available.[139] "Judging by the fact that some 962 of the 2,600 Turkish doctors working abroad are in Germany . . . ," he said, "such numbers may be large." [140]

Apparently, West Germany has replenished some of its brain drain losses from the thousands of foreign students who have gone there for undergraduate and graduate work and upon completion of their studies opted for permanent residency. The brain drain report of the U.N. Secretary General states: "Germany has become a major trainer of students from developing countries. It has been suggested that many of these students have sought permanent residence in the country and that some have succeeded." [141] According to the same report, "numbers of students from developing countries are known to stay in Germany as medical doctors." [142]

Statistics on the increasing number of foreign students studying in West Germany are impressive. In 1965, West Germany had approximately 31,000 foreign students, a substantial increase from the estimated 100 in 1950.[143] Conceivably, West Germany has a sizeable percentage of the 18,000 students from the Middle East who go to Europe to study, two-thirds of whom are undergraduates and thus especially vulnerable to nonreturn.[144] In 1968–69, 221 students from Lebanon alone went to Germany for study.[145] Presumably it was such patterns of migration that led Henderson to observe: "Numbers of former students from Near Eastern countries, of whom there are many in Germany, have gone into private business," and thus, it could be concluded, are lost for the development purposes of their own country.[146] Sketchy statistics on nonreturnee students, coupled with the judgments of seasoned observers and the assumption of a 20 percent loss among foreign students, indicate that the loss may not be insignificant to the LDCs who seek development as a national goal.[147]

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[138] Ibid.
[139] Henderson, op. cit., p. 8.
[140] Ibid., p. 39.
[141] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 21.
[142] Ibid., p. 32.
[143] Ibid., p. 31.
[144] Zahlan, *Science and Technology in Developing Countries*, p. 306.
[145] United Nations, Economic and Social Council, *Outflow of Trained Personnel from Developing to Developed Countries*, Report of the Secretary General, New York, June 9, 1970, p. 54. (Document E/4820, 49th sess.) Hereafter cited as, "Report of U.N. Secretary General, *Outflow of Trained Personnel from Developing to Developed Countries*, June 9, 1970."
[146] Henderson, op. cit., p. 39.
[147] A unique development in recent European migration has been the outward movement of Yugoslav workers. West European countries, especially West Germany, have benefited greatly by the outflow of Yugoslav workers. It is estimated that about 1,000,000 Yugoslavs, or 10 percent of the country's adult population, are employed abroad, mostly in West Germany and other West European countries. So great has been the outflow of manpower that Yugoslavia drafted legislation to bring the movement under tight control. Restrictions were expected to affect engineers, and similar experts, skilled workers, and men of military age. Though Yugoslavia's balance of payments has improved with the nearly $1 billion a year sent home by the Yugoslav workers, still the social and political costs have prompted legislative action. The problem of how to employ the workers abroad in Yugoslavia remains, however. In May 1973, for example, about 400,000 people were looking for employment. (Raymond H. Anderson, "Belgrade to Curb Worker Outflow," *The New York Times*, June 3, 1973, p. 5.)

Some Brain Drain Patterns Within British Commonwealth: Canada and Australia

Like the United States, Canada strongly attracts professional manpower from Western Europe, the Commonwealth, and the LDCs. According to Nuri Eren, Canada, along with the United States, is in the "forefront" of nations engaged in the global exchange of professional manpower.[148]

The magnitude of inflow of PTKs (Professional, Technical and Kindred Workers) into Canada is impressive. During the period 1946–65, 1,314,878 workers immigrated to Canada. Of this total 145,501 were PTKs. This figure constituted 11.1 percent of the total of immigrant workers. In 1965, this percentage of professionals jumped to 22.4 percent.[149] During the period 1962–68, an aggregate of 1,207,582 immigrated into Canada. Of this total, 130,217 were PTKs.[150]

Britain has been a substantial donor to Canada's professional manpower pool. It is estimated that between 1962 and 1965 the number of PTKs emigrating from the United Kingdom to Canada increased from 3,116 to 5,997.[151]

MOVEMENT FROM LDC'S TO CANADA

Canada has also drawn heavily on professional manpower from the developing countries. This is a matter of necessity. Traditionally Europe had been Canada's main source of immigration. The same is true of Australia. But in recent decades it has become increasingly more difficult to get professionals and skilled workers from Europe. Consequently, Canada has had to draw upon and absorb professionals from the LDCs. This shift in emphasis is borne out by statistics. The percentage of professionals immigrating into Canada from countries other than the United States, the United Kingdom, and the chief European sources increased from 7.2 percent in 1946 to 27.6 percent in 1963. In 1967, 37 percent of Canada's professional immigrants came from outside the United States and Europe. Between 1946 and 1963, the rate of immigration for skilled occupations increased dramatically from 8.5 percent to 36.3 percent.[152]

Tables 1 and 2 provide a profile of heavy donors to Canada's professional population from the LDCs.

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[148] Eren, op. cit., p. 11. According to Mr. Eren, 1,500 of Canada's 24,000 physicians have been trained abroad.

[149] Thomas, op. cit., p. 33.

[150] Henderson, op. cit., p. 178 (table VIII).

[151] Thomas, op. cit., p. 36. For a study on the emigration of British scientists, see James A. Wilson, "The Emigration of British Scientists," *Minerva*, v. 5. (Autum 1966), pp. 20–29. According to a report of an ad hoc committee of the Royal Society, the annual rate of permanent emigration of recent Ph. D.s had risen to about 12 percent of the total output in the fields included in the survey. The committee determined that by 1961, about 140 were departing per annum, with 60 entering the United States, 20 going to Canada, 35 to other Commonwealth countries and 25 to all other countries. They concluded further that the outward flow of recent Ph. D.s had increased by a factor of about three in the decade 1952–61. The report covered 8,537 out of an estimated 9,700 recipients of Ph. D. degrees in science; 1,136 of these emigrated permanently during the decade. In addition, 389 scientists on the staffs of universities and certain research institutions emigrated during the same period. During the period 1957–61, 1,053 recent Ph. D.s emigrated on a "mostly temporary" basis, of whom 545 returned, 143 had not returned, and the location of 365 was unknown. The overall average loss during the decade from 1952 to 1961 was about 16 percent of the Ph. D.s and scientific staff members of universities and research institutions in the various fields of science. Approximately half emigrated to the United States (pp. 21–22).

[152] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*. Nov. 5, 1968, p. 16.

TABLE 1.—IMMIGRANTS ADMITTED INTO CANADA, BY COUNTRY OF LAST PERMANENT RESIDENCE AND OCCUPATION, 1962–67 [1]

Country	Total immigrants (1962–66)	(1967)	1962–66 Total immigrant workers	1962–66 Professional and technical workers	(1967)	All for 1962–66 Engineers	Natural scientists	Physicians	Professional nurses
Argentina	1,837	(544)	731	114	(58)	16	5	22	7
Brazil	2,019	(715)	885	137	(45)	34	3	8	1
Ceylon	387	(112)	188	66	(35)	10	2	1	3
China (including Taiwan)	4,898	(6,409)	1,859	1,075	(1,376)	208	65	88	238
Egypt	7,888	(1,728)	3,150	913	(309)	116	68	100	7
Greece	25,707	(10,650)	15,171	435	(177)	36	30	38	31
Hong Kong (1962–65 only)	11,789	-------	2,991	848	-------	190	63	77	143
India	6,894	(3,966)	3,243	1,967	(1,213)	408	206	164	150
Israel	4,427	(2,345)	2,165	428	(262)	100	24	33	26
Lebanon	2,597	(1,096)	1,223	244	(165)	19	8	41	10
Mexico	645	(318)	209	75	(31)	14	4	19	3
Pakistan	1,447	(648)	772	477	(233)	144	52	37	7
Syria	266	(192)	158	37	(36)	5	2	9	2
Turkey	1,578	(488)	687	314	(109)	23	12	115	11

[1] Calendar years.

Source: Gregory Henderson, "Emigration of Highly Skilled Manpower From the Developing Countries," United Nations Institute for Training and Research (UNITAR) (New York, 1970), p. 171.

TABLE 2.—IMMIGRANTS ADMITTED INTO CANADA, BY COUNTRY OF ORIGIN AND OCCUPATION, OVER THE PERIOD 1964–67 [1]

Country	Total immigrants (1964–66)	(1967)	1964–66 Total immigrant workers	1964–66 Professional and technical workers	(1967)	All for 1962–66 Engineers	Natural scientists	Physicians	Professional nurses
Algeria	21	(15)	11	5	(3)	1	2	-------	-------
Burma	66	(7)	28	19	(3)	4	3	7	1
Chile	213	(105)	167	33	(20)	12	4	3	2
Colombia	200	(87)	93	41	(18)	5	2	11	-------
Indonesia	33	(11)	19	13	(6)	3	2	1	2
Iran	293	(136)	147	93	(49)	17	15	33	3
Iraq	152	(102)	81	33	(16)	13	8	2	-------
Jordan	256	(166)	149	35	(23)	-------	3	2	4
Kenya	309	(239)	140	80	(61)	10	9	4	1
Malaysia	298	(199)	144	102	(66)	13	20	8	21
Morocco	2,151	(547)	1,506	119	(48)	4	13	5	2
Peru	177	(78)	73	30	(24)	8	3	5	5
Philippines	4,378	(2,994)	3,746	3,266	(2,022)	237	202	221	1,902
Taiwan	500	-------	280	238	-------	45	31	27	30
Tunisia	54	(12)	20	5	(3)	-------	-------	2	1
Uruguay	258	(101)	102	10	(5)	1	3	2	1
Venezuela	963	(374)	418	44	(24)	11	6	1	1

[1] Calendar years.

Source: Gregory Henderson, "Emmigration of Highly Skilled Manpower From the Developing Countries," United Nations Institute for Training and Research (UNITAR) (New York, 1970), p. 172.

Egypt, Greece, India, Pakistan, Turkey, Iran, Kenya, Malaysia, Morocco, the Philippines, Taiwan, and Venezuela rank high among the contributors.[153]

Statistics on the proportion of PTKs from the LDCs out of the total immigrants with occupation going to Canada during the period 1962–66 fill out the profile showing the heavy burden borne by the LDCs. Selective percentages for the years 1964–66 are as follows:

[153] Henderson, op. cit., pp. 171–172. (Table III and Table IV.)

Burma, 67.9 percent; Indonesia, 68.4 percent; Iran, 63.3 percent; Iraq, 40.7 percent; Malaysia, 70.8 percent; Philippines, 87.2 percent; Colombia, 44.1 percent; Peru, 41.9 percent; and Kenya, 57.1 percent. For the period 1962–66, India is listed with 60.7 percent and Egypt with 29 percent.[154]

CANADA'S LOSSES TO UNITED STATES AND GAINS FROM THE LDC'S

Like the United Kingdom, Canada has a heavy two-way traffic of migrants, and what it loses in one quarter, it gains in another. In the decade 1950–60, Canada lost 42,000 PTKs to the United States, but at the same time it gained double this number from other countries, mostly from the LDCs.[155]

Thus the pattern of immigration into Canada is one of flow and counterflow with the United States being an integral part of the process. Between 1950 and 1963 Canada had an average annual inflow of 7,790 PTKs; 1,230 were from the United States. The annual outflow was 5,476, with 4,681 immigrating to the United States. To maintain an average net gain of 2,314 PTKs a year, Canada had to import 7,790 a year. Many professionals from Europe immigrating into Canada are really en route to the United States. In 1962 and 1963, the United States received 2,316 scientists and engineers who recorded Canada as their country of last permanent residence of whom the Canadian-born numbered only 1,159. One out of every two scientists and engineers to immigrate to the United States from Canada was therefore, a non-Canadian with temporary residence in Canada.[156] Canada is also a convenient "parking" place for professional migrants whose ultimate destination is the United States but who must fulfill certain nonresidence requirements under U.S. immigration laws before filing for American citizenship.

As it will be seen later in this chapter, the United States is really the preferred destination of professional migrants, and Canada benefits from its close proximity. So powerful is the American influence, wrote Brinley Thomas, that "the whole of North America is in fact one large market in human capital, and Canada, as a separate sovereign state, has to work trebly hard in the immigration business in order to keep her end up." That Canada has done well in this effort is illustrated in the few statistics noted above and also by the fact that the proportion of professional migrants in the total inflow for the year 1965 was almost exactly the same for both the United States and Canada, namely, about 22 percent.[157]

ATTRACTION OF STUDENTS TO CANADA

As an "intermediate advanced country," [158] Canada strongly attracts foreign students. In this regard Canada has had experience similar to that of Australia, where in 1966, 20 percent of the 12,000 Asian

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[154] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 74 (Table IV).
[155] Niland, op. cit., p. 7.
[156] Thomas, op. cit., p. 36.
[157] Ibid., pp. 36–37.
[158] Ibid., p. 36.

foreign students wished to remain in the country.[159] In the absence of statistics for other developed countries Mr. Baldwin assumed losses on the same order of magnitude.[160] Scattered figures are, however, available on students from the LDCs studying in Canada. In 1968–69, there were 38 students from Colombia, 110 from Lebanon, and 551 from Trinidad and Tobago. In 1969, there were 43 from Cameroon.[161] Between 1962 and 1968, 4,000 Trinidadians studied in Canada. During the 8-year period 1961–69, 180 Cameroonians studied in Canada, 120 of whom returned home.[162] Statistics on other student nonreturnees are not available, but the assumption of roughly 20 percent might be a useful guide for measurement.

Viewing brain drain patterns in the large, therefore, Canada is seen to be both a loser and a gainer. Large losses to the United States are recouped by large gains from the Commonwealth countries and Europe. Accordingly, Canadian authorities have been far less concerned than the British about losses through immigration to the United States.[163] Yet, as in so many instances of trade-offs in professional manpower, the LDCs are really the losers in the end: they pay the price, and the statistics cited above tell the story. With this in mind, the report of the U.N. Secretary General on brain drain from the LDCs concluded: "In proportion to its population, Canada's intake of professionals appear to be among the largest in the world; the trend towards an increasing reliance on the skilled from developing countries is strong." [164]

MOVEMENT TO AUSTRALIA

Australia probably ranks next to Canada as a major importer of human capital within the British Commonwealth. Unlike Canada, which must over-import to compensate for losses of professional manpower to its neighbor to the south, Australia is an independent destination and the outward flow is negligible. Free from the special influence of the United States because of its geographic location, Australia's pattern of immigration and rate of absorption are regarded as "more normal." [165]

Australia's total immigration of workers during the period 1949 to mid-1966 was 1,098,567. This figure compares favorably in magnitude with Canada's 1,314,878 for 1946–65. Australia's percentage of PTKs is, however, lower. In that 17½ year period Australia accepted 90,438 PTKs representing 8.2 percent of professionals from the total of immigrant workers; the corresponding figure for Canada was 11.1 percent. The percentage of PTKs from the total worker immigrant

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[159] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 32.

[160] Baldwin, op. cit., p. 361.

[161] Report of U.N. Secretary General, *Outflow of Trained Personnel from Developing to Developed Countries*, June 9, 1970, p. 54 (Table 4).

[162] Ibid., p. 9.

[163] Baldwin, op. cit., p. 359.

[164] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 16. To illustrate Canada's gain in international brain drain exchanges, Alessandro Silj cites Louis Parai as estimating that the immigration of human capital to Canada in the decade 1953–63 represented a total value of about $37 million, counting the costs of educating each emigrant in his native country. (Silj, op. cit., p. 6.)

[165] Thomas, op. cit., p. 37.

figure for Australia in 1965 was 9.5 percent; for Canada, 22.4 percent.[166]

In his survey of Australian immigration, Mr. Henderson notes that the pattern remains more firmly European-directed than oriented towards the LDCs, though in recent years this pattern has been changing. For the financial year 1966–67, a total of 138,676 immigrants arrived in Australia; 76,496 came from the United Kingdom and Ireland; 75,514 were born there.[167] Most of Australia's immigration tends to consist of craftsmen. Between 1949 and 1960, Australia absorbed 185,544 skilled craftsmen or about 16,860 a year.[168]

The European orientation of Australia's immigration is evident in the following statistics on the origin of immigrants during 1947–61: United Kingdom and its Dominions, 32 percent; North Europe, 18 percent; East Europe, 20 percent; South Europe, 27 percent; and the rest of the world, 3 percent. Except for Greece (9,826) and Yugoslavia (5,664), the developing countries played a small role in Australia's total immigration during that period. Those coming from South Europe were mostly craftsmen or unskilled labor. Moreover, among professionals, 14.115 of the 29,568 overseas-born professionals in the 1966 census were born in the United Kingdom; and 22 percent of Australia's male professional manpower were born overseas.[169]

MIGRATION FROM LDC'S TO AUSTRALIA

Australia's exclusive dependency on immigration from the so-called "white" developed countries has changed gradually since the late 1950's. Legislation has progressively opened up the country to non-Europeans. Thus a trend has been established of gradually increasing immigration from Asia, especially from India and Pakistan, and among ethnic Chinese from several Asian countries. This changing character of Australian immigration is seen in Table 3 on overseas-born professional workers residing in Australia in 1966 by birthplace and occupation.

Australia does not break down its immigration statistics by nationality, but the 1966 census shows a high proportion of professionals among Asian immigrants. For India and Indonesia the figure is 10 percent, and for Malaysia, 27 percent. Thus, a far higher proportion (12.3 percent in 1961) of those Australian residents born outside Australia were professionals than those born inside the country (4 percent) or of those born in Europe (ranging from 0.5 to 9.8 percent). Only one-third (34.7 percent) of the non-European foreign born were craftsmen or, to use Henderson's term, "operatives," while from Europe there were nearly two-thirds. Percentages of "administrative" personnel were also higher (11 percent from the non-European foreign born) than there were for Australian- or European-born persons.[170]

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[166] Ibid., p. 33.
[167] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, pp. 16–17, and Henderson, op. cit., p. 21.
[168] Thomas, op. cit., p. 37.
[169] Henderson, op. cit., p. 21.
[170] Ibid., p. 24.

TABLE 3.—OVERSEAS-BORN PROFESSIONAL WORKERS RESIDING IN AUSTRALIA IN 1966, BY BIRTHPLACE AND OCCUPATION

	Birthplace								
	India	Indonesia	Malaysia	Philippines	Singapore	Pakistan	Ceylon	China	Hong Kong
Architects, engineers, and surveyors	201	97	173	10	53	18	40	213	94
Chemists, physicists, geologists, and natural scientists	87	36	47	4	13	18	18	51	22
Biologists, veterinarians, agronomists, and scientists	27	32	12	1	7	1	8	8	3
Medical practitioners and dentists	85	26	118	5	47	7	41	76	65
Nurses	16	7	19	5	4	1	3	17	11
Other professional medical workers	9	8	16	2	8	3	1	27	13
Teachers	272	83	82	7	23	19	68	79	38
All professionals	681	289	467	34	155	67	179	471	246
All occupations	6,669	2,729	1,727	270	894	505	2,097	7,952	1,373
Percent professionals to total	10.2	10.6	27	12.6	17.3	13.3	8.5	5.9	17.9
Female professionals	596	182	306	81	113	29	147	94	94
Female all occupations	2,818	1,015	654	206	371	148	1,002	415	415
Percent professional females to total	21.2	17.9	46.8	39.3	30.5	19.6	14.7	22.7	22.7

Source: Gregory Henderson, "Emigration of Highly Skilled Manpower From the Developing Countries," United Nations Institute for Training and Research (UNITAR) (New York, 1970), p. 23.

That immigration to Australia from the LDCs has increased in recent years is shown by the statistics in Table 4.

Thus, Henderson generalizes, new arrivals from the LDCs to Australia were about three times the number in 1968 as during the decade ending in 1968. Since 1947, permanent residents of Asian descent have more than quadrupled from 25,000 to 101,387 at the time of the 1966 census, while the total Australian population increased 62.5 percent.[171]

In the light of these data, Henderson concludes that professional emigration from the LDCs to Australia, mostly from Asia, remains "fairly modest." Yet the increase since its beginning in the late 1950's has been considerable. The demand for services is there, and the rate of professional immigration among Asians is high—in some cases, the highest among all nations whose nationals immigrate to Australia. Thus, Mr. Henderson concludes, "it seems likely that the present trend will increase as Australia's 12 million population climbs, partly through swelling immigration, toward the 20 million that economists say are needed for proper expansion and development of that continent." [172]

TABLE 4.—IMMIGRATION FROM THE LDC'S TO AUSTRALIA, 1959-68

	Total settler arrivals, January 1959 to December 1968	Average yearly arrivals, 1959-68	Settler arrivals, calendar year 1968
Ceylon	4,149	415	838
India	5,002	500	2,100
Malaysia	850	85	230
Pakistan	238	24	87
Singapore	468	47	148
Burmese	1,007	101	272
Chinese	1,451	145	480
Filipino	614	61	127
Indonesian	139	14	41
Turkish	1,679	168	641
Total	11,497	1,560	4,944

Source: Gregory Henderson, "Emigration of Highly Skilled Manpower From the Developing Countries," United Nations Institute for Training and Research (UNITAR) (New York, 1970), p. 24.

ATTRACTION OF FOREIGN STUDENTS TO AUSTRALIA

Australia has also attracted foreign students, mostly from Asian LDCs, who decided to stay on after receiving their education rather than return home. However, data are scarce. According to Mr. Baldwin, Australia had only a negligible number of foreign students during the period 1954–60.[173] Perhaps the most authoritative statement on student nonreturnees (and the only one cited in the data examined) came from Australian's Minister of Immigration, who in 1966 referred to estimates that 20 percent of 12,000 foreign Asian students in Australia wished to remain in the country.[174]

That the 20 percent figure continues to be a valid basis for judging brain drain to Australia is verified by the complaint of Singapore's Prime Minister Lee Kuan Yew at the Commonwealth Conference in Ottawa during September 1973. The Prime Minister used the conference as a forum to accuse Australia of fostering a "brain drain." Since Australia had adopted more liberal immigration policies toward Asians, he said, some of Singapore's most brilliant students were being enticed to quit their country and settle permanently in Australia. Australia's Prime Minister Gough Whitlam rejected the charge; and in a statement released later in Canberra, "an aggrieved Immigration Minister," Al Grassby, according to the press report, said that Lee Kuan Yew was "up a gumtree," meaning, misinformed in his allegations.

Whether Australia's actions are deliberate in encouraging Singapore students to remain permanently may be an open question, but figures available indicate that of 3,652 Singapore students studying in Australian universities since 1969, as many as 730 failed to return home after graduation. Singapore's sensitivity on this matter arises from its concern for future economic planning which depends heavily on a steady supply of highly trained professionals in such fields as science, technology, and engineering. Talented students are sent to Australia and New Zealand to gain the training not yet available in Singapore. Reasons given for emigration from Singapore are its compulsory military service laws, higher salaries in Australia, shortage of housing in Singapore, and attraction to Australia's life-style. In general, these reasons fit into the pattern of causes for emigration which is examined in another chapter.

Before leaving Ottawa, Prime Minister Lee was given assurances by Mr. Whitlam that if Singapore decided to bring its students home, the Australian Government would not stand in the way. But, as the press report said and will be explained later on in this study, "it is hard to see how the students can be forced to return against their will." [175]

To sum up Australia's brain drain experience, despite incomplete data in certain categories, it is evident that Australia, like other intermediate and advanced countries, has in recent years drawn considerably on the LDCs, particularly those in Asia, to satisfy its professional

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[173] Baldwin, op. cit., p. 361, ff. 2.

[174] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 32.

[175] Alexander MacLeod, "Australia Charged—Singapore 'Brain Drain'." *The Christian Science Monitor*, Sept. 6, 1973, p. 12.

manpower needs. Moreover, given the perceptible trends in the future, this reliance on the Asian LDCs is expected not only to continue but to increase as Australia's development needs magnify.

Talent Migration to the United States Since the Late 1940's

Sources on the brain drain problem emphasize either directly or by implication that the United States is a mecca for migrating scientists, engineers, physicians, and other professionals. Dr. Zbigniew Brzezinski of Columbia University described this phenomenon in these words: "America's professional attraction for the global scientific elite is without historic precedent in either scale or scope." [176] The vast dimension and complexities of this phenomenon are revealed in the mass of statistics published by the United States, some pertinent examples of which are reproduced in Tables 5, 6 and 7. They are also evident in the many evaluative statements by students of specific aspects of the problem. For instance, Dr. Perkins concluded that collectively the statistics and studies on the brain drain present a "somber picture," particularly for the LDCs.[177]

UNITAR STUDY, 1970: IMMIGRATION OF PROFESSIONAL MANPOWER

Viewing postwar immigration into the United States in the large, it is possible to identify two general trends: (1) a large and rapid increase in the immigration of PTKs in general, and (2) a steep rise in the immigration of professionals from the LDCs, particularly after the mid-1960's. In his study on the emigration of high-level manpower from the LDCs prepared under the auspices of the United Nations Institute for Training and Research (UNITAR), Gregory Henderson gives the following explanation of these trends based on statistical data drawn from official American sources.

TABLE 5.—IMMIGRANTS ADMITTED INTO THE UNITED STATES BY COUNTRY OF ORIGIN AND OCCUPATION FROM THE YEAR ENDED JUNE 30, 1962, TO THE YEAR ENDED JUNE 30, 1967

Country of origin	Total immigrants admitted	Immigrants with occupation	Professional, technical and kindred workers	Engineers	Natural scientists	Social scientists	Physicians [1]	Professional nurses
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Europe:								
Greece	39,608	12,006	2,068	323	150	26	180	83
Turkey (Europe and Asia)	7,808	3,455	1,518	327	[2] 31	16	319	34
Asia:								
Burma	NA	NA	NA	40	10	4	13	3
China (including Taiwan)	51,218	23,291	7,343	1,406	619	72	99	112
Hong Kong	11,942	1,666	814	478	189	17	83	127
India	10,034	6,121	5,078	2,141	624	78	174	34
Indonesia	6,056	2,634	680	25	14	4	5	4
Iran	5,363	3,074	1,564	369	85	18	311	52
Iraq	3,128	1,434	608	122	52	3	33	10
Israel	6,694	2,304	1,201	371	130	48	174	153
Jordan (including Arab Palestine)	5,880	2,508	636	79	38	7	18	17

See footnotes at end of table.

[176] Zbigniew Brzezinski, *Between Two Ages: America's Role in the Technetronic Era*, (New York: Viking, 1970), p. 30.
[177] Perkins, op. cit., p. 617.

TABLE 5.—IMMIGRANTS ADMITTED INTO THE UNITED STATES BY COUNTRY OF ORIGIN AND OCCUPATION FROM THE YEAR ENDED JUNE 30, 1962, TO THE YEAR ENDED JUNE 30, 1967—Continued

Country of origin	Total immigrants admitted (1)	Immigrants with occupation (2)	Professional, technical and kindred workers (3)	Engineers (4)	Natural scientists (5)	Social scientists (6)	Physicians[1] (7)	Professional nurses (8)
Asia—Continued								
Korea	15,093	2,529	1,895	293	226	71	163	61
Lebanon	2,981	1,359	547	177	71	11	89	62
Malaysia	[3] 311	[3] 165	[3] 75	35	26	[2] 3	27	18
Pakistan	[4] 993	[4] 681	[4] 546	119	45	4	33	6
Philippines	30,149	10,384	5,421	434	187	36	1,158	793
Syrian Arab Republic	[5] 1,613	[5] 794	[5] 311	83	23	3	24	[2] 6
Thailand	NA	NA	NA	28	4	3	40	152
Vietnam	[6] 765	[6] 168	114	27	6	3	3	15
North America:								
Mexico	269,014	90,941	3,628	328	176	48	559	248
Dominican Republic	60,344	26,468	2,094	168	49	11	235	160
Haiti	16,232	8,130	1,988	78	34	10	114	161
Costa Rica	11,558	5,682	803	59	26	[2] 3	32	132
El Salvador	8,896	4,538	634	21	20	3	27	99
Guatemala	8,269	4,286	722	33	11	5	30	103
Honduras	10,297	5,039	760	42	[2] 18	[2] 4	32	83
Nicaragua	7,089	8,011	376	24	13	[2] 1	32	44
Panama	11,235	4,471	527	40	7	4	25	60
Other West Indies				1,127	388	74	1,184	1,733
South America:								
Argentina	27,738	12,745	4,226	516	213	43	742	186
Bolivia	[7] 2,319	[7] 1,014	[7] 362	57	23	7	101	40
Brazil	12,891	5,389	1,539	251	106	23	168	95
Chile	7,767	3,142	912	136	44	[2] 13	50	81
Colombia	45,515	16,924	3,924	383	137	71	601	234
Ecuador	21,984	8,897	1,646	78	41	9	84	132
Paraguay	NA	NA	NA	8	8	[2] 1	27	[2] 10
Peru	12,877	4,894	1,229	144	30	13	195	114
Uruguay	NA	NA	NA	28	4	([2])	20	13
Venezuela	5,788	1,450	650	211	72	20	125	60
Africa:								
Algeria	[2] 918	[2] 418	[2] 93	4	1	([2])	5	1
Ethiopia	NA	NA	NA	9	[2] 1	[2] 1	14	1
Ghana	NA	NA	NA	12	6	2	9	10
Kenya	NA	NA	NA	18	4	2	3	4
Morocco	1,894	747	183	14	3	([2])	9	9
Nigeria	[8] 417	[8] 255	[8] 131	31	9	[2] 2	[2] 9	34
Tunisia	[9] 392	[9] 145	[9] 23	[2] 1	5	[2] 1	6	2
United Arab Republic	6,285	2,998	1,181	89	57	13	91	15
Total, above developing countries	749,355	291,157	58,044	10,787	3,978	811	7,475	5,606
All countries	1,863,980	818,660	180,877	27,877	10,686	1,895	14,029	23,886

[1] Physicians include surgeons, and each occupation includes professors and instructors.
[2] 1962 through 1966 only.
[3] 1965 only.
[4] 1966 and 1967 only.
[5] From 1963 through 1967 only.
[6] 1966 and 1967 only.
[7] 1965, 1966, and 1967 only.
[8] 1964 through 1966 only.
[9] 1962, 1963, and 1964 only.

Note: The figures in column (1) and column (3) have been compiled from the figures given in the 1st and 2d columns of table 8, the "Annual Reports" (Department of Justice, Immigration, and Naturalization Service, Washington, D.C.) for the years 1962 through 1967 inclusive. Those in column (2) have been calculated by subtractintg the figures on "Housewives, children and others with no reported occupation" of the same source from the corresponding figures in our column (1). Columns (4) through (8) have been compiled from the corresponding data in appendix A, tables I through V in the "Staff Study" of the Research and Technical Programs Subcommittee, House of Representatives, July 1967.

Source: Gregory Henderson, "Emigration of Highly Skilled Manpower From the Developing Countries," United Nations Institute for Training and Research (UNITAR), New York, 1970, pp. 166–169.

TABLE 6.—IMMIGRANTS ADMITTED INTO THE UNITED STATES BY COUNTRY OF ORIGIN AND OCCUPATION

[A. From the 5 years ended June 30, 1962 to June 30, 1966, and B. For the year ended June 30, 1967]

Country of origin	(1) Total immigrants admitted		(2) Immigrants with occupation		(3) Professional, technical and kindred workers		(4) Engineers		(5) Natural scientists		(6) Social scientists		(7) Physicians [1]		(8) Professional nurses	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Europe:																
Greece	24,703	14,905	5,631	6,375	1,479	589	227	96	111	39	14	12	125	55	50	23
Turkey	5,595	2,213	2,423	1,032	1,091	427	256	71	31	--------	14	2	208	111	26	8
Asia:																
Burma	NA	--------	NA	NA	NA	NA	25	15	3	7	1	3	9	4	3	0
China (Republic of)	31,477	19,741	13,467	9,824	3,419	3,924	484	922	262	348	33	39	53	46	66	46
Hong Kong	6,587	5,355	851	815	411	403	251	227	90	99	8	9	50	43	75	52
India	5,392	4,642	3,315	2,806	2,604	2,474	1,074	1,067	355	269	38	40	87	87	14	20
Indonesia	5,586	470	2,430	204	559	121	14	11	9	5	1	3	--------	5	2	2
Iran	3,949	1,414	2,178	896	1,014	550	236	133	57	28	10	8	188	123	32	20
Iraq	2,057	1,071	983	451	428	180	86	36	40	12	1	2	22	11	8	2
Israel	5,213	1,481	1,657	647	826	375	255	116	23	47	35	13	138	38	123	30
Jordan	4,276	1,604	1,895	613	461	175	54	25	35	3	3	4	12	6	12	5
Korea	11,137	3,956	1,454	1,075	1,065	830	185	108	140	86	34	37	93	70	37	24
Lebanon	2,229	752	1,031	328	414	133	136	41	48	24	9	2	50	39	45	17
Malaysia	[3] 311	NA	[3] 165	NA	[3] 75	NA	27	8	17	9	3	--------	22	5	14	4
Pakistan	[3] 347	646	[3] 245	436	[3] 205	314	62	57	28	17	1	3	19	14	4	2
Philippines	16,284	10,865	5,555	3,829	2,621	2,800	86	348	81	106	21	15	608	550	358	435
Syrian Arab Republic	[4] 1,058	555	[4] 528	266	[4] 215	96	66	17	20	3	2	1	19	5	6	--------
Thailand	NA	NA	NA	NA	NA	NA	15	13	3	1	2	1	32	8	76	78
Vietnam	[3] 275	490	[3] 59	109	[3] 39	75	21	6	3	3	1	2	1	2	12	3
North America:																
Mexico	226,643	42,371	78,607	12,334	2,931	697	267	61	142	34	34	14	473	86	202	46
Dominican Republic	48,830	11,514	23,203	3,265	1,824	270	151	17	33	16	7	4	197	38	130	30
Haiti	12,665	3,567	6,559	1,571	1,681	307	65	13	30	4	8	2	74	40	133	28
Costa Rica	10,383	1,175	3,283	399	734	69	53	6	23	3	3	--------	29	3	119	13
El Salvador	7,851	1,045	4,025	513	574	60	19	2	18	2	1	2	22	5	88	11
Guatemala	6,800	1,469	3,598	688	633	89	30	3	10	1	4	1	22	8	95	8
Honduras	8,747	1,550	4,469	570	701	59	39	3	18	--------	4	--------	26	6	72	11
Nicaragua	6,360	729	2,709	263	325	42	23	1	12	1	1	--------	25	7	38	8
Panama	9,559	1,676	3,942	529	451	74	38	2	4	3	2	2	24	1	51	9

See footnotes at end of table.

TABLE 6.—IMMIGRANTS ADMITTED INTO THE UNITED STATES BY COUNTRY OF ORIGIN AND OCCUPATION—Continued

[A. From the 5 years ended June 30, 1962 to June 30, 1966, and B. For the year ended June 30, 1967]

Country of origin	(1) Total immigrants admitted		(2) Immigrants with occupation		(3) Professional, technical and kindred workers		(4) Engineers		(5) Natural scientists		(6) Social scientists		(7) Physicians [1]		(8) Professional nurses	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
South America:																
Argentina	25,261	2,477	11,637	1,108	3,720	506	424	92	172	41	33	10	616	126	167	19
Bolivia	[5] 1,684	635	[5] 732	282	[5] 266	96	41	16	19	4	5	2	85	16	30	10
Brazil	11,215	1,676	4,784	605	1,348	191	197	54	91	15	17	6	149	19	82	13
Chile	6,931	836	2,798	344	790	122	116	20	40	4	13	-------	47	3	74	7
Colombia	40,959	4,556	15,496	1,438	3,532	392	310	73	122	15	63	8	485	116	213	21
Ecuador	19,265	2,719	8,109	788	1,495	151	62	16	37	4	7	2	67	17	116	16
Paraguay	NA	NA	NA	NA	NA	NA	7	1	6	2	1	-------	19	8	10	-------
Peru	11,207	1,670	4,020	874	1,097	132	122	22	27	3	12	1	168	27	98	16
Uruguay	NA	NA	NA	NA	NA	NA	25	3	3	1	-------	-------	13	7	9	4
Venezuela	5,249	539	1,350	100	357	293	189	22	62	10	17	3	110	15	60	-------
Africa:																
Algeria	918	NA	418	NA	NA	NA	4	-------	-------	1	-------	-------	2	1	1	-------
Ethopia	NA	NA	NA	NA	NA	NA	6	3	1	-------	1	-------	13	3	11	-------
Ghana	NA	NA	NA	NA	NA	NA	8	4	2	4	1	1	1	8	5	5
Kenya	NA	NA	NA	NA	NA	NA	12	6	2	2	-------	2	2	1	4	-------
Morocco	1,437	457	555	192	138	45	9	5	1	2	-------	-------	7	2	9	-------
Nigeria	[6] 147	NA	[6] 255	NA	[6] 131	NA	14	17	5	4	2	-------	9	-------	19	15
Tunisia	[7] 392	NA	[7] 145	NA	[7] 23	NA	1	-------	4	1	1	-------	3	3	2	-------
U.A.R. (Egypt)	4,582	1,703	2,112	886	787	394	56	33	37	20	8	5	65	26	14	1
Total developing countries [8]	727,920	209,885	294,465	87,295	57,595	23,705	6,835	4,229	2,477	1,472	533	279	5,655	2,041	4,249	4,784
All countries	1,502,008	361,972	665,735	152,925	139,225	41,652	19,055	8,822	7,793	2,893	1,351	544	10,703	3,326	19,102	2,004

[1] Physicians include surgeons, and each occupation includes professors and instructors.
[2] 1965 only.
[3] 1966 only.
[4] From 1963 through 1966 only.
[5] 1965 and 1966 only.
[6] 1964 through 1966 only.
[7] 1962, 1963 and 1964 only.
[8] The totals used are those of all developing countries. These add to the above-listed countries the following rubics appearing in the U.S. statistics: "Other Asia," "Other North America," "Other South America," "Other Oceania," "Other West Indies" and "Fiji." The totals of the above are generally of minor consequence except in the instance of "Other West Indies," which contributed 1,521 engineers, scientists and medical personnel to the United States in fiscal year 1967 of whom 1,025 were medical personnel which included 202 doctors and surgeons, 19 dentists, 784 professional nurses, and 20 student nurses. Jamaica and Barbados are major contributors to the "Other West Indies" category.

Source: Gregory Henderson, "Emigration of Highly Skilled Manpower From the Developing Countries," United Nations Institute for Training and Research (UNITAR), (New York, 1970), p. 170. Complied from Sources cited in Table 5.

In 1947, Henderson points out, only 2,382 natural scientists, engineers, physicians, or surgeons immigrated to the United States. Data on national origins are not available in existing records; however, it can be assumed that since the immigration patterns then prevailing were European-oriented, only a few hundred (possibly 300–400) at most came from the LDCs. By 1965, "Immigrants with Occupations" had increased twofold from the figure for 1947, but PTKs had nearly tripled, increasing from 10,891 to 28,790, and moving from 16 percent to 22 percent of all "Immigrants with Occupations." By 1968, the PTKs had increased nearly fivefold, reaching a figure of 48,753 and constituting 23 percent of all "Immigrants with Occuptions." In 1969, for the first time in recent years, they declined in numbers to 39,980. Among these PTKs, the engineers, scientists, and medical personnel by 1965 had reached 11,749, or almost a fivefold increase. From this level, these categories increased to 11,449 in 1966, 20,760 in 1967, and 25,317 in the fiscal year ending June 30, 1968.[178]

A parallel trend in this rapid increase of professional immigration is the even more rapid rate of increase in professionals entering from the LDCs. (For a graphic illustration of this development, see Figures 1, 2 and 3. For statistical data on this matter, see Table 7.) Mr. Henderson explains that from the 300–400 level assumed above for 1947, the immigration of professionals from the LDCs increased in the following magnitude: to 2,231 in 1956 (about 25 percent of all 8,539 engineers, scientists, and medical personnel immigrating that year); to 3,604 in 1965 (about 30 percent); to 5,440 in 1966 (about 40 percent); to 10,254 in 1967 (50 percent); to 13,221 in 1968 (52 percent), that is, numerically more than 33 times the estimated figure for 1947 and nearly 6 times the entrants for 1956. The trend towards increased immigration of professionals from the LDCs, in Henderson's judgment, was expected to continue.[179]

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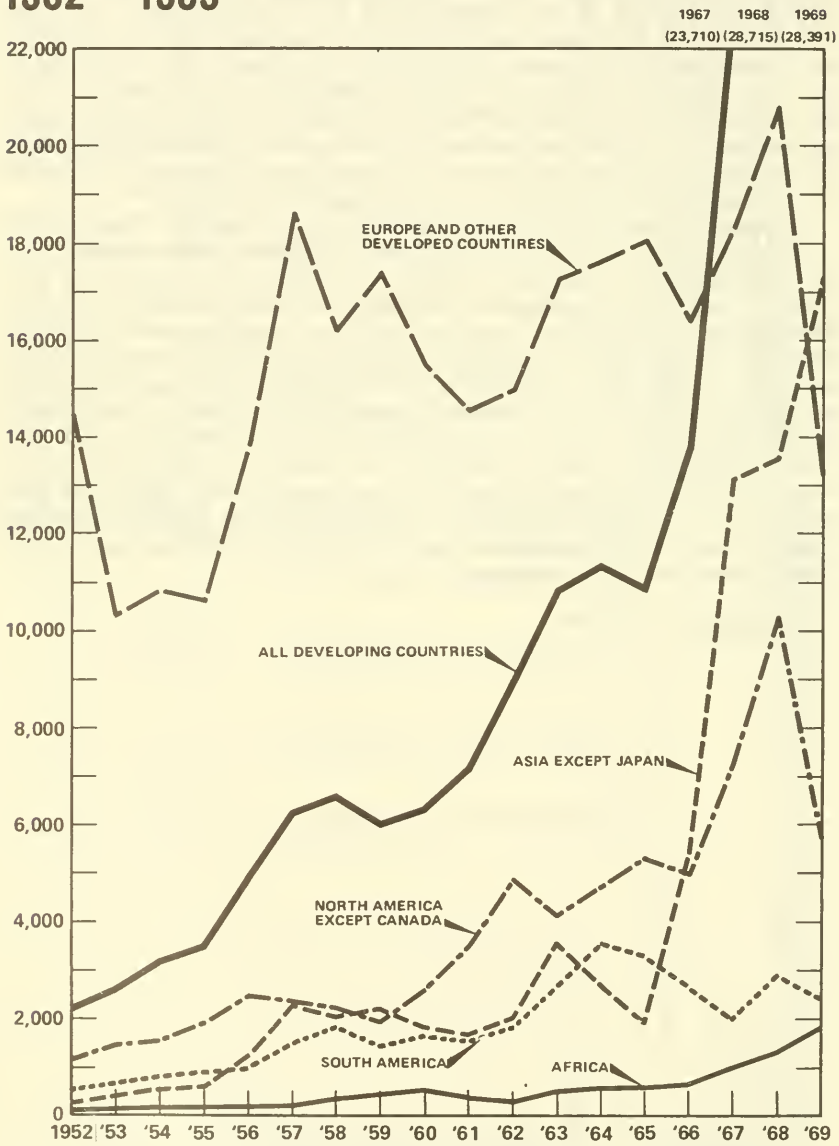
[178] Henderson, op. cit., p. 29.
[179] Ibid., p. 30.

Figure 1

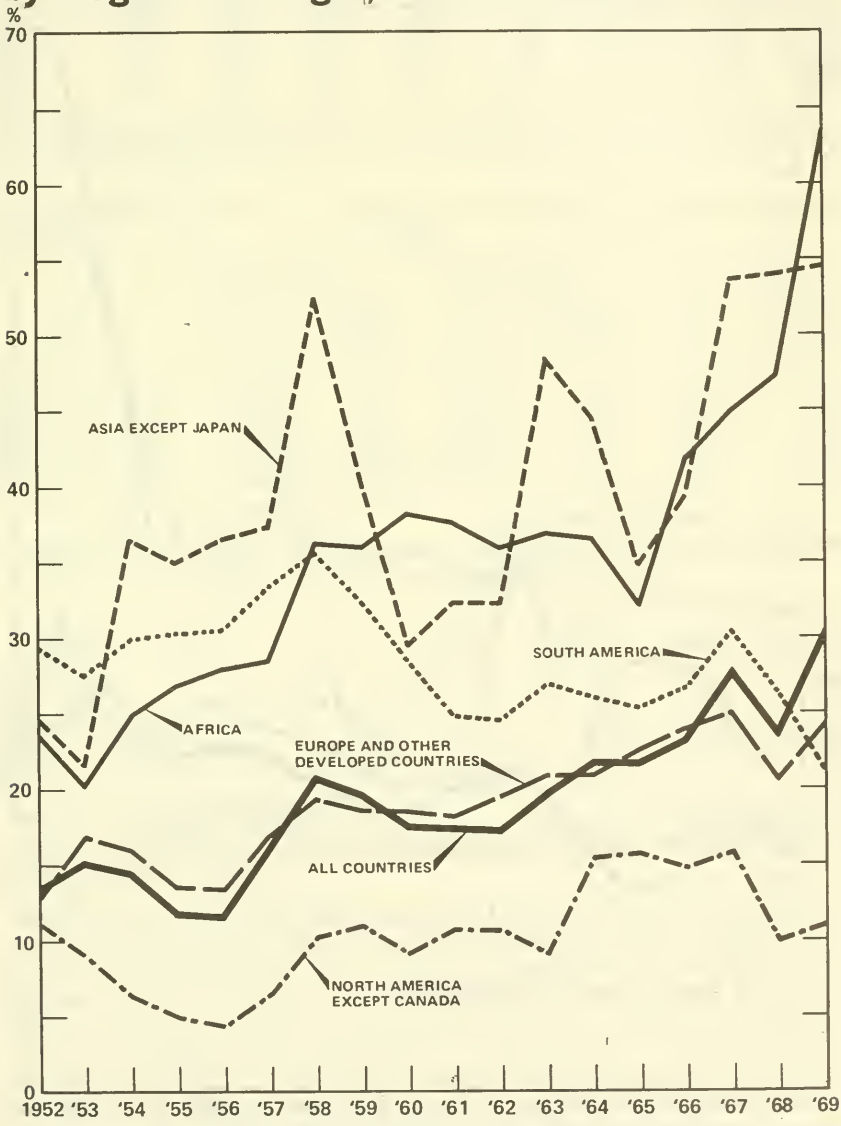
Annual Number of "Professional, Technical and Kindred Workers" Immigrating into the United States by Region of Origin, 1952 - 1969



Source: Gregory Henderson, *Emigration of Highly-Skilled Manpower from the Developing Countries,* United Nations Institute for Training and Research (UNITAR), New York, 1970. P. 196. (U.S. Annual Immigration Reports, 1952-1969.)

Figure 2

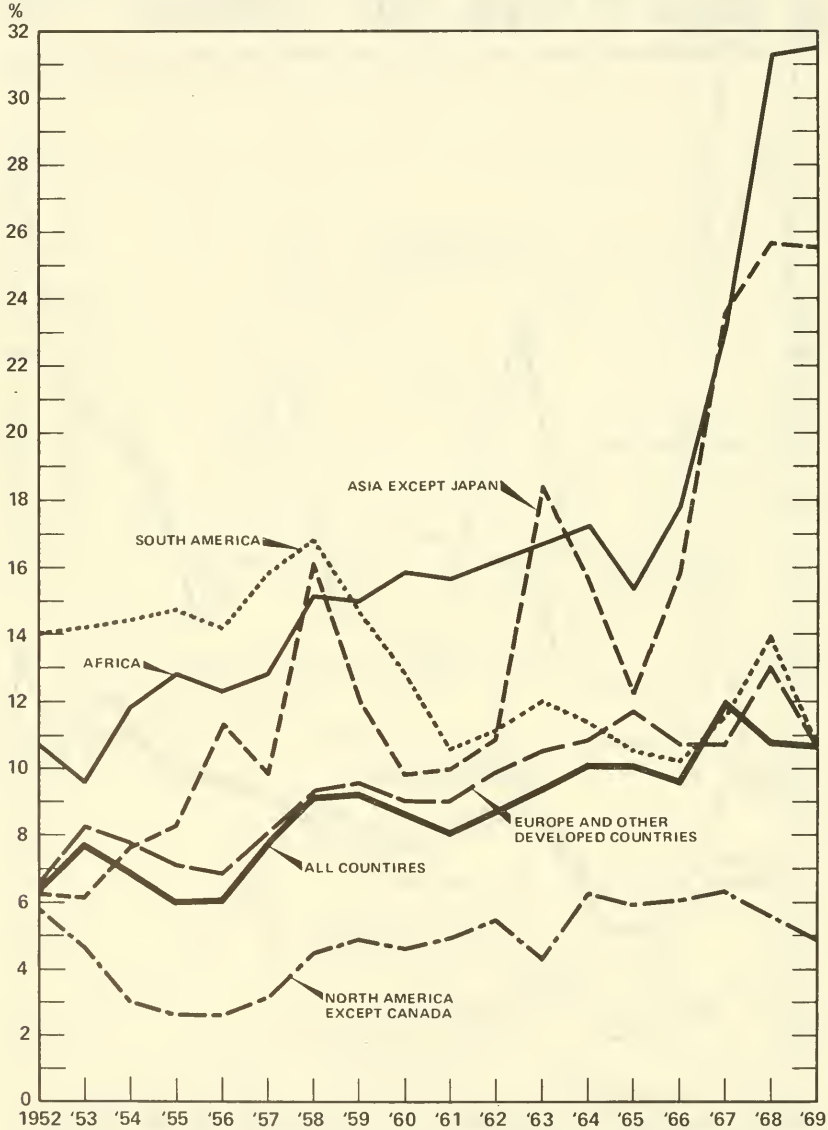
Percentage of "Professional, Technical and Kindred Workers" Out of Immigrants with Occupation Admitted into the United States by Region of Origin, 1952 - 1969



Source: Gregory Henderson, *Emigration of Highly-Skilled Manpower from the Developing Countries*, United Nations Institute for Training and Research (UNITAR), New York, 1970. p. 197. (The Annual Reports, 1952-1967.)

Figure 3

Percentage of "Professional, Technical and Kindred Workers" Out of Total Immigrants into the United States by Region of Origin, 1952 - 1969



Source: Gregory Henderson, *Emigration of Highly-Skilled Manpower from the Developing Countries,* United Nations Institute for Training and Research (UNITAR), New York, 1970. p. 198. (The Annual Reports, 1952 1967, of U.S. Immigration, cited from S. Watanabe, Economic Branch, ILO, Geneva, "Brain Drain from Developing to Developed Countries", April 1968.)

TABLE 7.—IMMIGRATION INTO THE UNITED STATES OF SCIENTISTS, ENGINEERS, AND PHYSICIANS, FISCAL YEARS 1956, 1962–67.

A.—ANALYSIS OF IMMIGRATION INTO THE UNITED STATES OF SCIENTISTS, ENGINEERS, AND PHYSICIANS, FISCAL YEARS 1956, 1962–67

Fiscal year	Total		Scientists		Engineers		Physicians	
	Number	Index (1956=100)	Number	Index (1956=100)	Number	Index (1956=100)	Number	Index (1956=100)
1956	5,373	100.0	1,022	100.0	2,804	100.0	1,547	100.0
1962	5,956	110.8	1,104	108.0	2,940	104.8	1,912	123.6
1963	7,896	147.0	1,612	157.7	4,014	143.2	2,270	146.7
1964	7,810	145.4	1,676	164.0	3,725	132.8	2,409	155.7
1965	7,198	134.0	1,549	151.6	3,455	123.2	2,194	141.8
1966	9,534	177.4	1,852	181.2	4,921	175.5	2,761	178.5
1967	15,272	284.2	2,893	283.1	8,822	314.6	3,557	229.9

Note: Developed countries include the European countries, Canada, Japan, South Africa, Australia, and New Zealand. Developing countries are all other countries.

B.—IMMIGRATION INTO THE UNITED STATES OF SCIENTISTS, ENGINEERS, AND PHYSICIANS, FISCAL YEARS 1956, 1962–67

Fiscal year	Total, all countries		Developed countries		Developing countries	
	Number	Percent of total	Number	Percent of total	Number	Percent of total
1956	5,373	100	3,604	67.1	1,769	32.9
1962	5,956	100	3,573	60.0	2,383	40.0
1963	7,896	100	4,534	57.4	3,362	42.6
1964	7,810	100	4,607	59.0	3,203	41.0
1965	7,198	100	4,548	63.2	2,650	36.8
1966	9,534	100	5,144	54.0	4,390	46.0
1967	15,272	100	7,359	48.2	7,913	51.8

C.—PERCENTAGE SHARE OF DEVELOPING COUNTRIES IN IMMIGRATION INTO UNITED STATES OF SCIENTISTS ENGINEERS, AND PHYSICIANS, FISCAL YEARS 1956, 1962–67

Fiscal year	Total, 3 groups	Scientists	Engineers	Physicians
1956	32.9	34.9	25.4	45.2
1962	40.0	26.9	33.5	57.6
1963	42.6	34.9	40.9	51.0
1964	41.0	32.6	36.8	53.3
1965	36.8	27.0	30.4	53.8
1966	46.0	41.2	40.9	58.5
1967	51.8	50.9	47.9	62.2

Source: U.S. Congress, House, Committee on Government Operations, Hearing, "The Brain Drain of Scientists, Engineers, and Physicians from the Developing Countries into the United States," Before the Subcommittee on Research and Technical Programs, 90th Cong., 2d sess., 1968, p. 2.

In giving further statistical support for the shifting trend in professional immigration to the United States from the LDCs, Mr. Henderson points out that the number of immigrating scientists and engineers born in Europe (presumably for 1969) declined almost to half while those born in Asia rose from 4,400 to 5,300. Those born in Africa increased by 56 percent over the number in 1968. Of 2,756 physicians, 1,600 came from Asia alone. The proportion of engineers, scientists, and medical personnel immigrating from the LDCs in 1969, he indicates, was about 60 percent or more. Entry of PTKs from the

LDCs in 1968 occurred at about twice the rate of such entries during the seven preceding years. Moreover, Henderson observes, scientists, engineers, and medical personnel among the immigrants from the LDCs in 1967 and 1968 totaled more than half the 40,000 fellowships granted since World War II by the United Nations Development Program and its predecessors to nations of low-income countries to study abroad for essential occupations at home, and more than those who had been trained at home during an average year for that period.[180]

Within these overall percentages, Mr. Henderson continues, the immigration of scientists to the United States from the LDCs rose nearly 10 times and that of engineers nearly 6 times between 1956 and 1967 with further increases by 1968. A number of individual countries showed an even more striking increase. The immigration of engineers, scientists, and medical personnel from China (Taiwan) rose from 47 in 1956 to 1,321 in 1967; in the case of India from 100 to 1,415; and in that of the Philippines from 90 to 1,066 in 1967 and 3,153 in 1968. As a region, Africa began to show a remarkable increase. In 1969, Africa surpassed South America in professional migration for the first time and did so almost two to one.

Thus, Henderson sums up, scientists from the LDCs made up an increasing part of the total American immigration. Moreover, in 1967, they constituted about 13 percent of the addition to the ranks of American scientists. Engineers from the LDCs constituted about 8 percent of the annual additions to the supply of American engineers. The total figure for engineers emigrating from the LDCs was placed at 4,229, that is, 28 percent larger in number than the total increase of 3,305 American engineers in 1967.[181]

PROFESSIONAL IMMIGRATION TO THE UNITED STATES, TRENDS THROUGH THE FISCAL YEAR 1970

Recently published data by the National Science Foundation on the immigration of scientists, engineers, and physicians from abroad reaffirm the continued increase in the immigration of professionals and the continued regional shift to the LDCs as the source of growing immigration. (See Figures 4 and 5, and Table 8.) The NSF report entitled, "Scientists, Engineers, and Physicians from Abroad: Trends through Fiscal Year 1970," highlights its compilation of statistical data and interpretive analysis with these generalizations.[182]

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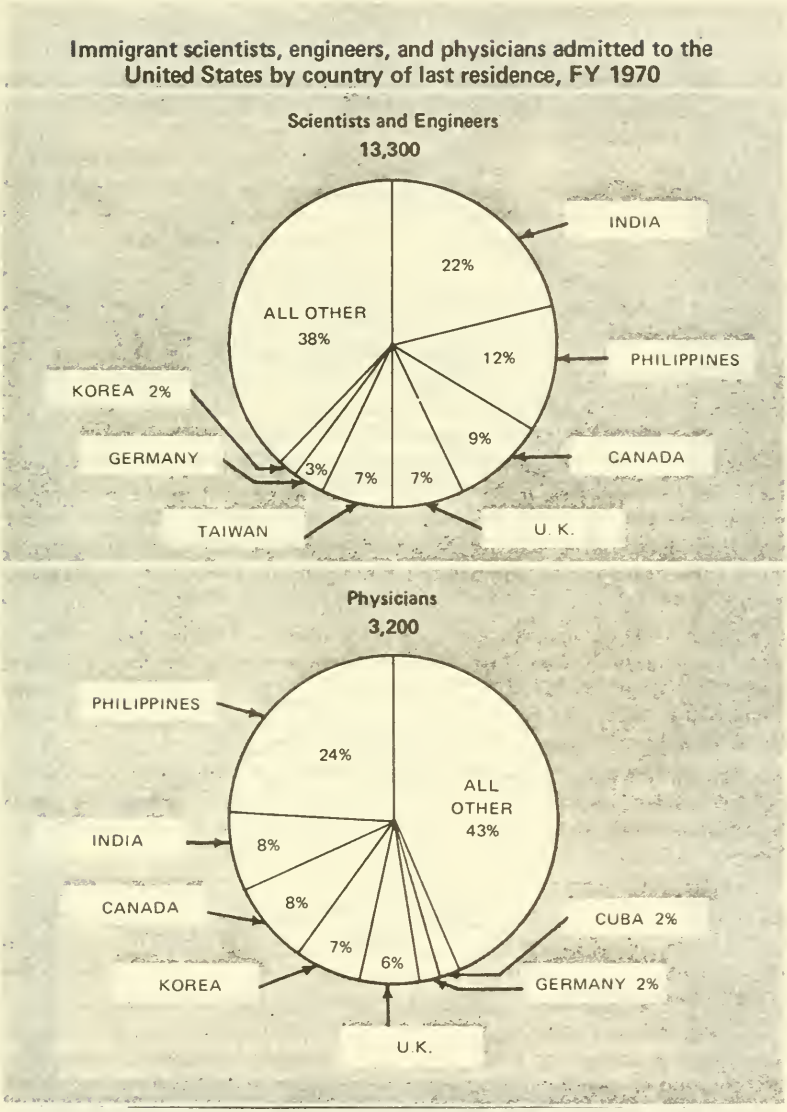
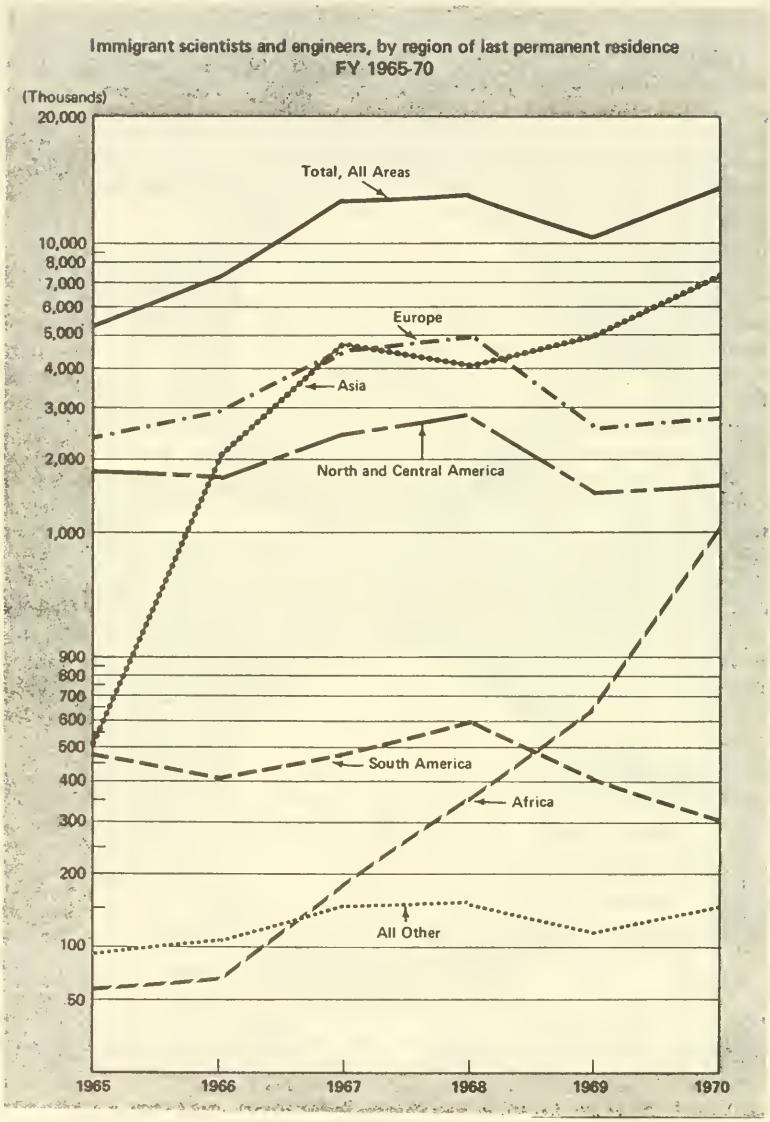
[180] Ibid., p. 30.
[181] Ibid., p. 31.
[182] National Science Foundation, *Scientists, Engineers, and Physicians from Abroad: Trends through Fiscal Year 1970*, 1972, pp. vi–vii. (Surveys of Science Resources Series, NSF 72–312). (Hereafter cited as, NSF, *Survey of Scientists, Engineers, and Physicians from Abroad*, 1972.)

Figure 4



Source: National Science Foundation, Scientists, Engineers, and Physicians from Abroad: Trends Through Fiscal Year 1970, 1972, p. 3. (From data of the Immigration and Naturalization Service, U.S. Department of Justice.)

Figure 5



Source: National Science Foundation, Scientists, Engineers, and Physicians from Abroad: Trends Through Fiscal Year 1970, 1972, p. 2. (From data of the Immigration and Naturalization Service, U.S. Department of Justice.)

The first major category of the survey pertains to immigrant scientists and engineers admitted to the United States. In the fiscal year 1970, 13,300 entered the United States, a record for the past 20 years. This figure represented an increase by one-third more than in 1969 and two and one-half times the number in 1965. Preliminary data available for fiscal year 1971 show 13,100 immigrant scientists and engineers. The figure for physicians also increased, but less dramatically, from 2,000 in 1965 to nearly 3,000 yearly in the next 5 years. Increases over the 1965 levels occurred as a result of amendments to the immigration law made effective in October 1965.

The contributions of immigrant natural scientists and engineers are seen in the fact that they equal 20 percent of the net addition to science and engineering employment since 1965, up from less than 10 percent in the period 1950–64.

The data also show a decided shift towards the LDCs of Asia. More than half of the immigrant scientists and engineers in 1970, an unprecedented 7,500, had last resided in Asia. In 1965, the last year under the old immigration law, only 10 percent of a much smaller number were from Asia. The increment of 2,900 Indian scientists and engineers for 1970 was substantial. Indians were the largest number admitted from any country over the last 20 years, as were the nearly 800 physicians from the Philippines in both 1969 and 1970. The stress on Asia is also seen in the statistics indicating that, among the 3,800 immigrant scientists and engineers in 1970 who had been born in one country and last resided elsewhere before entering the United States, there were 740 born in mainland China, 360 in Pakistan, and 620 in India.[183]

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[183] Ibid., p. 4.

TABLE 8.—IMMIGRANT SCIENTISTS, ENGINEERS, PHYSICIANS, AND SURGEONS, FISCAL YEARS 1949–70

Fiscal year	Total scientists and engineers	Engineers [1]	Natural scientists [1]	Social scientists [1]	Physicians and surgeons
1949	[2] 1,369	956	413	NA	1,148
1950	[2] 2,045	1,279	766	NA	1,848
1951	[2] 2,098	1,591	507	NA	1,387
1952	3,449	2,399	805	245	1,201
1953	2,866	2,064	654	148	845
1954	3,336	2,400	800	136	1,040
1955	3,002	2,071	791	140	1,046
1956	3,952	2,804	986	162	1,388
1957	6,046	4,547	1,345	154	1,990
1958	5,380	4,032	1,212	136	1,934
1959	5,290	3,950	1,188	152	1,630
1960	4,550	3,354	1,043	153	1,574
1961	4,171	2,890	1,102	179	1,683
1962	4,297	2,940	1,165	192	1,797
1963	5,933	4,014	1,688	231	2,093
1964	5,762	3,725	1,754	283	2,249
1965	5,345	3,446	1,597	302	2,012
1966	7,205	4,915	1,949	341	2,549
1967	12,523	8,821	3,158	544	3,325
1968	12,973	9,313	3,110	550	3,060
1969	10,255	7,150	2,601	504	2,756
1970	13,337	9,305	3,264	768	3,155

[1] Includes professors and instructors.
[2] Total excludes a small number of social scientists for whom data are not available.

Source: National Science Foundation, "Scientists, Engineers, and Physicians From Abroad: Trends Through Fiscal Year 1970." (Washington, 1972), p. 1. (Based on data of the Immigration and Naturalization Service, U.S. Department of Justice.)

Many immigrants in this category fulfill the immigration requirement by taking up the required 2-year residency in Canada or elsewhere other than their place of birth before reentering the United States. Data for 1970, for example, reveal that Canada was by far the major "way-station" for those born in one country and last resident in another. There were 1,000 such persons. Among this group were 260 born in India, 150 in United Kingdom, and 110 in Eastern Europe. Thus, the statistics for "way-stations" such as Canada and the United Kingdom—both regarded in this study as advanced countries—may include a substantial number of Asians, Africans, and others from the LDCs who are not accounted for in the statistics for the country of emigration according to nationality. The 260 professionals born in India may hence be carried on immigration statistics as coming from "Canada," not "India." NSF data for the fiscal year 1972 reveal that some 55 percent (243 of 439) of immigrant FMGs reporting Canada as the last place of permanent residence were actually from Asia; 92 or 21 percent were from India alone. Similarly, 69 percent (251 of 364) of those from the United Kingdom listed their country of birth as an Asian country: 179 or 49 percent were from India, and 12 percent from Africa, primarily Egypt. The inflows from the LDCs, therefore, may be considerably more than what is sometimes actually recorded. This fact should be kept in mind throughout this study when considering the drain-off of scientists, engineers, physicians, and surgeons from the LDCs, particularly in instances where differentiation between place of "last permanent residence" and "country or region of birth" is ambiguous.

TABLE 9.—SCIENTISTS, ENGINEERS, PHYSICIANS, AND SURGEONS WHO CHANGED FROM NONIMMIGRANT STATUS TO IMMIGRANT STATUS IN FISCAL YEAR 1970, BY YEAR OF NONIMMIGRANT ENTRY AND BY OCCUPATIONAL GROUP

Year of nonimmigrant entry	Scientists and engineers			Physicians and surgeons
	Total	Engineers	Scientists	
Adjusted to immigrant	5,470	3,636	1,834	890
Year of entry:				
Before 1960	105	50	55	50
1960–64	1,250	718	532	362
1965	637	383	254	72
1966	890	638	252	84
1967	1,107	839	268	103
1968	985	677	308	132
1969	456	300	156	86
1970	40	31	9	1

Source: National Science Foundation, "Scientists, Engineers, and Physicians From Abroad: Trends Through Fiscal Year 1970," 1972, p. 7. (Based on data of the Immigration and Naturalization Service, U.S. Department of Justice.)

TABLE 10.—SCIENTISTS, ENGINEERS, PHYSICIANS, AND SURGEONS ADJUSTED TO IMMIGRANT STATUS, BY STATUS AT ENTRY AND BY COUNTRY OR REGION OF BIRTH, FISCAL YEAR 1970

Occupation and status	All countries	Europe	Asia	North and Central America	South America	Africa	All others
Scientists and engineers	13,337	2,908	8,294	655	236	1,107	137
Adjustment of status	5,470	807	4,382	45	1	189	46
As percent of total	41.0	27.8	52.8	6.9	.4	17.1	33.6
Engineers	9,305	2,000	5,990	387	158	702	68
Adjustment of status	3,636	558	2,936	20	1	99	22
As percent of total	39.1	27.9	49.0	5.2	.6	14.1	32.4
Natural scientists	3,264	702	1,899	193	57	352	61
Adjustment of status	1,463	192	1,172	18	----------	59	22
As percent of total	44.8	27.4	61.7	9.3	----------	16.8	36.1
Social scientists	768	206	405	75	21	53	8
Adjustment of status	371	57	274	7	----------	31	2
As percent of total	48.3	27.7	67.7	9.3	----------	58.5	25.0
Physicians and surgeons	3,155	550	1,942	236	148	254	25
Adjustment of status	890	126	679	43	----------	39	3
As percent of total	28.2	22.9	35.0	18.2	----------	15.4	12.0

Note: Data include professors and instructors.

Source: National Science Foundation, "Scientists, Engineers, and Physicians From Abroad: Trends Through Fiscal Year 1970" 1972, p. 7 (based on data of the Immigration and Naturalization Service, U.S. Department of Justice).

TABLE 11.—SCIENTISTS AND ENGINEERS ADMITTED TO THE UNITED STATES AS NONIMMIGRANTS, BY CATEGORY AND REGION OF LAST PERMANENT RESIDENCE,[1] FISCAL YEARS 1965[2]–70

Nonimmigrant category	Region of last permanent residence						
	All regions	Europe	Asia	North and Central America	South America	Africa	All other areas
1970							
Total nonimmigrants	6,050	2,701	1,259	1,049	671	183	187
Exchange visitors	4,228	1,982	907	412	605	166	156
Other nonimmigrants[3]	1,822	719	352	637	66	17	31
1969							
Total nonimmigrants	5,362	2,446	1,313	788	460	182	173
Exchange visitors	3,975	1,787	1,175	342	379	163	129
Other nonimmigrants[3]	1,387	659	138	446	81	19	44
1968							
Total nonimmigrants	5,633	2,591	1,568	707	395	185	187
Exchange visitors	4,130	1,839	1,258	367	347	180	139
Other nonimmigrants[3]	1,503	752	310	340	48	5	48
1967							
Total nonimmigrants	5,379	2,494	1,350	697	424	244	170
Exchange visitors	4,141	1,820	1,210	383	360	235	133
Other nonimmigrants[3]	1,238	674	140	314	64	9	37
1966							
Total nonimmigrants	5,457	2,291	1,451	673	457	([4])	[4] 585
Exchange visitors	4,335	1,859	1,164	364	412	([4])	[4] 536
Other nonimmigrants[3]	1,122	432	287	309	45		49
1965							
Total nonimmigrants	5,323	2,133	1,458	770	440	348	174
Exchange visitors	4,214	1,677	1,294	379	390	327	147
Other nonimmigrants[3]	1,109	456	164	391	50	21	27

[1] 1 yr. or more.
[2] Although data for 1965 are available only on a calendar year basis, they appear to be largely consistent with what fiscal year data could be expected to show.
[3] Includes temporary workers of distinguished merit and ability, temporary workers performing services unavailable in the United States, and industrial trainees.
[4] Data for Africa, not separately available, included with all other areas.

Source: National Science Foundation, "Scientists, Engineers, and Physicians From Abroad: Trends Through Fiscal Year 1970," 1972, p. 12 (based on data of the Immigration and Naturalization Service, U.S. Department of Justice).

TABLE 12.—PHYSICIANS AND SURGEONS ADMITTED TO THE UNITED STATES AS NONIMMIGRANTS, BY CATEGORY AND REGION OF LAST PERMANENT RESIDENCE,[1] FISCAL YEARS 1965[2]–70

Nonimmigrant category	Region of last permanent residence						
	All regions	Europe	Asia	North and Central America	South America	Africa	All other areas
1970							
Total nonimmigrants	5,365	1,498	2,308	838	451	150	120
Exchange visitors	5,008	1,235	2,294	784	443	138	114
Other nonimmigrants[3]	357	263	14	54	8	12	6
1969							
Total nonimmigrants	4,759	1,261	2,216	684	363	119	116
Exchange visitors	4,460	1,029	2,191	652	360	115	113
Other nonimmigrants[3]	299	232	25	32	3	4	3
1968							
Total nonimmigrants	5,997	1,424	3,286	708	370	126	83
Exchange visitors	5,701	1,176	3,268	684	367	125	81
Other nonimmigrants[3]	296	248	18	24	3	1	2
1967							
Total nonimmigrants	5,631	1,509	3,079	605	208	101	129
Exchange visitors	5,264	1,234	3,067	532	204	100	127
Other nonimmigrants[3]	367	275	12	73	4	1	2
1966							
Total nonimmigrants	4,553	1,008	2,567	588	212	(4)	[4] 178
Exchange visitors	4,370	896	2,543	546	211	(4)	[4] 174
Other nonimmigrants[3]	183	112	24	42	1	(4)	[4] 4
1965							
Total nonimmigrants	4,114	994	2,171	564	182	84	119
Exchange visitors	3,904	849	2,154	523	181	81	116
Other nonimmigrants[3]	210	145	17	41	1	3	3

[1] 1 yr. or more.
[2] Although data for 1965 are available only on a calendar year basis, they appear to be largely consistent with what fiscal year data could be expected to show.
[3] Includes temporary workers of distinguished merit and ability, temporary workers performing services unavailable in the United States, and industrial trainees.
[4] Data for Africa, not separately available, included with all other areas.

Source: National Science Foundation, Scientists, Engineers, and Physicians From Abroad: Trends Through Fiscal Year 1970," 1972, p. 12 (based on data of the Immigration and Naturalization Service, U.S. Department of Justice).

The inflow of nonimmigrant scientists and engineers, the next major category and to be distinguished from the immigrant, for 1970 was 6,100, an increase from 5,300 in 1965. (See Tables 9–12.) Of these, 4,000 to 4,300 yearly were exchange visitors. The remainder were temporary workers performing services unavailable in the United States, workers of distinguished merit and ability, and industrial trainees.

Within this nonimmigrant category, foreign science and engineering students rose from 56,800 in 1967 to 72,100 in 1970. Foreign medical students numbered 2,000 to 2,100 yearly. Again, stress on Asia as a manpower source is evident: More than 50 percent of the science and engineering students and about 40 percent of the medical students come from Asian countries.

Another significant indicator within the nonimmigrant category is the number of foreign (that is, non-U.S. citizen) recipients of doctorates in science and engineering from universities in the United States. The number within this category increased 222 percent between 1960 and 1970, from 1,000 to 3,000 yearly. (American citizens receiving similar advanced degrees increased at a lesser magnitude of 182 percent, from 5,100 to 14,300.) Over the same period, the numbers of foreign holders of the Ph. D. in science and engineering intending to remain in the United States for postdoctoral work and study increased from 50 percent to 59 percent of the annual total of foreign recipients of American doctorates. The increased emphasis on Asia is again reflected in the geographic distribution of the doctorates. Recipients from Asia increased from 44 percent to 49 percent of the total. China and India accounted for about 70 percent of this increase. The European recipients, while increasing in numbers, remained at about 12 percent of the total for both years.[184]

What is significant about these statistics in the nonimmigrant category is that here lies a potential source for brain drain through the international educational route. Substantial numbers in this category adjust their status from alien to immigrant and thus gain permanent residency. In the fiscal year 1965, before the revised immigration law of 1965 took effect, fewer than 600 of the 5,300 immigrant scientists and engineers were former nonimmigrant visa holders. In 1966, the change-of-status group accounted for most of the increase in science-engineer immigrants, that is, 1,700 of 1,900. The number of changes-in-status increased even more in succeeding years, totaling 5,500 by 1970. In that year, they accounted for 61 percent of the increase in immigrant scientists and engineers over that for 1965. (See Tables 9–11.)[185]

Moreover, persons from the LDCs of Asia are more likely to take advantage of this route. According to the NSF study, the bulk of the change-of-status scientists and engineers in 1969 and 1970, as in previous years, were from Asia. Asians numbered 2,900 in 1969, and increased to 4,400 in 1970. In 1969, former nonimmigrants from Europe numbered only 470 and then increased in 1970 to 810. Both regions combined were the source of more than 90 percent of change-of-status scientists and engineers. And for both regions, students were by far the largest of the groups of former nonimmigrants. Asia also accounted for by far the largest proportion of the change-of-status physicians with 80 percent in 1969 and 76 percent in 1970. In addition, substantial percentages of scientists, engineers and physicians from LDCs other than those in Asia adjusted to immigrant status in the fical year 1970. Of a total of 1,107 African scientists and engineers, 189 (or 17.1 percent) adjusted their status. Of the 137 cited in the "All others" cate-

[184] Ibid., p. 15.
[185] Ibid., p. 6.

gory, that is, except Europe, Asia, North and Central America, South America and Africa, 46 (or 33.6 percent) adjusted their status.[186]

A final category highlighted in the NSF study that provides further evidence of the magnitude of talent migration to the United States is that of foreign-born scientists in this country. About 22,900 or 8 percent of all scientists in the National Register of Scientific and Technical personnel in 1970 (total registry, 270,000) had been born abroad and had also received their secondary education abroad. Nearly 63 percent held Ph. D.s and about one-half were in research and development, including R. & D. management. (Only 39 percent of the American-born scientists had Ph. D.s.)

Europe is strongly represented in the Register with 9,700 scientists, owing to the preeminence of the European orientation of immigration in the early postwar years. Though fewer in number, those from Asia still are a substantial representation of 6,600. North and Central America have 3,300. (Presumably mostly Canadians.) Nearly two-thirds of the Europeans held doctorates, while over three-fifths of the Asians and North and Central Americans held doctorates.[187]

Other regions of the world than Asia falling within the LDC category are also represented in the NSF statistics on foreign-born scientists in the 1970 Register. Africa is listed with a total of 596 scientists at all degree levels, that is, Ph. D., M.A., and baccalaureate; South America with 556; North and Central America lumped together with 3,277 (presumably the largest percentage is from Canada); and other areas of the world, 2,165.[188]

Thus, National Science Foundation data on the migration of scientists, engineers and physicians to the United States through fiscal year 1970 corroborate the judgments of those who contend that professional immigration to the United States is increasing and that nations of the LDCs are making a progressively greater contribution to that increase.

NSF "HIGHLIGHTS" ON IMMIGRANT SCIENTISTS AND ENGINEERS, PHYSICIANS AND SURGEONS, FISCAL YEAR 1972

On August 20, 1973, the National Science Foundation published an analysis of data on immigrant scientists, engineers, physicians, and surgeons for the fiscal year 1972.[189] According to the report, 11,300 immigrant scientists and engineers were admitted to the United States in the fiscal year 1972, 14 percent below the 13,100 in the fiscal year 1971 and still further below the 13,300 that entered in 1970. Reflected in the 1972 figures was a reduction in numbers for almost all countries in both Eastern and Western Hemispheres. (See Figure 6 and Table 13.) The 7,100 immigrant physicians and surgeons entering in 1972 was the largest inflow in the past two decades. In 1972, 5,700 entered. Figures for 1971 and 1972 contrast sharply with the earlier yearly inflows of no more than 3,300. All regions of the world contributed to this increase for 1972, particularly the LDCs.[190]

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[186] Ibid., p. 7.
[187] Ibid., pp. 17–19.
[188] Ibid.
[189] National Science Foundation, Science Resources Studies Highlights, *Immigrant Scientists and Engineers Decline in Fiscal Year 1972, Physicians Increase Sharply,* Aug. 20, 1973, 4 pp. (Prepared in Manpower Utilization Studies Group, Division of Science Resources Studies). Hereafter cited as, NSF, *Highlights, August 1973.*
[190] Ibid., p. 1.

Figure 6

Immigrant Scientists, Engineers, Physicians, and Surgeons, by Broad Occupational Group, FY 1967 - 1972

Source: National Science Foundation, Science Resources Studies Highlights, *Immigrant Scientists and Engineers Decline in FY 1972, Physicians Increase Sharply,* August 20, 1973, p. 1. (From data of the Immigration and Naturalization Service, U.S. Department of Justice.)

TABLE 13.—SCIENTISTS, ENGINEERS, PHYSICIANS, AND SURGEONS ADMITTED TO THE UNITED STATES AS IMMIGRANTS, BY COUNTRY OR REGION OF BIRTH, FISCAL YEARS 1971 AND 1972

Country or origin of birth	Fiscal year 1971					Fiscal year 1972				
	Scientists and engineers				Physicians and surgeons	Scientists and engineers				Physicians and surgeons
	Total	Engineers	Natural scientists	Social scientists		Total	Engineers	Natural scientists	Social scientists	
All countries	13,102	9,015	3,456	631	5,748	11,323	7,436	3,271	616	7,143
Europe	1,885	1,240	485	160	561	1,710	981	534	195	654
Western Europe	1,346	914	328	104	335	1,184	690	376	118	440
Germany	163	98	51	14	33	153	93	42	18	54
Greece	165	105	41	19	52	114	72	30	12	76
United Kingdom	462	322	115	25	58	413	231	143	39	77
Other	556	389	121	46	192	504	294	161	49	233
Eastern Europe	539	326	157	56	226	526	291	158	77	214
North and Central America	797	478	250	69	349	655	341	277	37	362
Canada	280	158	87	35	66	177	86	72	19	103
Other	517	320	163	34	283	478	255	205	18	259
South America	319	213	76	30	259	278	175	76	27	264
Ecuador	47	29	16	2	39	32	21	11		25
Colombia	92	67	20	5	85	90	59	25	6	80
Other	180	117	40	23	135	156	95	40	21	159
Asia	9,423	6,703	2,409	311	4,380	8,155	5,657	2,193	305	5,558
Near and Middle East	602	439	126	37	434	556	374	136	46	683
Far East	8,821	6,264	2,283	274	3,946	7,599	5,283	2,057	259	4,875
China	897	501	366	30	207	660	383	244	33	274
India	4,226	3,267	864	95	1,057	3,567	2,598	885	84	1,802
Korea	450	268	142	40	999	546	368	134	44	810
Pakistan	630	531	91	8	161	491	367	108	16	260
Philippines	1,528	1,096	396	36	1,040	1,540	1,165	340	35	831
Other	1,090	601	424	65	482	795	402	346	47	898
Africa	589	331	204	54	222	433	249	147	37	259
United Arab Republic (Egypt)	387	204	155	28	146	239	126	98	15	115
Other	202	127	49	26	76	194	123	49	22	144
All other areas	89	50	32	7	17	92	33	44	15	46

Note: Data include professors and instructors.

Source: National Science Foundation, Science Resources Studies Highlights, "Immigrant Scientists and Engineers Decline in Fiscal Year 1972, Physicians Increase Sharply," Aug. 20, 1973, p. 2 (from data of the Immigration and Naturalization Service, U.S. Department of Justice).

The major factor in the decline in immigrant scientists and engineers in 1971 and 1972 was believed to be the revision of regulations by the Department of Labor after February 4, 1972 to require certification of scientists and engineers for employment. Certification is given if the alien's employment does not adversely affect wages and working conditions of domestic workers similarly employed and if he has a job offer for which domestic workers are not available.

A striking feature of the immigration of scientists and engineers in 1972 is the continuation of the trend towards the entry of large numbers from Asia, that is, the "Far East, Near and Middle East"—more than 7 of every 10 immigrants. Of the 8,200 Asian immigrants 3,567 were from India and 1,540 from the Philippines. The inflow from India was about 16 percent below its 1971 total: the 1972 influx from the Philippines was about the same as that for 1971. The 21 percent increase from Korea was the only substantial increased inflow from either the Eastern or Western Hemisphere.[191]

Of the total 11,323 scientists and engineers in the fiscal year 1972, 9,581 appear to have been drawn from the LDCs. In the fiscal year 1971, 11,102 of the total of 13,102 scientists and engineers seem to have had LDCs as their country source. In the fiscal year 1971, only 2,000 of the total of 13,102 scientists and engineers entered from Germany, the United Kingdom, "other" countries of Western Europe, Eastern Europe, and Canada. In the fiscal year 1972, the total for these countries declined to 1,773 of the 11,323 entering.

The immigration of physicians and surgeons between 1971 and 1972 increased by 24 percent, from 5,748 in 1971 to 7,143 in 1972. In great measure this rise reflects the increase of 24 percent in the inflow from the Far East, from 3,946 to 4,875. By far the largest number of immigrants from any country in any year came from India, a growth of 70 percent between 1971 (1,057) and 1972 (1,802). The Philippine and Korean inflows, though still substantial, each decreased nonetheless, about 20 percent, from 1,040 in 1971 to 831 in 1972 for the Philippines and from 999 to 810 for Korea. The 57 percent increase in physicians and surgeons from the Near and Middle East (434, 1971; 683, 1972) was caused largely by the increase of inflow from Iran. The inflows from Africa (222, 1971; 259, 1972), Central America (283, 1971; 259, 1972) and South America (259, 1971; 264, 1972) remained largely unchanged.[192] Of the total of 7,143 physicians and surgeons entering in 1972, 6,462 appear to have been from the LDCs. Of the total of 5,748 entering in 1971, 5,213 appear to have been from the LDCs.

In 1971, only 575 physicians and surgeons of the total of 5,748 entered from Germany, the United Kingdom, "Other" Western European countries, Eastern Europe and Canada. In 1972, the number entering from these areas increased but still to a proportionately low 681.

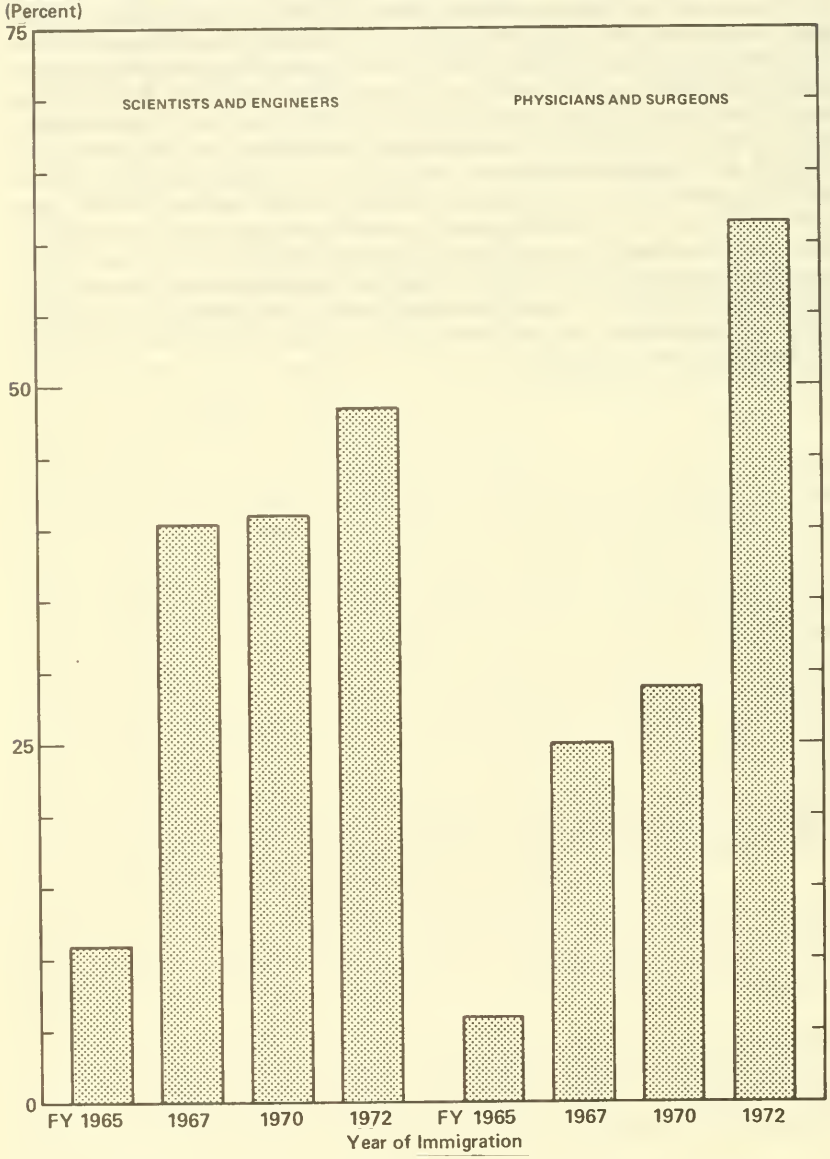
What seems equally significant among the data presented in the NSF report that shows heavy drains from the LDCs is that relating to aliens who adjusted to an immigrant status. This is perhaps one of the best indicators of brain drain through the nonimmigrant international

[191] Ibid., pp. 1–2.
[192] Ibid., p. 2.

educational route, since opting for immigrant status is an unmistakable declaration of intention. According to the NSF report, a record 48 percent of the immigrant scientists and engineers and 61 percent of the physicians and surgeons were already living in the United States as nonimmigrant "temporary" residents at the time they adjusted to immigrant status in 1972. (See Figure 7.) The nonimmigrant category includes students, by far the largest group for immigrant scientists and engineers; exchange visitors, the most numerous among immigrant physicians and surgeons; industrial trainees, conditional entrees, and parolees; and an "other" group, such as visitors and foreign government officials. An indicator of vulnerability to brain drain is the time of residency before opting for immigrant status. Both the nonimmigrants and the scientists, engineers, physicians, and surgeons who adjusted to immigrant status in 1972 had a median residency of less than 3½ years prior to attainment of immigration status. In 1967, this figure had been close to 5½ years for both groups. Thus, over the 5-year period the time for final decision had been reduced by 2 years. This reduced time period for decision suggests the progressive lowering of the threshold before taking the final step of expatriation, but the easing of restrictions on adjustment of status in 1970 should probably be taken into account.

Figure 7

Percent of Immigrant Scientists, Engineers, Physicians, and Surgeons Who Changed from Nonimmigrant Status to Immigrant Status



Source: National Science Foundation, Science Resources Studies Highlights, *Immigrant Scientists and Engineers Decline in FY 1972, Physicians Increase Sharply,* August 20, 1973, p. 4. (From data of the Immigration and Naturalization Service, U.S. Department of Justice.)

As in the past, the LDCs of Asia accounted for the highest percentage of nonimmigrant scientists and engineers (78 percent) and of physicians and surgeons (88 percent) who opted for immigrant status. That student exchange is a source of leakage is shown by the fact that about 62 percent of the Asian scientists and engineers who adjusted their status had formerly been students. Seventy-four percent of the change-of-status doctors and surgeons had been exchange visitors, another source of drain.[193]

Immigration of M.D.s to the United States: A Special Case

The entry of foreign medical graduates (FMGs) is a special case in the immigration of foreign professionals to the United States. (The term "FMG" generally, but not always, refers to foreign medical graduates in all countries *except* Canada and Puerto Rico, whose standards of medical training are equivalent to those in the United States.) An extensive literature both in the public and private domain exists in which all facets of this problem have been surveyed and analyzed in the most minute detail. Reference has already been made to the Margulies-Bloch study of FMGs. Their work has recently been updated and expanded in a study prepared by Rosemary Stevens and Joan Vermeulen of Yale University's Medical School. This study was sponsored by the U.S. Department of Health, Education, and Welfare, printed in June 1972 and released to the public a year later.[194] In addition, the American Medical Association (AMA) publishes periodically a special report on FMGs in the United States; the most recent was published in 1971.[195]

CRITICAL VIEWS ON MEDICAL BRAIN DRAIN

The literature conveys the impression that the United States is vulnerable to criticism as to medical brain drain. Such criticism, much of which comes from within the country, illustrates both the magnitude and seriousness of the problem for domestic medical manpower concerns and more important, for the purposes of this study, for its foreign policy implications. The following are examples:

1. *Gregory Henderson, Harvard University:*

The medical situation is worse. Dr. Ward Darley in the *Journal of the National Medical Association* has observed: 'In the years from 1950 to 1960 almost 10,000, approximately 12 percent of the country's licentiates in medicine, were trained in foreign medical schools.' He also states: 'In 1960, 1,400 foreign-trained physicans were added, or 18 percent of the total number of licentiates for that year.'

"Though all these entered under visitor exchange visas and were thus constrained to leave the United States for at least 2 years after a maximum period of 5 years of study, the Bureau of Immigration and Naturalization between 1958 and 1963 gave 3,636 waivers permitting them to remain in the United States. Dr. H. Van Zile Hyde, former Chief of the Division of International Health of the U.S. Public Health Service, observes that under the education and exchange program, other countries in effect maintain the equivalent of three medical schools to satisfy U.S. domestic medical care demands. In 1961, the United States

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[193] Ibid., p. 4.

[194] Rosemary Stevens and Joan Vermeulen, *Foreign Trained Physicians and American Medicine*, U.S. Department of Health, Education, and Welfare, Bureau of Health Manpower Education, Division of Manpower Intelligence, June 1972, 184 pp. (DEW Publication No. NIH 73–325.)

[195] J. N. Haug and B. C. Martin, *Foreign Medical Graduates in the United States, 1970.* (Chicago; American Medical Association, 1971), 319 pp. (Special Statistical Series; Center for Health Services Research and Development) (Hereafter cited as, AMA, *FMG Study.*)

absorbed into its permanent medical structure almost one-third of the medical graduates of that year from Greece. There are more American-trained Iranian doctors in New York than in all of Iran. Korea, where more than one-half of all sections of the country have not a single doctor with modern medical training, provides 20 anesthesiologists for the staff of one east coast American hospital alone. Filipinos, Turks, Indians—all less healthy than we—must delay advances in their own health standards because we use their resources." [196]

2. *Rosemary Stevens and Joan Vermeulen, Yale University Medical School:*

"In the decade ending June 1971, almost 29,000 physicians entered the United States under immigrant visas, and the number of immigrants admitted in fiscal 1971 alone—5,756 physicians—was equivalent to the output of graduates from 60 American medical schools." [197]

3. *George B. Baldwin, Economic Adviser on Projects of the World Bank:*

"We produced 9,862 doctors in 1956; eleven years later the figure had increased by less than 10 percent. Today approximately one out of three new doctors entering practice in the United States is an immigrant trained abroad." [198]

4. *Dr. Irene Butter, School of Public Health, University of Michigan:*

"A permanent loss of doctors from the poorest to the richest nations is the most disturbing aspect of the medical brain drain. Generally the impression has been conveyed that about four out of every five FMGs in the U.S. eventually return to their native countries. This impression is not confirmed by the data . . . [presented in this article]. Though these data refer to two distinct groups rather than to one population, they indicate that in the two-year period at least four FMGs entered for each departing doctor, and that among departing doctors there is a tendency to return." [199]

5. *Dr. G. Halsey Hunt, Executive Director, Educational Council for FMGs:*

"It is a depressing and humbling experience for an American doctor to visit a medical school in one of the unindustrialized countries of Asia, to have his host open the conversation with a bland statement. 'You people in the United States and your hospitals couldn't get along without our doctors'—and to realize at the present time this is a fact. If the 11,000 foreign graduates who are now occupying internships and residencies in the United States hospitals were to be suddenly withdrawn, many U.S. hospitals would be forced to curtail sharply their services to patients. I submit that for the long run this is a completely untenable situation. By almost any standard of measurement, the United States is the richest country in the world. American standards of medical education, medical research, and hospital practice are among the highest in the world. It ill becomes us to depend indefinitely on other countries for the production of medical manpower to provide services to American patients." [200]

Thus the problem exists, and its gravity has been acknowledged by officials in the Federal Government, by Members of the Congress, and by the Nation's leading medical and health authorities. To reduce its complexities to the simplest form, general illustrative statistics and evaluative data are presented below, mainly from the Stevens-Vermeulen study and the AMA's compilation on FMGs.

ESSENTIAL DATA FROM AMA'S 1971 REPORT ON FMG'S

According to the AMA study, FMGs have played an "important role" in the demand/supply aspect of this Nation's medical services.

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[196] Gregory Henderson, *"Foreign Students: Exchange or Immigration?"* In, U.S. Congress, House, Committee on Education and Labor, *International Education: Past, Present, Problems and Prospects.* Selected Readings to Supplement H.R. 14643, prepared by the Task Force on International Education, 89th Cong., 2d sess., 1966, pp. 350–351. (House Doc. No. 527). (Hereafter cited as, *Selected Readings on International Education,* House Committee on Education and Labor, 1966.)

[197] Stevens and Vermeulen, op. cit., p. 64.

[198] Baldwin, op. cit., p. 370.

[199] Irene Butter, "The Migratory Flow of Doctors to and from the United States," *Medical Care,* 9 (January–February 1971), p. 23.

[200] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills,* (October 1966, pp. 126–127.

As of December 31, 1970, there were 57,217 FMGs in the AMA's registry of physicians in the United States, representing 17.1 percent of the total physician population of 334,028. (See Tables 14 and 15.)[201] There were another 6,174 graduates from Canadian medical schools, bringing the grand total of FMGs, including Canada, to 63,391.[202] (A very small percentage of FMGs—5,972 in 1970—were American-born citizens who, being unable to gain admission to the highly competitive American medical schools, apparently for the want of a sufficient number of schools, went abroad for training and then returned to the United States. However, this number is more than offset by the estimated 10,000 or more FMGs in the United States not included on the AMA registry.)

The FMG population has grown steadily since the 1950's. According to the AMA study, the total physician population has increased by about 8,000 physicians per year since 1963 half of whom are FMGs.[203] Between 1963 and 1970, the absolute number of FMGs in the United States increased 85 percent.[204]

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[201] AMA, *FMG Study*, 1971, p. 3.
[202] Ibid., p. 15.
[203] Ibid., p. 1.
[204] Ibid., p. 3.

TABLE 14.—FOREIGN MEDICAL GRADUATES IN THE UNITED STATES BY COUNTRY OF GRADUATION AND COUNTRY OF BIRTH,[1] DEC. 31, 1970

Country of graduation	Country of birth			
	Total	U.S. born	Not U.S. born	Unknown
Total	52,217	5,972	50,927	318
Afghanistan	19	0	19	0
Algeria	1	0	1	0
Argentina	1,313	4	1,305	4
Australia	325	18	305	2
Austria	1,698	194	1,486	18
Belgium	511	208	301	2
Bolivia	146	0	146	0
Brazil	377	4	371	2
Bulgaria	49	0	49	0
Burma	98	0	98	0
Ceylon	93	0	92	1
Chile	176	7	169	0
China	589	18	567	4
Columbia	952	4	945	3
Congo (Kinshasa)	1	0	1	0
Costa Rica	11	1	10	0
Cuba	2,757	25	2,725	7
Czechoslovakia	554	10	635	9
Denmark	82	3	79	0
Dominican Republic	629	18	609	2
East Germany	745	53	682	10
Ecuador	147	0	147	0
El Salvador	91	0	89	2
Ethiopia	1	0	1	0
Finland	31	2	29	0
France	685	115	564	6
Greece	813	41	768	4
Guatemala	109	0	107	2
Haiti	329	2	326	1
Honduras	49	0	49	0
Hong Kong	105	0	105	0
Hungary	862	21	820	11
Iceland	42	1	41	0
India	3,957	0	3,934	23
Indonesia	89	0	89	0
Iran	1,631	0	1,628	3
Iraq	188	0	188	0
Ireland	924	151	766	7
Israel	214	3	208	3

See footnote at end of table.

TABLE 14.—FOREIGN MEDICAL GRADUATES IN THE UNITED STATES BY COUNTRY OF GRADUATION AND COUNTRY OF BIRTH,[1] DEC. 31, 1970—Continued

Country of graduation	Country of birth			
	Total	U.S. born	Not U.S. born	Unknown
Italy	3,208	1,375	1,810	23
Jamaica	46	2	43	1
Japan	882	29	848	5
Lebanon	615	36	578	1
Malaysia	1	0	1	0
Malta	6	0	6	0
Mexico	1,821	413	1,395	13
Netherlands	726	232	490	4
New Zealand	79	0	78	1
Nicaragua	78	0	77	1
Nigeria	24	0	24	0
North Korea	5	0	5	0
North Vietnam	3	0	3	0
Norway	44	2	42	0
Pakistan	784	0	783	1
Panama	23	1	21	1
Paraguay	76	0	76	0
Peru	618	2	614	2
Philippines	7,352	28	7,306	18
Poland	602	9	590	3
Portugal	107	10	96	1
Rhodesia	1	1	0	0
Romania	317	5	306	6
Senegal	1	0	1	0
Singapore	23	0	22	1
South Africa	356	6	347	3
South Korea	2,095	1	2,093	1
South Vietnam	12	0	12	0
Spain	1,801	622	1,167	10
Sudan	2	0	2	0
Surinan	2	0	2	0
Sweden	54	2	51	1
Switzerland	2,510	1,338	1,155	17
Syria	173	0	173	0
Taiwan (Formosa)	976	3	970	3
Thailand	1,098	1	1,095	2
Turkey	866	1	863	2
Uganda	7	0	7	0
Union of Soviet Socialist Republics	871	16	845	10
United Arab Republic (Egypt)	732	1	728	3
United Kingdom	1,641	667	1,938	36
Uruguay	46	0	46	0
Venezuela	133	2	130	1
West Germany	3,502	253	3,233	16
Yugoslavia	405	11	391	3

[1] Excludes Canadian medical graduates in the United States.

Source: J. N. Haug, and B. C. Martin, "Foreign Medical Graduates in the United States, 1970." (Chicago American Medical Association, 1971), pp. 292-293 (special statistical series; Center for Health Services Research and Development).

TABLE 15.—FOREIGN PHYSICIANS AND SURGEONS ADMITTED TO THE UNITED STATES, FISCAL YEARS 1953–70

Year [1]	Physicians and surgeons admitted to the United States as immigrants	Nonimmigrant physicians and surgeons adjusted to immigrant status	Exchange visitor physicians and surgeons adjusted to immigrant status
1953	845	(2)	(2)
1954	1,040	(2)	(2)
1955	1,046	(2)	(2)
1956	1,388	(2)	(2)
1957	1,990	(2)	(2)
1958	1,934	(2)	(2)
1959	1,630	(2)	(2)
1960	1,574	(2)	(2)
1961	1,683	(2)	(2)
1962	1,797	(2)	(2)
1963	2,093	(2)	(2)
1964	2,249	(2)	(2)
1965	2,012	112	68
1966	2,549	474	347
1967	3,325	841	417
1968	3,060	652	308
1969	2,755	576	333
1970	3,155	890	505

[1] The 1st column indicates all such immigrants by year since 1953. The 2d column is the yearly total of all foreign physicians changed from nonimmigrant to immigrant status during each year since 1965, the earliest year for which such data are available. These numbers are also part of the yearly immigrant totals of the 1st column. The 3rd column shows those changing from exchange visitor—the largest nomimmigrant category—to immigrant status (also since 1965). These numbers are also part of the totals in the 1st and 2d columns.

[2] Not available.

Source: Rosemary Stevens, and Joan Vermeulen, "Foreign Trained Physicians and American Medicine," U.S. Department of Health, Education, and Welfare, Bureau of Health Manpower Education, Division of Manpower Intelligence, June 1972, p. 98. (National Science Foundation, from data of the Immigration and Naturalization Service.)

The LDCs of Asia, Africa, and Latin America are heavily represented in the AMA statistics on FMGs for 1970. (See Tables 14, 16, and 18.) Africa is listed with 1,126 (2 percent), Asia, 21,002 (36.7 percent), and Latin America 9,929 (17.4 percent). Altogether the LDCs representing an FMG population of 32,157 of the total 57,217 or 56.1 percent. European FMGs number 24,756 (43.3 percent), and those from Oceania, 404 (0.7 percent). High on the list of countries from the LDCs are the Philippines with 7,352; India, 3,957; South Korea, 2,095; Mexico, 1,831; Iran, 1,631, and Thailand, 1,098. Those foreign countries where English is the predominant language were represented by only 4,377 FMGs or 7.6 percent of the total FMG population.[205] The language factor is important in considerations of competence and ability to pass the ECFMG examination.

[205] Ibid., p. 5.

TABLE 16.—PERCENT DISTRIBUTION OF PHYSICIANS AND SURGEONS ADMITTED TO THE UNITED STATES AS IMMIGRANTS BY COUNTRY OR REGION OF LAST PERMANENT RESIDENCE, 1957, 1965, AND 1971

Country or region	Fiscal year— 1957	1965	1971
Asia	7.8	10.2	66.6
Canada	12.9	18.9	8.2
Cuba	10.0	10.0	1.7
Mexico	4.8	5.5	.5
South America	11.5	17.3	4.7
United Kingdom	7.1	7.3	4.7
Other Europe	36.6	20.9	8.0
Other	9.3	9.9	5.6
Total	100.0	100.0	100.0
Number	1,990	2,012	5,756

Source: Rosemary Stevens and Joan Vermeulen, "Foreign Trained Physicians and American Medicine," U.S. Department of Health, Education, and Welfare, Bureau of Health Manpower Education, Division of Manpower Intelligence, June 1972 p. 100.

TABLE 17.—MIGRATION OF PHYSICIANS FROM SELECTED COUNTRIES. FISCAL YEAR 1971

Country	Immigrants	Exchange visitors	Total
Argentina	45	125	170
Brazil	17	103	120
Canada	474	311	785
Germany	62	183	245
India	821	692	1,513
Iran	251	150	401
Jamaica	21	205	226
Japan	31	189	220
Korea	965	38	1,003
Mexico	28	183	211
Pakistan	104	162	266
Peru	20	106	126
Philippines	980	385	1,365
Taiwan	199	41	240
Thailand	91	213	304
United Kingdom	268	157	425

Source: Rosemary Stevens, and Joan Vermeulen, "Foreign Trained Physicians and American Medicine," U.S. Department of Health, Education, and Welfare, Bureau of Health Manpower Education, Division of Manpower Intelligence, June 1972. p. 102. (U.S. Department of Justice, Immigration and Naturalization Service.)

TABLE 18.—PHYSICIANS AND SURGEONS ADMITTED TO THE UNITED STATES AS IMMIGRANTS BY COUNTRY OR REGION OF LAST PERMANENT RESIDENCE, FISCAL YEARS 1953–71

Fiscal year	United Kingdom	Other Europe	Canada	Mexico	Cuba	South America	Asia	Other	Total
1953	66	299	130	40	58			252	845
1954	66	373	116	60	90			335	1,040
1955	62	417	128	63	92			284	1,046
1956	76	513	151	93	112			443	1,388
1957	142	729	256	95	199	228	155	186	1,990
1958	189	592	218	57	86	285	316	191	1,934
1959	147	579	210	44	77	227	207	139	1,630
1960	125	425	245	66	94	256	244	119	1,574
1961	140	413	287	64	94	208	269	208	1,683
1962	119	383	280	70	120	298	265	262	1,797
1963	154	421	467	97	156	327	260	211	2,093
1964	165	458	440	77	229	454	204	222	2,249
1965	147	421	380	110	201	348	205	200	2,012
1966	187	483	393	119	150	355	588	277	2,552
1967	206	596	449	86	162	358	1,175	294	3,326
1968	185	481	314	55	215	345	1,277	256	3,128
1969	140	426	236	32	54	172	1,448	248	2,756
1970	192	436	240	29	52	161	1,744	304	3,158
1971	268	461	474	28	95	269	3,836	325	5,756

Source: Rosemary Stevens, and Joan Vermeulen, "Foreign Trained Physicians and American Medicine," U.S. Department of Health, Education, and Welfare, Bureau of Health Manpower Education, Division of Manpower Intelligence, June 1972. p. 99. (U.S. Department of Justice, Immigration and Naturalization Service.)

DATA FROM THE STEVENS-VERMEULEN STUDY ON FMG'S

The growing prevalence of FMGs in American medicine, notably from the LDCs, is apparent in the many evaluative judgments made in the Stevens-Vermeulen study. For example, one of every six M.D.s now practicing in the United States is a graduate of a foreign medical school; if Canadian graduates are included, the proportion rises to almost one-fifth.[206] More foreign physicians (10,540) were admitted to the United States in 1971 than were graduated from American medical schools (8,974) in the same year. (See Table 20.) There is now one FMG to every two graduates of American schools serving in hospital house staffs in approved graduate educational positions. About one-half of the candidates for state licensing examinations are now FMGs; in some States it is as high as 75 percent.[207] Almost 20,000 FMGs were in graduate educational positions in American hospitals and universities in 1970–71. Of these about 3,000 were interns, 13,000 residents and 3,000 in other traditional training positions.[208] In 1950–51, FMGs represented only 10 percent of interns and 9 percent of residents in U.S. hospitals. The figures for 1970–71 were 29 percent and 33 percent respectively.[209] Finally, the dominant trend is clearly toward more FMGs from the LDCs. The majority of ECFMG certificates (granted after passing the required examination in order to practice) now being granted to foreign medical graduates are from the LDCs. The largest single group awarded in 1970 was to graduates from schools in India (791); others with large numbers represented were the Philippines (366), Korea (229), and Egypt (228).[210]

DATA ON MEDICAL IMMIGRANTS AND NONIMMIGRANTS

As noted above, FMGs, along with their fellow scientists and engineers, enter the United States under two categories, namely, immigrant and nonimmigrant. The latter includes exchange visitors, scholars, and foreign students. The status of nonimmigrant can be adjusted to permanent residence after a 2-year interval of residing outside the United States. After April 1970, this requirement could be waived if the Attorney General found that it would impose undue hardship on the alien or his family or if the foreign country of the alien's nationality or last residence states in writing it would not object to such a waiver.[211]

In the fiscal year 1970, 3,200 foreign physicians were admitted to the United States as immigrants. (See Table 8 and Figure 4.) A record 1,700 were from this continent. Preliminary data for 1971 shows a figure of 5,700, well above the prior record of 3,300 in 1967. The LDCs were strongly represented in this category, with 41 percent of the total

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[206] Ibid., p. 96.
[207] Stevens and Vermeulen, op. cit., p. xi and p. 96. Also, U.S. Congress, House, Committee on Interstate and Foreign Commerce, *Oversight of HEW Health Programs*, Hearing before the Subcommittee on Public Health and Environment, 93d Cong., 1st sess., 1973, p. 55. (Hereafter cited as, Hearings, House Interstate and Foreign Commerce Committee, *Oversight of HEW Health Programs*, 1973.)
[208] Stevens and Vermeulen, op. cit., p. 6.
[209] Ibid., p. 6.
[210] Ibid., pp. 33–34.
[211] NSF, *Survey of Scientists, Engineers, and Physicians from Abroad*, 1972, p. 16.

3,200, and perhaps higher if the 43 percent designating "all other" were broken down and specific countries identified individually. The Philippines was first with 780 immigrant physicians, a figure exceeded only by the 790 in 1969.[212]

A considerable number of change-of-status foreign physicians, 890 or 28.2 percent, are also included in the total immigrant figure of 3,200 for fiscal year 1970. (See Table 10.) Nearly 75 percent of the former nonimmigrant physicians since 1966 had originally entered the United States before that year. Again the largest proportion in the adjusted status category came from the LDCs: Asia with 679 or 76 percent, a slight drop from the 80 percent in 1969; Africa with 39; and North and Central America, 43, probably mostly from Canada.[213]

In the nonimmigrant category, the figure for foreign physicians totaled 5,400 in 1970, an increase over the 1969 figure of 4,800. Of these, 93 to 96 percent yearly were exchange visitors. (See Tables 12 and 19.) Again the inflow from the LDCs was significant. Asia advanced from 2,200 in 1965 to 3,300 in 1968, and then dropped to 2,300 in 1970. Increases from Africa followed a steady upward line: 84 in 1965, 101 in 1967, 126 in 1968, 119 in 1969, and 150 in 1970. South America followed a less consistent pattern but in 1970 showed a considerable increase over 1965: 182 in 1965, 212 in 1966, 208 in 1967, 370 in 1968, 363 in 1969, and 451 in 1970.[214]

Thus, recent data on the medical brain drain reveal that the United States is a prime and increasing recipient of foreign physicians; that the LDCs are increasingly becoming the greatest source of supply; and that these trends seem to be firmly established.

TABLE 19.—IMMIGRANTS AND EXCHANGE VISITORS, ALL OCCUPATIONS AND PHYSICIANS BY MAJOR REGION OF ORIGIN, FISCAL YEAR 1971

Geographical region	Total		Physicians	
	Number	Percent	Number	Percent
Immigrants:				
Africa	5,844	1.6	168	2.9
Asia	97,196	26.2	3,836	66.6
Europe	92,375	24.9	729	12.7
North America	149,002	40.2	728	12.6
South America	22,678	6.1	269	4.7
Oceania	3,383	.9	26	.5
Total	370,478	100.0	5,756	100.0
Exchange visitors:				
Africa	2,808	5.3	143	3.0
Asia	12,622	23.6	2,226	46.5
Europe	26,537	49.7	934	19.5
North America	3,901	7.3	874	18.3
South America	6,182	11.6	549	11.5
Oceania	1,343	2.5	58	1.2
Total	53,393	100.0	4,783	100.0

Source: Rosemary Stevens, and Joan Vermeulen, "Foreign Trained Physicians and American Medicine," U.S. Department of Health, Education, and Welfare, Bureau of Health Manpower Education, Division of Manpower Intelligence, June 1972. p. 101. (U.S. Department of Justice, Immigration and Naturalization Service.)

[212] Ibid., p. 3.
[213] Ibid., pp. 3–4.
[214] Ibid., pp. 11–12.

TABLE 20.—COMPARISON OF FOREIGN PHYSICIANS ADMITTED TO THE UNITED STATES WITH NUMBER OF U.S. MEDICAL GRADUATES 1962–71

Year ending June 30	Foreign physicians			U.S. graduates
	Immigrants	Exchange visitors	Total	
1962	1,797	3,970	5,767	7,168
1963	2,093	4,637	6,730	7,264
1964	2,249	4,518	6,767	7,336
1965	2,012	4,160	6,172	7,409
1966	2,552	4,370	6,922	7,574
1967	3,326	5,204	8,530	7,743
1968	3,128	5,701	8,829	7,973
1969	2,756	4,460	7,216	8,059
1970	3,158	5,008	8,166	8,367
1971	5,756	4,784	10,540	8,974
Total	28,827	46,812	75,639	77,867

Source: Rosemary Stevens and Joan Vermeulen, "Foreign Trained Physicians and American Medicine," U.S. Department of Health, Education, and Welfare, Bureau of Health Manpower Education, Division of Manpower Intelligence, June 1972, p. 96. (DEW Publication No. NIH 73-325.) (Figures on immigrants and exchange visitors are from the U.S. Department of Justice, Immigration and Naturalization Service. Figures of U.S. graduates from "Medical Education in the United States," Journal of the American Medical Association, 218, 1971, 1221.)

Educational Exchange of Foreign Students and Scholars in the United States

An area for potential brain drain is through the educational exchange of foreign students and scholars. An indication of U.S. leadership in advocating international educational exchange is contained in the report "Open Doors, 1971" issued by the Institute of International Education (IIE), a private organization dedicated to international educational exchange.[215] This report states that in 1970–71 there were 144,708 foreign students reported to be enrolled in United States institutions of higher learning. This figure is 9,749 more than the 1969–70 total of 134,959, an increase of 7 percent. "Thus," says the report, "the pattern of annual increases in the number of foreign students in the United States remains unbroken." [216]

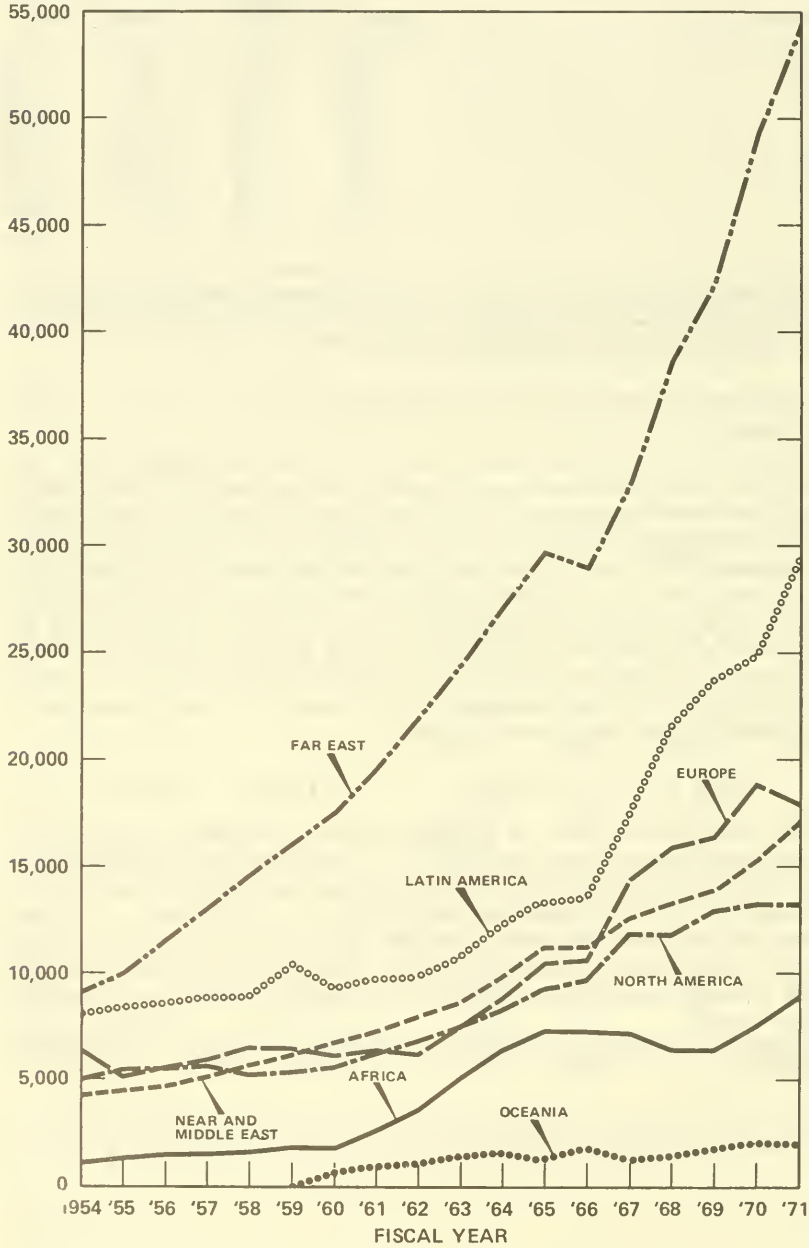
DATA FROM "OPEN DOORS, 1971" ON FOREIGN STUDENTS

While the overall total of foreign students increased, notably by increased enrollment from the LDCs, the numbers from Europe, Canada, and Oceania declined. (For trends in the migration of foreign students to the United States during 1953–71, see Figure 8.) In these years for the first time since 1959–60, these categories showed a decrease in absolute numbers. However, student enrollment from the other areas increased. In relation to the total number of students, the

[215] Institute of International Education, *Open Doors, 1971: Report on International Exchange* (New York: September 1971), 82 pp. (Hereafter cited as *Open Doors, 1971.*)
[216] Ibid., p. 3.

Figure 8

Foreign Students in the U.S., 1953 - 1971



Source: Institute of International Education, *Open Doors, 1971: Report on International Exchange,* New York, Sept. 1971, p. 11.

proportion coming from different regions of the world, according to the report, were the same as they had been in the past 5 years, namely, 37 percent from the Far East, 20 percent from Latin America, 13 percent from Europe, 12 percent from the Near and Middle East, 9 percent from North America, 6 percent from Africa, and 1 percent from Oceania.[217]

Table 21 lists those foreign countries which had more than 1,000 students in the United States during 1970–71. What is significant about these data is that with few exceptions the LDCs are most strongly represented, having a total student enrollment of 84,755. The figure would be larger if the many small countries with fewer than 1,000 students were taken into account.

In compiling its 1970–71 report, the IIE surveyed 2,729 institutions. Of those polled, 789, or 29 percent, did not reply. Other difficulties were noted. Accordingly, the IIE suggests a word of caution, but insists that the statistics "are never exaggerated or inflated." [218] Two sets of data important for the purposes of this study are those relating to intentions as to future plans. There are two indicators of future intentions: the type of visas held by the students, and their answer to the IIE questionnaire when specifically asked if they intended to stay in the United States. According to the IIE report, 18.5 percent of all the responding foreign students, or 26,732, indicated that they held immigrant visas, that is, they had been granted permission to apply for permanent citizenship. The others were as follows: 51 percent had F, or student, visas; 9 percent had J, or exchange-visitor, visas; and 5 percent had other types of nonimmigrant visas. No answer was given in the questionnaire by 24,978 students, that is, 17 percent. The largest proportion of the immigrant visa holders, 33 percent, came from Latin America; 25 percent from the Far East; 21 percent from Europe; 3 percent from Africa; 6 percent from the Near and Middle East; 7 percent from North America; and 1 percent from Oceania.[219] Thus, at least potentially some 67 percent of the respondent students from regions of the world designated as LDCs declared by choice of visa their intention of staying in the United States.

In response to the specific question regarding future residency in the United States, only 11 percent answered in the affirmative. The IIE report reasoned that since 18.5 percent were immigrant visa holders, this affirmative answer from only 11 percent suggested that either (1) a number came to the United States on this type of visa because it was easily available and not because they intended to immigrate, or (2) that a large proportion of the 38 percent of the students who did not answer this question at all, in fact, intended to remain in the United States. According to the survey, 33 percent said they did not intend to remain in the United States, and 18 percent reported that they were undecided.[220]

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[217] Ibid., pp. 3–4.
[218] Ibid., p. 3.
[219] Ibid., p. 8.
[220] The IIE report explained that the high proportion of non-response to this question as well as to those concerning length of stay and sources of support (18 percent) could be attributed to the fact that a third of the institutions surveyed responded to the questionnaires with lists of data compiled from registration information. These lists, the report states, do not normally include information specifically designed for foreign students, such as, duration of stay, intention of remaining and source of support (p. 9).

TABLE 21.—FOREIGN COUNTRIES WITH MORE THAN 1,000 STUDENTS IN THE UNITED STATES, 1970–71

Country	Number	
	1970–71	1969–70
Canada	12,595	13,318
India	12,523	11,327
China, Republic of	9,219	8,566
Hong Kong	9,040	7,202
Cuba	7,435	4,487
Iran	6,402	5,175
Thailand	5,627	4,372
Japan	4,350	4,156
United Kingdom	3,859	4,216
Korea, Republic of	3,857	3,991
China, Unspecified [1]	3,105	3,463
Philippines	2,759	2,782
Mexico	2,689	2,501
Germany, Federal Republic of	2,521	2,634
Israel	2,361	2,288
Nigeria	2,333	1,851
Colombia	2,190	2,045
Pakistan	2,001	1,576
France	1,994	1,977
Greece	1,968	1,811
Venezuela	1,863	1,722
Jamaica	1,557	1,353
Brazil	1,473	1,349
Peru	1,422	1,307
Turkey	1,420	1,309
Italy	1,235	1,174
Lebanon	1,210	1,020
Vietnam, Republic of	1,198	993
United Arab Republic	1,103	1,015
Australia	1,045	1,077

[1] This category consists of those whose country of citizenship was given as China. (In many cases, these students are residents of countries other than the Republic of China.)

Source: Institute of International Education. "Open Doors, 1971: Report on International Exchange," New York, September 1971, p. 4.

How many of these students would actually remain in the United States cannot be determined with absolute accuracy from the available data. Aspects of the problem as it bears on adjusted immigration status are, however, discussed above on pages 66–67 and 70–71. If the assumption of 20 percent loss through foreign students can be accepted as valid, it is reasonable to estimate that some 29,000 of the total 144,708 could be expected to remain in the United States. The figure would be still higher (perhaps some 49,000) if the 18.5 percent immigrant visa holders (26,732) could be assumed to remain as their visa indicates and if 20 percent of the remaining total of foreign students (22,595) were combined with it.[221]

[221] Tai K. Oh, Associate Professor of Management in the School of Business Administration and Economics at California State University, Fullerton, made a study of brain drain from Asia using an extensive survey among all students from 6 Asian nationality groups on the campuses of the University of Wisconsin at Madison and the University of Minnesota at Minneapolis-St. Paul in the spring semester of 1968. The groups surveyed were from China, Hong Kong, Formosa, Japan, Korea, and India. Of the 100,262 foreign students in the United States during the academic year 1967–68, there were 12,244 Chinese (including those from Formosa and Hong Kong), 7,518 Indians, 3,768 Japanese, and 3,218 Koreans—all of whom accounted for 26 percent of the total. Except for the Japanese, estimates of nonreturnees among these groups tend to be particularly high. ("Push" factors are not very prominent in Japan which ranks among the great industrial powers of the world.) Usable returns from those surveyed numbered 657. Among the respondents were 127 Chinese, 79 residents of Hong Kong, 49 Japanese, 72 Koreans, 248 Indians, and 82 Formosans. Undergraduates numbered 98, MA candidates 231, and Ph. D. candidates 297. On the basis of this data, and assuming that the sample is representative and that the current causal factors remain constant, Professor Oh reached the following conclusions:

DATA FROM "OPEN DOORS, 1971" ON FOREIGN SCHOLARS

Foreign scholars in the United States add to potential brain drain through educational exchange. For the year 1971, the IIE reported a total of 12,047 foreign scholars in the United States, a 5 percent decrease from the 12,659 for 1970. (For a list of foreign countries with more than 100 scholars in the United States during 1970–71, see Table 22.) The economic pinch on the campuses and among private grant sponsors, in addition to the decline in government funding for international education, were believed to be largely responsible for the decline. The sharpest numerical decline occurred in the Far East where 3,519 scholars were reported, about 400 fewer than in 1970. A very slight decline was registered for Latin America with 869, 8 less than in 1970. There were 5,218 scholars from Europe, about 140 fewer than in 1970, and 655 from North America, about 23 less than the year before. Only two regions had an increase in scholars, the Near and Middle East with 816, an increase of 3, and Africa with 398, an increase of 9.[222]

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(1) If the brain drain is considered to be composed of those who do not leave the United States immediately after graduation, the non-return rate for the survey nationalities as a whole is 77.8%.

(2) If the brain drain is considered to be composed only of those who acquire immigrant visas, the non-return rate for the survey nationalities as a whole is 38.6%

(3) If a compromise between the definitions in (1) and (2) above is considered a workable and meaningful definition of the brain drain, the non-return rate for the total sample is 58.2%.

To summarize, the survey indicates that, under a continuation of the socioeconomic conditions of the 1960's in Asia and the United States, nearly 60% of the Asian students entering the United States will remain for some significant amount of time after graduation. But findings from parts of the study not reported here indicate that, should the labor market balance change significantly, this rate would change with it.

(Tai K. Oh, "A New Estimate of the Student Brain Drain from Asia," *International Migration Review* 7 [winter 1973], pp. 449–456.)

A survey of brain drain from Africa by Man Singh Das of Northern Illinois University presents a contrasting experience of African students in the United States during the fall of 1968. Man Singh Das concludes that "no such phenomenon operates in Africa as the migration of professionals has little ill effect on the economic development of African nations," (p. 81). He defines brain drain in these restrictive terms: ". . . if the migration of persons . . . is dysfunctional for the sending country (for example, Egypt) in the sense that it retards the development of a society, but functional for the receiving country (for example, the United States) as well as for the individuals concerned, the phenomenon may appropriately be characterized as brain drain." (p. 77). "The problem of brain drain for Africa," he concludes, "is a doubtful one from the outset in view of the great majority of students (84 percent) who plan to return home," (p. 77). On the basis of a sample consisting of 372 male students. Man Singh Das reports that 84 percent planned to return home while 16 percent wished to remain in the United States. It is not known whether they did return. Man Singh Das, "Brain Drain Controversy and African Scholars," *Studies in Comparative International Development* 9 (Spring 1974), pp. 74–83.)

[222] Ibid., pp. 11–12.

TABLE 22.—FOREIGN COUNTRIES WITH MORE THAN 100 SCHOLARS IN THE UNITED STATES, 1970–1971

COUNTRY	Number of Foreign Scholars	
United Kingdom	1,596	13.2%
Japan	1,307	10.8%
India	1,166	9.7%
Germany, Fed. Rep. of	853	7.1%
Canada	652	5.4%
France	525	4.4%
Australia	428	3.6%
Israel	390	3.2%
*China, Unspecified	286	2.4%
Italy	282	2.3%
China, Rep. of	243	2.0%
Switzerland	236	2.0%
Czechoslovakia	180	1.5%
Korea, Rep. of	180	1.5%
Spain	172	1.4%
Argentina	171	1.4%
Netherlands	162	1.3%
Sweden	147	1.2%
Brazil	136	1.1%
United Arab Rep.	135	1.1%
Philippines	132	1.1%
Belgium	126	1.0%
Poland	124	1.0%
Yugoslavia	113	.9%
Austria	112	.9%
Turkey	112	.9%
Pakistan	107	.9%
Greece	104	.9%
Mexico	101	.8%

*This category consists of those whose country of citizenship was given as "China." (In many cases, these scholars are residents of countries other than the Republic of China.)

Source: Institute of International Education, *Open Doors, 1971: Report on International Exchange* (New York: September 1971), p. 2.

According to the IIE, the proportion of the total number of scholars from Europe shows a pattern of slow and uneven increase, while that from the Far East has declined. In 1965–66, 40 percent of the scholars were from Europe and 35 percent from the Far East, a ratio that had persisted during the preceding 4 years. In 1966–67, the proportion from Europe began to grow, unevenly, and that from the Far East to decline, to the 1971 ratio of 43 percent to 29 percent. Viewed in the long-term perspective, however, this ratio shows a slow change of direction toward the Far East. In 1954–55, the proportion was 53 percent from Europe and only 20 percent from the Far East. The proportions reported from other regions of the world in 1970–71 were the same, or no more than a 1 percent differential, as in the previous year; Latin America, 7 percent; Near and Middle East, 7 percent; North America, 5 percent; Oceania, 4 percent; and Africa, 3 percent. There were 29 countries that had more than 100 scholars in the United States, totaling 10,278. About one-third of this number (3,263) were from the LDCs. India ranked third on the list with 1,116 scholars. According to the IIE report, there were no significant variations in the ranking on this list from that of the previous year.[223]

Thus, data on foreign scholars in the United States show the growing prominence of the LDCs in U.S. programs of international exchange. In some instances this trend is demonstrated by numerical increases as in the case of the Near and Middle East. But most importantly, it is demonstrated in the proportional increases that have been occurring in recent years in the direction of the LDCs and accordingly narrowing the gap between the source countries of Europe and those of the Far East and other LDC regions of the world. That there is substantial brain drain of foreign scholars is evident from the data presented above on pages 66–67 and 70–71 drawn from the National Science Foundation reports of 1972 and 1973 on scientists, engineers, and physicians from abroad.

Some Tentative Generalizations on Brain Drain as a Contemporary Problem

From the material presented above on the brain drain as a contemporary international problem, a series of tentative generalizations can be drawn:

1. A changing world environment occurring over the past three decades has created unique political and economic conditions for brain drain to flourish as a contemporary international phenomenon.

2. The political aspects of the brain drain problem are rooted in this changing world environment, specifically, in the processes of decolonization that has produced a "Third World" of independent states in Asia and Africa.

3. The economic aspects of the problem derive from the nature of an evolving and globalizing industrial revolution with parallel developments in the world of science and technology. This dual phenomenon has created an expanding world economy, stimulated the universalization of knowledge, and generated a competition

[223] Ibid., p. 12. In compiling the report on foreign scholars, the IIE polled 2,372 U.S. institutions. Sixty-one percent responded. Of the respondents, 580 reported foreign scholars and 856 reported no foreign scholars; 936 did not reply. (p. 18)

of needs and demands, priorities and goals between the advanced industrial societies and the LDCs: the former seek expanding markets and resources, human and material, for enlarging their industrial systems; the latter seek development and modernization of their undeveloped or developing countries. One of the primary objects of the competition is to secure trained professional manpower needed by both.

4. By reordering immigration priorities to stress quality over quantity and by enlarging incentives, the advanced industrial societies have been able to draw heavily on the LDCs for their professional manpower requirements, seemingly to the detriment of the latter.

5. In this competition for trained manpower, most advanced industrial societies bear "universal culpability" for brain drain from the LDCs. The data suggest that the United States, long the mecca of world immigration, has been a prime beneficiary; though the number of immigrant scientists and engineers has declined in 1972, the inflow of foreign physicians and surgeons continues on a steady upward trend.

IV. Causes of Brain Drain: Interaction of "Push/Pull" Forces

Why professional and highly skilled persons emigrate on the order of magnitude described above is a basic question to be addressed in this study. To arrive at the answer would be to clarify responsibility, suggest policy directions, and elucidate more sharply the relationship between brain drain and foreign policy.

To cite Adam Smith again, since human baggage is the most immobile of all, the causes of professional migration are reduced to the interaction of "push/pull" forces that produce movement: the "push" force comes from the country of origin, the "pull" force from abroad. Generally, structural maladjustment and inner disequilibrium in the country of emigration or immigration, or both, activate these forces and ultimately produce brain drain.[224] Specifically, the movement occurs when maladjustments and disequilibria are manifested in a nation's economic, cultural and intellectual, social and political realms.

"Push" Factors in Brain Drain

Examination of the "push" factors in brain drain fall naturally into four major categories: The economic, cultural and intellectual, social, and political. Each element contributes in its own special way to "pushing" the discontented professional into migration.

ECONOMIC FACTORS: SYMPTOM OF UNDERDEVELOPMENT

Brain drain, particularly as it relates to the LDCs, derives from structural maladjustments in the economies of the developing countries. An undesirable byproduct of unbalanced national development, brain drain has its root cause in the larger problems of economic development. It is a symptom more than a cause of underdevelopment. Briefly, brain drain can be a consequence of a forced march from a starting point of underdevelopment to what is ultimately expected to be a goal of economic modernity.[225]

MISMANAGEMENT OF MANPOWER; MISCONCEPTION OF EDUCATIONAL REFORM

The basic problem of underdevelopment is compounded by mismanagement in manpower resources and a misconception of the purpose of educational reform. Coming into the contemporary world from a colonial heritage, most LDCs took on many of the values, attitudes,

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[224] Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 54. (Adams testimony)

[225] Ideas for this section are drawn from virtually all of the major sources on the brain drain used in this study and cited in the previous chapters. Special attention is directed to the CIMT study, pp. 679–689; Adams and Diriam, op. cit., pp. 254–56; Henderson, op. cit., pp. 87–94; Myint, op. cit., pp. 238–40; and Adam's testimony in Hearings, House Government Operations Committee, *Brain Drain*, 1968, pp. 57–58.

habits, and institutional forms of the old imperial order. One value most appealing to the new leaderships was belief in the regenerative power of educational reform as a means to speed modernization. As admirers of liberal democratic ideas which ascribed to education a power to transform man's environment, they sought material salvation through education. The defect of their approach lay in their failure to master concepts of orderly and rationalized manpower management. Pursuing illusions of prestige and other false goals hanging over from the colonial past, the LDCs created educational systems largely for the sake of education, essentially unplanned (at least in a sufficiently rational way), and most important, unrelated to the larger goals of national development.

The result was predictable. A surplus of an educated elite was created, notably at the university level. Graduates could not be absorbed by the underdeveloped economies. Thus in July 1965 *The London Times* could report that 40 percent of the engineers trained in Burma in 1961 had not found employment in engineering 18 months later. Graduates of Khartoum University in the Sudan engaged in a near-riotous siege of their Government as pressure to provide them with jobs. A household survey in the Philippines in the early sixties disclosed 35,000 college graduates without jobs. In Thailand, more than 1,000 candidates, including university graduates, could be expected to appear for three clerical posts in the government. According to another report, a 1961 census in India revealed that 10.4 percent of all scientific and technical personnel were unemployed, and 18.6 percent were employed outside the occupations for which they were trained.[226] The persistent surplus of an educated elite is shown by the report in *The Washington Post* on January 21, 1973, stating that neither government nor industry in India can absorb even half of the 600,000 graduates each year who move into the job market.[227]

Educational reform fulfilled manpower demands during the transition from colonial status to independence, but the systems have continued to turn out students, many poorly trained, at a progressively increasing rate (10 percent a year) often far beyond the absorptive capacity of the nations' economies. This dilemma of overproduction and underabsorption has often been compounded by the tendency toward indiscriminately stressing in education of quantity over quality, thereby creating a mismatch in manpower supply to demand. Following the tradition of educational preferences held by the former colonial mentors and often those traditions existing in their own societies, many students pursued the law and the humanities, liberal arts and medicine; they shunned the more practical related studies of science, engineering, agronomy, and the other technical arts so crucial for national development. As a result, an imbalance was created in their nations' educational structures, adding to the accumulating surplus of educated talent. Specialists on brain drain refer to this waste of talent as "overflows." An example of this waste is seen in the case of the Philippines where in 1967, 70 percent of all registered scientific and professional people were reported to be in the medical field. According

[226] Adams and Dirlam, op. cit. *Brain Drain*, p. 251.
[227] Lewis M. Simons, "India's Colleges Slide Into Choas," *The Washington Post*, Jan. 21, 1973, p. C5.

to Dr. Pacifico Marcos, President of the Philippine Medical Association, only half of the 28,000 registered medical doctors were in active practice. The Philippines' seven medical schools were then graduating 1,200 medical doctors a year, but only 800 were actually able to go into active practice.[228]

The Philippines, therefore, suffers from both a surplus in medical personnel and an insufficiency in other science and technical related fields.[229]

Yet, a paradox seems to exist in this situation of apparent manpower plenty in the LDCs: The *demands* may seem to have been met, as evidenced by the surplus, but not necessarily the *needs* of the LDCs. Indeed, here seems to be the crux of the brain drain problem. As Gregory Henderson explained, the principal general cause of the brain drain seems to lie in the inability of the LDCs to create an *effective demand* for professionals despite the presence of an almost *unlimited need*. All other causes are subsumed under this anomaly.[230]

EMIGRATION, AN ESCAPE HATCH FOR ELITE

If the results of manpower mismanagement and the misconception of educational reform were predictable, so were the secondary consequences. In time many LDCs accumulated unmanageable surpluses of educated elites, discontented, unemployed, sometimes unemployable, perhaps more often underemployed. Caught in a scissors of exploding populations and limited economic resources, their economies could not expand at a rate sufficient to absorb the surplus. Avenues for individual progress were closed off by limited jobs and restricted career opportunities. A catalog of economic and social problems for this elite inevitably accumulated from this depressing situation: low salaries, unpleasant working conditions, limited chance for professional advancement, demoralization, frustration, discontentment. Then there were the further burdens of lost prestige and personal dignity that come with rejection. For the educated professional the "job" is his profession, his way of life. Deprivation of the opportunity to pursue professional goals can create within him a devastating spiritual void. Lane Kirkland of the AFL–CIO described the feeling in these brusque terms: "The job is still the secret to a guy's general happiness and attitude. If you like your work, you're happy. If you don't, you're miserable." Albert Camus put it more poetically: "Without work all life goes rotten. But when work is soulless, life stifles and dies."[231]

Faced with this hard reality, the superfluous educated man in the LDCs has two options. He can stay home, living and working beneath his potentialities and possibilities at a subprofessional level. Or he can emigrate to an advanced country in the West, notably the United States—and to a new world of opportunity and professional fulfill-

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[228] Harold E. Howland, *Brain Drain: As it Affects the Philippines*. Foreign Service Institute, Department of State. 9th Session, Senior Seminar in Foreign Policy, Washington, D.C., 1967, p. 4.

[229] Amador Muriel, "Brain Drain in the Philippines: A Case Study," *Bulletin of the Atomic Scientists* (September 1970), pp. 38–39.

[230] Henderson, op. cit., p. 146.

[231] Quoted in, "The Worker's Day" (editorial), *The Washington Post*, Sept. 3, 1973, p. A26.

ment. For the discontented educated elite, emigration is an escape hatch to a new and successful life; his discontentment provides the necessary "push."

Cultural and Intellectual Inadequacies

Thus it appears that migration is more an effect than a cause of underdevelopment and that underdevelopment is the seminal source of brain drain. Even in countries adversely affected by migration, other factors generally far outweigh the effects of migration.[232] Among the serious economic factors are one-crop economies, shortages of capital and foreign exchange, economic instability and inflation, resource scarcity and shortcomings in management—all indicators of underdevelopment that contribute to the "push" of outward migration. Likewise in the cultural and intellectual realm, arrested technological development and scientific stagnation, common characteristics of the LDCs, "push" trained manpower into migration. For it is axiomatic that economic resources and trained manpower are necessary ingredients to creating the essential cadres of talent that in turn can construct a viable scientific-technological infrastructure.

INADEQUATE SCIENTIFIC-TECHNOLOGICAL INFRASTRUCTURE

Lacking in most LDCs are the elementary necessities for the development of science and technology: adequate government funding for research, institutions to carry on research, a sufficiency of laboratories and equipment, journals and learned societies to disseminate findings, and most important, a scientific tradition. "Only a comparatively small number of governments of developing countries allocate substantial funds for research," said the report of the U.N. Secretary General on brain drain. "Even among the twenty or thirty nations who do research, sharply different levels of expenditure, plant, equipment, and professional opportunity occur. These differences are a factor leading to brain drain even among these countries." [233]

A UNITAR study on brain drain from Lebanon expressed a view applicable to many other LDCs: "A major reason for the loss of the best talents in the country is the lack of facilities for research in the institutions." And speaking of the Arab world generally the report said: "Extensive interviews with a wide variety of people indicate that the main reason why Arab natural scientists emigrate is because of the conditions in Arab national universities, such as lack of research facilities." [234]

With reference to Cameroon the report stated that facilities for training and research in the higher institutions of learning were extremely limited. As evidence it cited the fact that there was still no department or college of medicine.

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[232] CIMT Study, p. 670.

[233] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 38:68.

[234] United Nations Institute for Training and Research (UNITAR), *The Brain Drain from Five Developing Countries: Cameroon, Colombia, Lebanon, the Philippines, Trinidad and Tobago*, (New York: 1971), pp. 86 and 91. (UNITAR Research Report No. 15). Hereafter cited as, UNITAR, *Brain Drain from Five LDCs, 1971*.

LACK OF QUALIFIED TEACHERS AND GRADUATE FACILITIES

Failure of the educational systems in many LDCs to develop qualified teachers in science and the technical arts, a rare commodity, compounds the larger institutional problem. A further deficiency is that graduate training, so vital to developing a national scientific infrastructure, has not been adequately developed. Prof. A. B. Zahlan, Chairman of the Department of Physics at the American University of Beirut, explained the virtual nonexistence of graduate schools in the Middle East in a way that might be applicable for many other undeveloped areas: "It has been generally assumed that backward countries could get along with rudimentary educational institutions, and that the only source of advanced training for citizens of developing countries should be the institutions of advanced countries." [235] Graduate training of Greek students is almost exclusively carried on abroad. Greece does not have a fully integrated training cycle for the formation of a professional class.[236] And according to Habib Naficy, Minister for Curtural Affairs at the Iranian Embassy in Washington, with eight universities in Iran "it is still impossible to provide the higher education training demanded by qualified graduates." [237] By failing to develop graduate facilities, the LDC is thus placed in double jeopardy: the possibilities of creating the core talent for scientific development are further reduced, and the student going abroad becomes vulnerable to brain drain.

Added to the failure in developing graduate training are the negative characteristics of LDC academic institutions. The structure of intellectual and educational institutions in many LDCs is rigid, tradition-oriented, and compartmentalized, having the effect, as Dr. Frankel said, of "frustrating the innovator." [238] This faulty educational structure adds to the problem of upward mobility for young, ambitious scholars who are trying to establish an academic career for themselves.

WEAKNESSES IN COMMUNICATIONS NETWORK

Finally, the absence of a network of communication contributes to intellectual stagnation in the LDCs. Academic publications, conferences, and seminars among scholars, important appurtenances to the scholarly life often taken for granted in the advanced countries of the West, are uncommon in the LDCs. Yet they are a vital source of group communication, interaction, and cross-fertilization. They provide the stage for the exchange of ideas, the testing of hypotheses, the dissemination of newly acquired knowledge, and the creating of an intellectual environment of challenge and response, that dialectic so necessary for the advance of scholarship and learning.

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[235] Quoted in, Said, op. cit., p. 14.

[236] George Coutsoumaris, "Greece," *In* Adams, *Brain Drain,* chapter 11, p. 172.

[237] Habib Naficy, "'Brain Drain': The Case of Iranian Non-Returnees," *International Development,* 1966 (Dobbs Ferry, N.Y.: Oceana, 1967), pp. 66–67.

[238] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills,* 1968, p. 22.

These are missing in the LDCs. As Pakistan's leading physicist, Dr. Abdus Salam, explained in describing the rationale for the International Center for Theoretical Physics at Trieste, Italy, men of genius in the LDCs tend to go into mathematics and theoretical physics because their countries lack facilities for other kinds of research. Such gifted men, he said, sooner or later are drawn to great centers of learning in the West or in the Soviet Union. Some never return home; others after reaching first rank return home, but find themselves utterly isolated. Before the Trieste Center was established, he continued, this small group of men was too small to form a critical mass. There were no good libraries, and there was inadequate communication with similar scientific groups abroad. "There was no criticism of what they were doing. New ideas reached them too slowly," he went on. "Their work fell back within the grooves of what they were doing before they left." These men were isolated, Dr. Salam declared, and he added, "isolation in theoretical physics as in most fields of intellectual work is death." [239]

PUSH OF EMIGRATION

Such conditions prevailing within many LDCs, as described above, can create intellectual decay and ultimately fossilization in the sciences and other fast-moving disciplines. The growth of a scientific spirit is arrested by the forces of mediocrity. Stagnation sets in, and is perpetuated by isolation from the mainstream of the international communication, one of the main contributors of brain drain.[240] Frustration and dissatisfaction build within the intellectual community, for as Dr. Frankel said in explaining why highly trained people leave their own countries, "The scale of intellectual and cultural life is too small. It does not satisfy the need of professional and scientific people, and of teachers and intellectual leaders, for broad contacts and for opportunities for important work." [241]

As a result of the interaction of these forces, scientific and technological development in the LDCs is impaired, perhaps even consigned to a chronic state without hope or expectation of reaching the "take-off" stage to modernity. And as a consequence, scientists, engineers, physicians, and surgeons, representing a form of human capital which is universally marketable, are "pushed" by these internal forces into going elsewhere.

Social Factors Causing Brain Drain

Social pressures generated within the LDCs add considerable force to the "push" of outward migration of professionals. Traditions, drawn from a nation's historical past and reinforced by the legacy of the colonial experience, can be an obstacle to social change within the LDCs. Past customs, habits, and values, deeply engrained in traditional societies, are difficult to change, much less expunge, yet many conflict with the requirements of modernization and impose a special burden on the progressive forces.

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[239] Walter Sullivan, "Center for Physics in Trieste Tries To Check Brain Drain from Third World," *The New York Times*, Nov. 23, 1969, p. 82.

[240] Dr. Michael J. Moravcsik, physicist, Director of the Institute of Theoretical Science at the University of Oregon, and a student of brain drain, writes: "The problem of isolation must be faced also because it is one of the main contributors of the brain drain." Communications Among Scientists and Its Implications to Developing Countries (May 1970, p. 4).

[241] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 22.

ARCHAIC TRADITIONS AS OBSTACLE TO PROGRESS

Traditions and customs often rigidify the social structures of traditional societies, perpetuating inherited class barriers, reinforcing the inequities of social and economic discrimination, and infusing the social order with mediocrity, bureaucratism, and nepotism. Educational institutions, as noted above, suffer from this disability. But what is more important, this spirit can permeate the whole of society.

Inherited social status, family position, and political connections, rather than individual talent and capability, and the importance of particular jobs for the task of nation-building, become the criteria for holding professional positions, structuring salary scales, and creating social status and prestige. Such a dislocation of talent, rewards, and status in society effectively excludes the talented young intellectual from playing a proper and positive role in his society. In the case of India, V. M. Dandekar, Director of the Gokhale Institute of Politics and Economics, Poona, India, observed that this was a "disease" underlying the entire brain drain phenomenon. As a result, the intellectual classes of India are alienated totally from the rest of society and anything but an intellectual life has developed within the ranks of the intellectuals. And he concludes with this severe judgment: "These ranks have been infiltrated by wrong persons with wrong aptitudes and wrong motivations, and bureaucracy, servility, frustration, and resentment permeate the intellectual life in the country. These conditions keep the young talented persons away from their home." [242]

SOCIAL AND RACIAL DISCRIMINATION

One of the most serious social aspects of traditional societies that contributes to the "push" factor is discrimination. (Many LDCs fall into the "traditional" category.) Rigidly established class and racial barriers bar the gifted professionals from positions commensurate with their talent. The Chinese in Malaya, the Asians in Kenya, and the Tamils in Ceylon are adversely affected by discriminatory attitudes and legislation.[243] Qualified native Cameroonians are often denied jobs that go to employees of foreign organizations, thus closing off career prospects for native professional cadres and forcing them to go elsewhere.[244] Speaking of discrimination in Africa, R. K. A. Gardiner, Executive Secretary of the United Nations Economic Commission for Africa, applied to Nigeria a principle that has universal relevance: "Given the general scarcity of nation-building talent, a country like Nigeria cannot indulge in the luxury of differentiating between Ibos, Hausas, and Yorubas in the selection of advancement of personnel." [245]

Dr. William C. Johnstone of Johns Hopkins School of Advanced International Studies recounts the experience of 2½ years in Burma in setting up an international relations program at the University of

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[242] V. M. Dandekar, "India," *In* Adams, *Brain Drain*, pp. 228–229. Dr. Adams discusses the social aspects of brain drain in, Hearings, House Government Operations Committee, *Brain Drain*, 1968, pp. 55–56. See also, CIMT study, pp. 710–712.

[243] Report *Ditchley Park Conference on Brain Drain*, 1968, p. 15.

[244] UNITAR, *Brain Drain from Five LDCs*, 1971, p. 122.

[245] Adams and Dirlam, op. cit., p. 260. Advertisements of job opportunities placed in *The New York Times* during April 1974 by the Nigerian delegation currently attempting to retrieve lost professional talent carries the statement familiar to Americans but also particularly relevant to Nigerians, "An Equal Opportunity Employer."

Rangoon. To his surprise he found a clerk in one of Rangoon's main hotels who had an M.A. from the University of Chicago under Quincy Wright and was "a very competent teacher." He also discovered another young man with an M.A. from the University of Southern California, interested in radio and electronics, who was working with a private firm. The university needed the skills of the international relations specialist, he said, and the government "certainly needed the skills of somebody in electronics." But, according to Dr. Johnstone, "Both were barred from any kind of government jobs because they were Karens, Shans; not Burmese." And he added, "This is a factor which I think is true in many countries." [246]

REJECTION OF INNOVATION

Resistance to innovation is another social aspect of traditional societies that adds to the "push" factor of outward migration. Innovation is a necessary ingredient of modernization. It often requires a different perception of the roles played by scientists, engineers, technologists, and other educated professionals. It commonly requires acceptance of radical economic and technological changes and the realization that the ever-accelerating rate of these changes are creating a new class or a new elite of human capital. This emerging scientific-technical-managerial elite refuses to accept traditional values and established power relationships and has acquired values and traditions of its own that transcend national boundaries. Characteristically it is ambitious, able, impatient; and what is most important, it is a mobile class which threatens the stability, inertia, and conservatism of traditional societies. It insists on a broad stage for its activities and searches out the social environment receptive to innovation. Not all traditional societies of the LDCs are prepared to accept this principle of change, and accordingly push their talent into emigration, for as Dr. Adams observed, "In order to retain such manpower, a society must be prepared for constant self-renewal—for permanent self-transformation." [247]

PREJUDICE AGAINST SCIENCE AND TECHNOLOGY

What makes many traditional societies unreceptive to changes required for modernization today is a prejudice against science and technology in favor of jurisprudence, the humanities, and liberal arts. This prejudice permeates such societies and their culture; it has a spoiling effect on the development of the scientific spirit; it produces values and priorities that frequently conflict with the requirements of a modern industrial order; and it pushes the scientist and technologist into emigration. For denial of status and prestige, which is the main point here, carries with it tangible social, political, and economic disabilities, the most important being the inability of the scientist and technologist to function as respected professionals with power and influence in their own country.

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[246] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 116.
[247] Hearings, House, Government Operations Committee, *Brain Drain*, 1968, p. 57.

In Hispanic cultures, notably in Latin America, science and technology are not held in high esteem. Scientists, engineers, and other technologists do not enjoy the prestige and recognition extended to those in the "liberal" professions. Indeed, the dominant elites are inclined to place a low value on science and technology as degrading.[248] As the report of the Pan American Health Organization on brain drain from Latin America said: "The most fundamental problem confronting the development of science—including biomedical science—in Latin America relates not to any specific deficiency but to a complex of social attitudes that result in a nonscientific or an antiscientific attitude on the part of the population generally and often on the part of political leaders as well." [249]

Without status and prestige, Latin American scientists and technologists are excluded from participation in government activities and in other areas of national life where they could contribute to national development.[250]

A more tangible consequence of this prejudice is a failure by governments and societies to give scientists and technologists adequate support for carrying on their work. Studies on the state of science and technology in Latin America invariably emphasize the failure of adequate funding.

Other countries hold similar prejudices, and the effects are predictable. The lack of proper status and adequate recognition for scientists and technologists is a factor in compelling Africans with initiative and special aptitude to emigrate to France and Britain.[251] Korea, Taiwan and South Vietnam hold similar misplaced values.[252] Even Britain shares this prejudice, which has been a factor in pushing its scientists and technologists into migration to North America.[253] In the Philippines the same is true. The medical profession is the most prestigious of all. This is an established national tradition. And parents will make great sacrifices to put their children through medical school.[254] Consequently, the Philippines produce an enormous surplus of doctors, while the disciplines of science and technology, so necessary for balanced national development but held in low esteem, are virtually ignored.

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[248] Skolnikoff, op. cit., pp. 200–201.

[249] Pan American Health Organization, *Migration of Health Personnel, Scientists, and Engineers from Latin America* (Washington: September 1966), p. 48. (Scientific publication No. 142.) Hereafter cited as, *Report on Brain Drain from Latin America,* Pan American Health Organization, 1966.

[250] Ismael Escobar of the Inter-American Development Bank observed at a conference on science and technology meeting in Santiago, Chile: "As a result of exclusion from governmental bodies and foreign affairs, scientists are unable to contribute to such great socioeconomic movements as Latin American unity, the trend towards regionalization and economic, educational and scientific integration." United Nations Educational, Scientific and Cultural Organization, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* Organized by UNESCO with the cooperation of the Economic Commission for Latin America, Santiago, Chile, Sept. 13–22, 1965, p. 168. Hereafter cited as, UNESCO, *Final Report of Conference on the Application of Science and Technology to the Development of Latin America,* 1965.

[251] R. K. A. Gardiner, "Africa," *In,* Adams, chapter 13, pp. 197–198.

[252] Report of U.N. Secretary General, *Outflow of Trained Personnel From LDCs,* Nov. 5, 1968, p. 46.86.

[253] James A. Wilson cited the following as a cause for emigration: "That scientific research *as such* is not respected; that scientists are not welcomed into general industrial management; that the rewards in Britain go to the liberal-arts trained Oxbridge and Eton types." (The value pattern of productive scientists, as reflected in the contemporary "brain-drain" from Britain to North America. Project on, "The impact of American values of the current revolution in science and technology," conducted at the University of Pittsburgh, September 1965, p. 6. Preliminary draft.)

[254] Howland, op. cit., p. 4.

TREND TOWARD URBANIZATION

Another social factor that creates "push" conditions for professional manpower in the LDCs is the world trend toward urbanization. Invariably, intellectuals concentrate in cities. Cities are centers of wealth, opportunity, and intellectual intercourse. Educational and cultural institutions, hospitals, seats of governments, and major industries are generally located in urban areas. Life is also more comfortable in the cities than in many rural areas. Intellectuals can, moreover, share common professional interests with friends and colleagues living in close proximity with one another in an urban environment.[255]

A special problem arises in the LDCs where the surplus educated elite are concentrated in urban areas. Unable to be absorbed into the economy, this elite represents, at least potentially, a social hazard for the country and an opportunity for brain drain to the advanced countries, because they are usually unemployed or underemployed. This elite shuns the countryside where in some professions, such as medicine, a need exists. According to Dr. Marcos, in Manila there is one doctor for every 671 persons; in rural areas the ratio is 1 for every 5,000.[256] Yet, the Philippines has a surplus of doctors. Of a total of 28,000 M.D.s, one-half practice in Manila and other cities, one-fourth are not practicing at all, and the other fourth immigrate to the United States.[257] In India, another country with a surplus of M.D.s, 60 percent of the rural clinics in East Punjab are without doctors.[258]

The same is true of Bolivia where 51 percent of its annual output of M.D.s applied for immigration to the United States in 1965, at a time when most of the country's rural areas were inadequately served by doctors.[259] (The habit of concentrating in the great metropolitan areas continues after foreign medical graduates (FMGs) come to the United States. They shun the rural areas where the medical need is great and settle in the large cities. In 1970, 90.8 percent of all FMGs were located in 300 Standard Metropolitan Statistical Areas, a percentage that has remained constant since 1963.)[260]

Urbanization in the LDCs with the problems it creates for the educated elite, particularly that of their allocation for optimal social use, and the special preference of this elite for city life as opposed to the country, creates "push" conditions for the dispossessed and discontended intellectual. If there is a way out through emigration to an advanced country, he will take it if he can. The CIMT study stated the problem and its resolution very succinctly: "People [i.e. professionals] prefer to remain in cities, even if they are unemployed. If these unemployed or underemployed people are given a choice of migrating to rural areas in the country or of migrating to another country, they tend to choose the latter."[261]

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[255] CIMT Study, p. 683.
[256] Howland, op. cit., p. 4.
[257] Dublin, op. cit., p. 875.
[258] Report, *Ditchley Park Conference on Brain Drain*, 1968, p. 16.
[259] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 45.85.
[260] AMA, *FMG Study*, 1971, pp. 13–14.
[261] CIMT Study, p. 683. The Ditchley Conference report made a similar observation: "Many doctors and other professionally qualified people prefer to emigrate rather than work in rural areas." (p. 16).

COMPULSION TO EMIGRATE

By nature, traditional societies in the LDCs work at cross-purposes with the spirit of the scientific-technological age and accordingly create conditions that generate brain drain. Institutions, like society itself, rigidly structured and closed to innovation, become both the perpetuator and protector of socially archaic, outmoded values.

Political power tends to remain with the keepers of the status quo, unshared with the innovators, thus raising the threshold of change and modernization. Processes of societal and intellectual calcification prevent upward mobility of the young and ambitious, frustrate intellectual growth, depress the spirit of scientism, reduce the horizons of action and expectation among the scientific-technological intelligentsia, and impose a negative attitude toward the role of science and the science-oriented man in modern society. Demoralized and uncertain about his future and that of his country and pushed by forces of social obscurantism into a choice, the intellectual finds escape in immigration to the advanced technological societies of the West.[262]

Political Factors Causing Brain Drain: Intellectual Repression

Oppression, instability and unrest, governmental indifference to scientific development, and erosion of loyalties among nationals are political elements that push professional manpower into migration. Science and technology can flourish within totalitarian systems, but seem most ideally to flourish in a free environment unhindered and unimpeded where freedom of thought and inquiry, so necessary to the pursuit of the scientific method, are given full reign. Failure to achieve this ideal often pushes scientists and other professionals into migration. Others suffering direct political persecution seek the same way out, for political tyranny and politically inspired anti-intellectualism can destroy the scientific spirit.

Classic cases of men who suffered for their beliefs and emigrated, are those of Einstein, Enrico Fermi, and numerous other scientists, including Nobel laureates Born, Debye, Chain, Krebs, Lipmann, Loevi, von Hess, Perutz, and Schroedinger, who fled Germany and Austria during the Nazi period.[263] Less prominent are the thousands of professionals who fled Cuba and other Communist dominanted lands in the postwar period. During 1960–61 alone, 1,360 doctors immigrated to the United States from Castro's Cuba. This figure comprised one-fourth of Cuba's medical manpower and represented an output of 3 years of its faculty of medicine. Two months after the Soviet bloc invasion of Czechoslovakia in August 1968, some 1,500 refugees had been processed by the U.S. Consulate in Vienna for immigration to the United States. Many of these refugees were professionals.[264]

During January to June 1973, 115 doctors fled Communist East Germany to West Germany in search of freedom and higher incomes, much to the displeasure of the Honecker regime, which needed the manpower and deplored the loss of a substantial investment.[265] From

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[262] Some scientists and engineers in advanced countries are also influenced by this psychological mood of uncertainty about the future of their country and thus choose to emigrate. This attitude was expressed in the following statement by the British Council of Engineering Institutions which, taken with the lower prestige factor of scientists and engineers in British society, acts as a precondition for emigration: "The lack of faith on the part of its young men in the future of the United Kingdom as a technological power is a serious threat to the country's future." (Quoted in, Silj, op. cit., p. 9.)

[263] Adams and Dirlam, op. cit., p. 259.

[264] Adams, "Talent That Won't Stay Put," p. 73.

[265] *The Christian Science Monitor,* Aug. 11, 1973, p. 8.

January 1972, when restrictions on East-West contacts were eased in the GDR, until September 1973 some 3,000 East German physicians, scientists, and technologists fled to West Germany, according to an authoritative East German source.[266]

Under pressures of harsh discrimination, some Jews from the Soviet scientific community and many from other sectors of the intelligentsia, probably numbering in the thousands, have been permitted to emigrate to Israel in recent years. Others like Zhores A. Medvedev, the noted Soviet geneticist and civil rights dissident writer, have lost their citizenship while abroad, and still others like Andrei Sakharov, Russia's world renowned physicist and father of the Soviet H-bomb, suffer serious personal and professional deprivations and are objects of harsh regime attacks. From time to time, scientific communities in Latin America, particularly in Brazil and Argentina, have been targets of direct political attacks and outright persecution by hostile political regimes. Emigration of valuable faculty members and destruction of scientific centers long in building have often resulted.[267]

POLITICAL INSTABILITY AND UNREST

Political instability and unrest are disruptive to orderly national life and unsettling to professionals. Pushed by forces of political adversity, they often seek tranquility in other lands. In generalizing on the reasons for such behavior, Dr. Kidd explained that this factor is one of a number of "push" forces "inherent in the process of development itself." [268]

Instability is a common characteristic of political life in those LDCs that are in the early stages of modernization coupled with new responsibilities of self-government. Many emerging nations, faced with so many new challenges all at once, proved to be incapable of orderly transition from colonialism to independence. Institutions often hastily grafted on the body politic from essentially alien cultures could not withstand the burdens of self-rule.

Universities have been especially vulnerable to the adverse effects of unrest issuing from these conditions. Often politicized to the extreme, they tend to become enmeshed in the conflicts for power. Political unrest among university students may result in frequent strikes and sporadic mob violence which makes normal academic life impossible.[269] Continued residence under such political conditions is sometimes uncongenial, if not dangerous, for academic professionals, particularly those who believe that the university is a marketplace for the free exchange of ideas and that scholars have a right and obligation to examine and discuss all problems no matter how contemporary or relevant to conditions at home.[270]

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[266] Journal of Joseph G. Whelan, Notebook No. 3, Sept. 25, 1973, pp. 166–175.

[267] For a discussion of experiences in Brazil and Argentina, see H. Moyses Nussenzveig, "Migration of Scientists from Latin America," *Science*, 165 (Sept. 26, 1969), pp. 1328–1332. Mr. Charles V. Kidd of the Executive Office of Science and Technology made the following all-inclusive judgment on the cause of brain drain from Argentina: "In Argentina, I would venture the guess that the structural problems, the nature of the university, the antiquated university structure, and the political situation, the heritage of Peron—all put together are the primary reasons for migration from Argentina." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 84.)

[268] Hearings, Senate, Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 80.

[269] Myint, op. cit., pp. 243–244.

[270] Melvin J. Fox, "Some Pluses and Minuses of the Brain Drain," *In, International Development*, 1966, op. cit., p. 74.

Unrest and instability can drive professionals into migration. As physicist A. B. Zahlan of the American University of Beirut observed, "Today, political instability may be the greatest factor behind migration because there are other 'stable' countries to which scientists can go." [271]

Generalizing on the consequences of adverse political developments, including instability and unrest, and their relevance to brain drain, the CIMT study stated: "These movements have generally resulted in losses of large numbers of highly trained people who might otherwise have made a substantial contribution to the development of their own society." [272]

GOVERNMENTAL INDIFFERENCE TO SCIENTIFIC DEVELOPMENT

Governmental indifference to scientific development, science policy, research support, and the role of scientists in society provides motivation for many scientists and engineers to emigrate. This "push" factor is closely related to the low prestige accorded science and technology in some parts of the Third World. Assigned a low priority in a nation's value system, scientists and engineers suffer deprivations accordingly in the allocation of resources, in the shortfall of rewards, and in minimal participation in national development.

The predictable consequence is emigration. "Among research scientists" in Africa, wrote R. K. A. Gardiner, "a sense of dissatisfaction with an attitude of indifference which prevents their ideas from being put into practice, provides a powerful urge to go elsewhere." [273] Prof. Amador Muriel portrays graphically the impoverished and primitive state of Philippine science and then concludes: "As in all other professions, the chief motive for emigration is poor working conditions bred by government apathy and corruption." [274] A UNESCO study on science and technology in Latin American development attributed one of the "most evident" "push" factors for emigration to the ". . . absence of a national policy for science and technology which would ensure that adequate means are provided for scientific work and that it is properly related to the country's general development." [275]

EROSION OF NATIONAL LOYALTIES

Less directly related to the impact of political acts of governments in "pushing" professionals into migration, but nonetheless a power-

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[271] Science and technology in developing countries. Nader and Zahlan, op. cit., p. 491. Professor Nader added this explanation: "The problem of political instability in relation to developing scientific institutions becomes important because there *are* other places in the world to which scientists from developing countries can go. Moreover, those who do not leave are prevented or hindered by political upheavals from developing the kind of support system for science which I have outlined. If a developing country aims at having a flourishing network of scientifically trained persons making various contributions in support of scientific activities, including research, then this network has to be protected from political disorders. The international political situation of today is quite different from that which prevailed when England and Italy were developing their scientific institutions."

[272] CIMT study, p. 695. Lafi Ibrahim Jaafari, a Ph. D. from Iowa State University, concluded in a study on Palestinian and Jordanian Arab brain drain to the United States that, "Political instability at home is not the primary reason why students come to the United States to study, but it is one of the major reasons why they do not return." (The Brain Drain to the United States: The Migration of Jordanian and Palestinian Professionals and Students," *Journal of Palestine Studies,* 3 (Autumn 1973), p. 123.)

[273] Gardiner, op. cit., p. 198.

[274] Muriel, op. cit., p. 39.

[275] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 30.

ful and pervasive force, is the erosion of national loyalties that eases transition to life in a new land.

Various elements contribute to the erosion of national loyalties. The universality of science usually creates a binding sense of brotherhood among like-minded world scientists. From this unique relationship there often develops a kind of transcendent loyalty that eases communication and interaction, and creates conditions for developing larger and more universal values than those restricted to national frontiers. Saleh Ambah of Saudi Arabia's College of Petroleum and Minerals explained: "The higher an individual moves in the technical and professional scale, the greater his mobility and the less the differences which are attributable to national culture." [276]

Expatriation frequently comes with long exposure to other lands and cultures, especially among foreign students who come to advanced countries at a young age and after a period of time find their sense of national loyalty substantially diluted. Reflection on conditions and career possibilities at home can provide the necessary "push" to effect the final break. For Christian Arabs who admire Western culture, such transitions are not difficult. Nor is it difficult for students in Britain from the Commonwealth LDCs as well as from more prosperous Australia, New Zealand, and Canada to transfer loyalties in response to the sociological and cultural attractions of the "mother country" that overcome loyalty to their native country.[277] Then there are those like the "too many trained" Cameroonians who, in the words of the UNITAR study, "lack a strong sense of nationalism and responsibility toward the development of the country" and find changing allegiance to France or some other advanced country no great wrenching experience.[278]

"Pull" Factors in Brain Drain

"Pull" factors are the converse of "push" factors: combined, they stimulate brain drain. The "pull" factors, like those providing the "push" of migration, lend themselves to the convenient economic, cultural and intellectual, social, and political categories.

ECONOMIC FACTORS: VITALITY OF THE AMERICAN ECONOMY

By far the most powerful "pull" factor is the economic strength of the advanced receiving countries, particularly the United States. America's scientific-technological civilization, the main source of its economic prowess, attracts talented if less affluent professionals from abroad.

The growth of American power in the decades since the close of World War II has been phenomenal. The principal base for this power was the Nation's economic vitality. Economic growth was the natural result of a combination of favorable conditions existing in the United States: an abundance of resources, human and material; mastery of advanced techniques of production, distribution and marketing; commitment to universal education; and possession of a national and his-

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[276] Saleh Ambah, "The Role of the College of Petroleum and Minerals in the Industrialization of Saudi Arabia," *In* Nader and Zahlan, op. cit., p. 253.
[277] Mvint, op. cit., p. 237.
[278] UNITAR, *Brain Drain From Five LDCs*, 1971, p. 122.

toric commitment to industrialism. As the Cold War gained momentum, the Nation's economy was gradually adapted to meet growing foreign policy and defense requirements. Defense and space, high priority needs in foreign policy, absorbed much of the vast energies of the expanding American economy. Growth was stimulated by massive support from the Federal Government, not only in direct outlays of funds for defense and space, but what is more important for considerations on brain drain, in the form of research and development in science and technology. R. & D. became one of the main catalysts for brain drain of professionals from abroad.

GOVERNMENT SUPPORTED R. & D.

Data on the extent of federally supported R. & D. in the 1960's are impressive. The total expenditure on R. & D. in U.S. industry rose from $7,731 million in 1957 to $14,197 million in 1965; 55 percent of it came from Federal funds. In 1965, the number of federally financed R. & D. scientists and engineers totaled 162,000, or nearly half of all such personnel (346,000) in industry. The Department of Defense supported 59 percent and the National Aeronautics and Space Administration 30 percent of all R. & D. scientists and engineers employed in Federal projects.[279]

During the years of 1958–66, the expansion of the Nation's science and engineering manpower was dramatic. The number of R. & D. scientists and engineers in industry increased by 47 percent from 243,800 in January 1958 to 358,900 in 1966. In the same period industrial R. & D. funds increased by 84 percent. During this period R. & D. scientists and engineers increased markedly in two industries closely related to defense and aerospace: 43,300, or 90 percent, in electrical equipment and communications, and 42,100, or 72 percent, in aircraft and missiles. Federal financing was proportionately largest in these industries, 63 percent and 88 percent respectively. "It is a striking fact," wrote Brinley Thomas, an economics professor at the University of Wales, "that no less than 74 percent of all-industry growth in employment of R. & D. scientists and engineers in the last 8 years occurred in these two industries, largely governed by the defense and space programs of the Federal Government."[280] In 1966, the aircraft and missile industry alone employed 28 percent of all R. & D. scientists and engineers.[281]

Comparative figures on United States and West European R. & D. underscore the intensity of the American commitment to science and technology. Spending in 1969 for R. & D. amounted to about $24 billion annually in the United States, more than two-thirds of which was federally financed. Western Europe with a much larger population, spent only $6 billion annually. And though the population of Britain, France, West Germany, Belgium, and The Netherlands totalled nearly that of the United States, these countries put only about half as many scientists, engineers and technicians in R. & D.: the United States employed 1.2 million; the five West European nations, 519,000.[282]

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[279] Thomas, op. cit., pp. 40–41.
[280] Ibid., pp. 41–42.
[281] Ibid., p. 42.
[282] Adams, *Talent That Won't Stay Put*, p. 77.

Expenditures in R. & D. on this scale enhanced the technological predominance of the United States in the world.[283] Parallel increases in Federal expenditures, though not on the same scale, were made in the Nation's health services during the postwar decades as economic and social pressures stimulated a governmental response to the growing health needs of the American people. The combination of both created unique conditions to drain talent from many countries into the United States.[284]

SHORTAGES OF SCIENTISTS, ENGINEERS, AND PHYSICIANS

American preeminence in science and technology would have been sufficient to attract manpower from abroad. Disadvantaged professionals from the LDCs and even the dissatisfied from the advanced countries of Europe, "pushed" by multiple forces within their own lands, would find the American environment appealing and professionally satisfying. But added economic incentive was given to this natural attraction by the disequilibrium in the supply and demand of certain categories of professional manpower.[285] As Dr. Kidd observed, "scientists and engineers are in chronically short supply in technologically advanced countries."[286] This was true of the United States; it was also true of other advanced countries.[287]

Expansion of American science and technology along with the expansion of the Nation's health services created a demand for manpower that the American educational system could not satisfy. Oversupply, especially in the LDCs, and undersupply in the United States created a natural "pull" interaction, to the advantage of the United States, but a marked disadvantage to the LDCs.

As Dr. Kidd notes: "Highly trained people are difficult to produce, and importation of brains is less expensive than the expansion of universities. The attainment of important national goals is made easier by immigration."[288] In brief, economic disequilibrium in supply and demand creates the "pull" and immigration provides the means.

Perhaps the largest contributor to the economic "pull" factor in the United States, in addition to the undersupply of scientists and engi-

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[283] British Prime Minister Wilson gave this explanation for United States leadership: "America's technological dominance in so many parts of the world derives from the original opportunities presented by her own wide, dynamic open market; it derives too from the fact that her industries are sufficiently developed and massive, sufficiently free from undue fragmentation, to enable her to reap the advantages of large-scale production which modern technology demands. . . . So it must be for us." (EFTA Reporter, Jan. 9, 1967, quoted *In* Hearings, House, Government Operations Committee, *Brain Drain,* 1968, p. 59).

[284] Dr. Frankel gave the following explanation for U.S. Government responsibility for brain drain: "Finally, it is important, in the interests of accuracy, to recall that United States Government funds may have an indirect and unintended impact on the 'brain drain'. We do not know the figures, which by their very essence would be hard to get at. Undoubtedly, however, foreigners do come to our country, and occupy positions in laboratories, hospitals, universities, and the like—positions that exist because the United States Government, through its general assistance to research, development and educational activities in the national interest, has provided financial resources. In this sense, there is probably an indirect Government contribution to the 'brain drain'. But the extent of this contribution is naturally hard to measure, and its significance is even harder to appraise." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills,* 1968, p. 17.)

[285] Mylnt, op. cit., p. 236.

[286] UNESCO, *Final Report on the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 184.

[287] CIMT Study, pp. 668–69.

[288] UNESCO, *Final Report on the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 184.

neers, has been the growing shortage of medical doctors. In the recent past the figure 50,000 seems to have been most frequently cited as indicating the dimension of this shortage.[289] However, more current assessments tend to portray the shortage not so much in numerical terms as in certain types of M.D.s and the maldistribution of specialists. According to the American Hospital Association, American hospitals are currently short 10,000 physicians.[290] Hardly more than half of the internships and residencies being offered in American hospitals are filled by graduates of American or Canadian medical schools.[291]

In 1970, the Public Health Service estimated a shortage of 150,000 nurses and more than 250,000 allied health personnel, in addition to the shortage of almost 50,000 doctors.[292] "The United States simply does not produce enough physicians to meet its national need for health manpower," wrote Dr. Jacob L. Halberstam, Dr. Howard A. Rusk and others in a study on FMGs.[293] Some students of the medical brain drain are more sharply critical in their judgments. "Senator Walter F. Mondale and others have deplored our shortages in the medical field, terming that shortage a 'national disgrace,'" wrote Harold E. Howland in his case study of the medical brain drain from the Philippines, and he added: "This writer must agree with that view."[294]

Nor is it likely that this shortage will be rectified in the near future. Indeed the prognosis is gloomy, according to qualified observers on the medical manpower scene, if retrenchment in federally supported health programs continues. In 1968, Dr. Harold Margulies, author of a thorough study on FMGs, wrote to the House Government Operations Subcommittee on Research and Technical Programs: "Although some of the brain drain is due to our own manpower shortages, it is almost certain that these will persist for many years, despite even the most extraordinary efforts on our part."[295] Dr. Charles C. Sprague, Dean of the University of Texas Southwestern Medical School, told the subcommittee in assessing the impact of Federal health programs on medical manpower requirements: "It would be difficult either to define or to exaggerate the physician and other medical manpower needs these new programs will generate. It is patently obvious that, unless we make some giant strides forward in the area of research in delivery of health services and increase our output of physicians and other health personnel, we will have to continue to rely on personnel trained in other countries to a very substantial degree or simply delay full implementation of many, if not all, of these programs."[296]

Six years later in 1974 the shortage continues at a progressively accelerated pace. Future prospects are not bright. Should funds be reduced in the area of federally supported medical research during the coming year, said Dr. John A. D. Cooper, President of the Association of American Medical Colleges, on May 15, 1973, there was a "strong

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[289] *The Christian Science Monitor,* Sept. 12, 1973, p. 6.
[290] Stevens and Vermeulen, op. cit., p. 5.
[291] Ibid.
[292] *The New York Times,* Nov. 22, 1970, p. 40.
[293] Jacob L. Halberstam, Ph. D., Lawrence Antler, Ph. D., Howard A. Rusk, M.D., and Joseph D. Seltzer, "Foreign Interns in Commmunity Hospitals," *Journal of Medical Education* (June 1971), p. 504.
[294] Howland, op. cit., p. 6. Mr. Howland proceeded to enumerate and categorize areas where the shortage was most acute.
[295] Hearings, House, Government Operations Committee, *Brain Drain,* 1968, p. 91.
[296] Ibid., p. 6.

possibility" that a substantial number of medical schools would have to reduce the size of future entering classes and curtail innovative programs for the curriculum.[297]

Medical scientists and medical educators, traditionally cautious in public pronouncements, reacted sharply to the Administration's budget cuts for health and medical research. The *New York Times* termed their reaction "quite spectacular," and quoted the doctors expressing such adjectives and epithets as: "unimaginative," "obtuse," "irresponsible," "disastrous," "catastrophic," and "lunacy." [298]

Some of the sharpest criticism of current health policies came from Dr. Jesse L. Steinfeld, at present head of a department at Mayo Clinic and for 3 years before that, the Surgeon General of the United States, a post to which he was not reappointed and which remains unfilled. Correspondent Richard L. Strout of the *Christian Science Monitor* enumerated three facts in his article on Dr. Steinfeld: (1) The shortage of 50,000 physicians in the United States; (2) the turning away of some 20,000 qualified American premedical students from U.S. medical schools each year for lack of space; and (3) the hiring of 40 percent of the interns in American hospitals from foreign countries, often to the disadvantage of the LDCs which produced and still need them. A paradox like this, he said, had convinced Dr. Steinfeld, in the doctor's words, that the "whole complex health-delivery apparatus is out of control" and that the "health and medical apparatus is in chaotic condition." [299]

The shortage in American medical manpower has created a disequilibrium in the supply and demand equation in this country, providing what Dr. Margulies termed "Almost unlimited opportunities for the employment of foreign medical graduates." [300] The marginally employed, superfluous Asian, African, and Latin American FMG is irresistibly drawn to the possibility of wealth, social status, and American citizenship.

Why the shortage of doctors in the United States? Students of brain drain emphasize that the great expansion of health services under federally sponsored programs increased the demand for M.D.s. And American medical schools could not supply the demand. (In 1956, the United States produced 9,862 doctors; 11 years later the figure had increased by less than 10 percent.) [301] Accordingly, U.S. medical institu-

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[297] In reporting the results of the AAMC survey of medical schools, Dr. Cooper said: "In terms of undergraduate medical education, one third of the schools reporting indicated the strong possibility of having to reduce the size of future entering classes. For a considerable number of schools, future increases in first-year enrollments will not be possible. And for a majority of the reporting schools, programs for curriculum innovation may have to be abandoned or curtailed." Statement by AAMC on the costs of medical care and the role of the Federal Government, presented by John A. D. Cooper, M.D. before the Consumer Economics Subcommmittee of the Joint Economic Committee, May 15, 1973, p. 6.

In citing the shortage of doctors to staff hospitals and indicating the degree of dependency on FMGs, Stevens and Vermeulen made this projection: "Presumably, then their [i.e., American hospitals] demand for more foreign physicians will continue." (Stevens and Vermeulen, op. cit., pp. 4–6.)

For a discussion of the impact of cutbacks in federal funding on American medical education, see Harold M. Schmeck, Jr., "Medical Educators Here Alarmed by Proposed Slash in U.S. Funds," *The New York Times*, Apr. 25, 1973, p. 45. Nine medical educators in the metropolitan New York area discussed this problem. They said that the cutback in general research funds and training grant money, in the words of the *Times*, "would retard the development of the next generation of medical scientists."

[298] Harold M. Schmeck, Jr., "Policy Shift: The Doctors See a Bad Prognosis," *The New York Times*, May 27, 1973, p. 16E.

[299] Richard L. Strout, "Health-Care 'Paradox' Blamed on U.S. Policy," *The Christian Science Monitor*, Sept. 12, 1973, p. 6.

[300] Margulies and Bloch, op. cit., p. x.

[301] Baldwin, op. cit., p. 370.

tions tapped the surplus labor market abroad to meet their demands.

However, the key question is why the United States with its abundance of wealth, power, and human material resources could not produce a sufficient number of medical doctors to meet its needs. Repeatedly, American students of brain drain attribute the cause to the American Medical Association, which they assert has maintained effective control over the supply. Perhaps the most complete statement of this process was made by Dr. Adams in hearings on the brain drain problem before the House Government Operations Subcommittee.

He said:

> The cartel-like guild restrictions, such as those imposed by the American Medical Association, which restrict entry into certain professions, set up an almost irresistible magnet which, at prevailing income differentials, attracts talent from advanced and underdeveloped countries alike. They constitute an impediment to the proper functioning of the free market within the "pull" country, and thus prevent the domestic production of the talent required to satisfy the effective demand for it. By stimulating immigration to compensate for existing artificial shortages, these restrictions lend force to the argument that "have-nots" are subsidizing the "haves." [302]

In contrast, the AMA appears to attribute the shortage to problems in medical manpower maldistribution and excessive demands on health services created by new programs. In its 1970 report on FMGs, the AMA explained in the introduction:

> While the United States enjoys a physician-to-population ratio higher than that of most nations, the geographical distribution of physicians and the mechanisms which bring patients into contact with physicians are thought to create shortages of physicians in some areas of the United States and overutilization of medical services in others. New programs which have increased access to health services have increased demands on the physician population without doing much to alleviate this imbalance.[303]

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[302] Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 60. For other comments on the role of the AMA in restricting the supply of American doctors, see, Johnson, op. cit., p. 73 and Myint, op. cit., p. 237. Herbert G. Grubel writes: "In the United States highly skilled persons are attracted from abroad as a result of conditions of excess demand. Thus, practices by the American Medical Association restricting the supply of doctors in conjunction with massive government medical care and health research programmes have created an excess demand for medical personnel." "The Reduction of the Brain Drain: Problems and Policies," *Minerva* 6 (Summer 1968), p. 550.

[303] AMA, *FMG Study,* 1971, p. 1.

An editorial appearing in the *Journal of the American Medical Association* of Oct. 22, 1973 entitled, "Physician Migration: Brain Drain or Overflow?" commented approvingly of an article by an Iranian medical educator, Bahman Joorabchi, who challenged the brain drain theory adopted by American writers. Yet it raised many basic questions that go to the heart of the brain drain problem.

According to the *JAMA* editorial, Dr. Joorabchi "demonstrates in very clear terms that the shifting from Iran is an overflow and not a brain-drain." The editorial explained the problem of mismatched training and failure of LDC economies to absorb surplus manpower. The editorial cited the fact that American observers who espouse the brain drain theory point to the very low physician-population ratios in these countries as evidence that they need the doctors more than the U.S. "Yet, they fail to observe," the editorial said, "that 90% to 95% of their physicians practice in urban centers where the physician-population ratios are considerably higher than the U.S. cities. In these countries, therefore, large segments of the rural population have no medical care." Dr. Joorabchi noted that in suburbs of Teheran there is one M.D. for every 200 persons. In the rural areas where 76 percent of the people reside, there are few physicians. He explained that rather than struggle through economic, professional, and social barriers, the doctors naturally move to where their services are in demand.

The *JAMA* editorial concluded with the observation that the data indicate that "the business of providing professional services for its people is today a complex matter for an agrarian nation." And it posed the following questions that suggest an awareness of the complexity of the dilemma of medical brain drain: "Should such a nation be training a technician or professional other than the traditional physician (as Dr. Joorabchi suggests)? Should the United States deny physicians from these countries the privilege of taking specialty training in its hospitals? If so, is there any assurance that the problem of providing medical services in the rural communities of these countries will be relieved? Moreover, is it consistent with our basic tenets of individual freedom and the pursuit of excellence to deny training to foreign-educated professional people." (Henry R. Mason, AMA Division of Medical Education, "Physician Migration: Brain Drain or Overflow? *JAMA,* 226, (Oct. 22, 1973), p. 463.)

The Stevens-Vermeulen study made no mention of asserted AMA restrictive policies but did stress maldistribution of medical manpower as a causal factor in the doctor shortage. It gave this explanation:

> The nature of the "pull" factors deserves special scrutiny, however. Has the United States been training too few physicians to meet current needs? Current efforts toward a rapid increase in the number of medical students would suggest that it has. Yet in comparative terms the United States is already one of the world's richest countries in terms of its production and supply of physicians. It is perhaps more accurate to say that the American health system encourages a relatively prodigal use of physicians, compared with the more tightly organized health systems elsewhere, and that this, in turn, reflects the absence of goals and policies for physician manpower distribution in America. If so, domestic and foreign policies cannot be considered separately.[304]

PULL OF HIGH SALARIES AND CAREER OPPORTUNITIES

The shortage of scientific, engineering, and medical manpower combined with the Nation's powerful economic base make the United States the strongest competitor in the world's labor market. Heavily influenced by rates of economic growth in the world economy, responsive to the pull of undersupply, and highly mobile internationally, professional human capital is attracted to such areas where productivity is highest and manpower demands strongest. And as Professor Thomas observed, the "magnetic pull" of high salaries and career opportunities is "felt right down to the poorest of countries." [305]

Students of brain drain cite salary as a principal economic "pull" factor. This conclusion would seem to be supported by the salary differential between professionals in the United States and those in the LDCs, and even in other advanced countries. In March 1966, the National Science Foundation reported that in the United States the median annual salary for chemists and mathematicians was $11,000; for physicists, economists, and statisticians, $12,000; for professional medical personnel, $15,000. The difference between this salary scale and those offered in some LDCs is substantial. In many Asian and African countries the annual median for such professions hardly exceeds $3,000. Even allowing for substantial differences in purchasing power, the U.S. salary scale would still provide a much higher standard of living.[306] In India, in the mid-1960's medical and engineering graduates received Rs. 677 ($90.00) and Rs. 540 ($72.00), respectively a month; those trained in geology, mathematics, statistics, and zoology were paid Rs. 420 or $56.00 a month, while falling between the last two categories were chemists and other scientists.[307] Symbolic of the widespread discontent in India among professionals is the doctors' strike in February 1974 for higher salaries.[308]

A report on migration from Chile shows somewhat comparable salary differentials. Three-fourths of the highly skilled emigrants earned between $150 and $300 a month before leaving, and in the United

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[304] Stevens-Vermeulen, op. cit., p. xii.
[305] Thomas, op. cit., p. 40.
[306] Eren, op. cit., p. 11.
[307] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, pp. 35.60–61.
[308] *The New York Times*, Feb. 17, 1974, p. 8.

States three-fourths of them earned over $400 a month, and 40 percent earned over $800 a month.[309]

Even among advanced countries, American salaries attract the less advantaged professional. Starting salaries of most professional categories in the United States are three times higher than in Britain. Estimates for other countries confirm the wide salary differential.[310] And as in the case of Britain, Netherlands, and Sweden, low salaries paid to scientists and engineers are correlated with the greatest "drain" of professional manpower.[311] This differential in salaries as Adams and Dirlam observed, "is an inevitable magnet for migration." [312] Salary and the high standard of living that it can provide the itinerant professional in the United States exert, as Dr. Giorgi wrote, "a permanent draw." [313]

Current data from the National Science Foundation corroborate these observations on salary and living standard as a substantial "pull" factor in professional immigration. A sample survey in mid-1970 of some 8,000 alien scientists and engineers who were admitted into the United States between February 1964 and January 1969 and who were reported as permanent U.S. residents in January 1961, revealed that "most often" (between 60–70 percent) they were "seeking a higher standard of living." It was also found that about 90 percent earned more than $10,000 yearly and 9 percent more than $20,000. According to the survey, about one-half said that their current salary was at least 200 percent greater than those abroad. On the basis of this survey, NSF concluded:

> Immigration of scientists and engineers leads to greatly increased income, more intellectual freedom, and opportunities for these personnel to advance themselves and their families professionally and personally.[314]

Closely related to the salary factor in attracting professional manpower is that of career opportunity often denied scientists, engineers, and other professionals in their own country. The lure of a promising career in American industry, the universities, the medical establishment, and even the Government is compelling to the economically disadvantaged and professionally dispossessed. As Stevens and Vermuelen said, FMGs have "virtually unlimited opportunities to practice medicine in major cities" of America.[315] Few Saudi Arabian stu-

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[309] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 79.

[310] Adams and Dirlam, op. cit., p. 248.

[311] Silj, op. cit., p. 9.

[312] Adams and Dirlam, op. cit., p. 248.

[313] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America*, 1965, p. 174.

DeTocqueville understood the nature of this "permanent draw" early in the American experience. After his visit to the United States, he wrote in his "Democracy in America" published in 1832: "To build a house, to run a ship, to manufacture an object, or to produce wheat, the American people always found a way to use half the manpower needed in Europe. Hence, salaries are twice as high and this in turn draws large groups of immigrants." (Quoted by Dr. Kidd *in* Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 49.)

[314] National Science Foundation, *Immigrant Scientists and Engineers in the United States: A Study of Characteristics and Attitudes*, 1973, pp. vi–viii. NSF 73–302. (Hereafter cited as, "NSF, *Study of Characteristics and Attitudes of Immigrant Scientists and Engineers in the U.S.*, 1973.")

[315] Stevens and Vermeulen, op. cit., p. xii.

dents emigrate, according to the UNITAR study, "probably because they are offered excellent professional opportunities in their own country." "The chief reason for emigration in the Arab world," the study noted, "is the inability to find an adequate job" [316] The same is true of other areas of the world. In 1966 Dr. Dael L. Wolfle, then Executive Officer of the American Association for the Advancement of Science, referred to this more or less universal truth at a State Department workshop on international migration. In explaining both internal and external brain drain, he said: "We talk of this as a brain drain when it comes across national boundaries, but the reasons for movement . . . are likely to be much the same. They are reasons of opportunity. They are reasons of positions offered." [317]

But the pull of immigration to the United States is not necessarily left to chance. In competing in the world labor market for highly skilled manpower, American business firms, especially those with overseas connections, actively recruit. Universities have found foreign students a rich field for recruitment for permanent staff, for ongoing positions, and for research. Hospitals and other health services institutions have similarly found a rich field among foreign medical graduates. Published announcements on career opportunities in the press and professional journals and even recruiting visits to foreign countries are not uncommon practices.[318]

REVOLUTION IN WORLD COMMUNICATIONS

The revolution in modern communications is a final "pull" factor in the economics of professional migration. This revolution created an individual mobility unprecedented in the history of mankind. Communications specialists like Marshall McLuhan now speak of the world as a "global village" and a "contracting planet." [319] Expansion of the world's educational systems, responding more to popular demands than to immediate needs, combined with this revolution in communications to foster a universalization of knowledge. These forces encouraged the development of transnational communities of professional

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[316] UNITAR, *Brain Drain From Five LDCs,* 1971, p. 91. Lafi Ibrahim Jaafari discovered from a survey of Palestinian and Jordanian students and professionals residing in the United States that the initial motivation for education in the United States changed from "becoming of more benefit to my country" to "improving job opportunities." In the United States where there is a "better professional environment" most of the respondents felt that the career opportunities were greater. Hence, the rationale for immigration. Forty-five percent of the respondents were planning to remain in the United States either temporarily or permanently. (Jaafari, op. cit., pp. 123 and 125.)

[317] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills,* October 1966, p. 138.

[318] Aspects of the recruiting activities of American business and universities is discussed by Rev. William J. Gibbons, S.J. director, Scientific Manpower Survey, Fordham University, in Hearings, House Government Operations Committee, *Brain Drain,* 1968, pp. 4, 6–7. See also the example inserted in the testimony of Dr. Donald F. Hornig in, Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills,* 1968, p. 103. An announcement in the New Scientist, an English publication, on Nov. 17, 1966 noted the arrival of a recruiting team from America to discuss new job opportunities in the United States for qualified British engineers and scientists. It went on to say: "Employers will pay the full fare to the States for you, your family and belongings—probably offer you an advanced study course—give you staff support and facilities you never had before, and do their best to make you feel at home. The powerful American economy offers terrific prospects for technical people at all levels of experience. Major long-term projects opening up are creating countless new opportunities. Back orders alone run into billions of dollars. The professional's role in research, development and manufacture is highly valued in the USA. Employers are more willing than ever to hire a man for his potential and give him lots of responsibility fast."

[319] Robert Leestma, "OE's Institute of International Studies," *American Education* (May 1969), (HEW reprint pp. 5–8).

men. And these communities enabled the most isolated professional in the LDCs to know and to move wherever opportunities beckoned.

A "common market" for brainpower developed, transcending national boundaries. Improved transportation and communication, the global flow and accessibility of market information, increased individual mobility, the universalizing of knowledge, standardizing of professional training, and rationalizing of the mechanism for allocating talent—all interacted to aid the "pull" forces in the international movement of brains and talent.

A SUMMING UP OF ECONOMIC "PULL" FORCES

Realities of American economic strength have been a compelling force in pulling the disadvantaged scientist, technologist, and physician into the path of immigration. Promise of continued economic growth as the world's greatest industrial power, evidence of a continued Government commitment to R. & D., and undersupply of professional manpower created a natural attraction. High salaries, career opportunities, and prospects for improved present and future living standards added vital economic incentives. The revolution in communications, like a "want ad" in a local newspaper, brought these opportunities to the attention of professionals in the most remote parts of Africa, Asia, and Latin America. With the conveniences and cheapness of modern transportation, they could come, and did come, to America.

Cultural and Intellectual "Pull" Forces in Brain Drain

An advanced scientific-technological civilization in the West is a powerful cultural and intellectual force attracting skilled manpower into migration. This is especially true of the United States, the center of scientific and technological power in the world today.

U.S. DRAWING POWER AS A "CENTER OF EXCELLENCE"

The United States is a "center of excellence," a term used by students of brain drain to define ideal conditions for scientific development. All components of these conditions that are lacking in the LDCs and often wanting in many advanced countries of the West are amply supplied in the United States: economic resources and research support; universities and scientific institutions; laboratories and experimental centers; great teachers; a communication network connecting all professional organizations into a composite grid; a cooperative spirit among the scientific institutions, industry and government—in brief, the total infrastructure for the development of science and technology.

Matching these practical assets in importance is the all-pervading scientific spirit in this country that places a high value on science and technology and assigns their development a top-ranking priority in the Nation's hierarchy of goals. This spirit of scientism is responsible for creating the organizational structure of science in the United States and it has fostered an intellectual atmosphere that favors experimentation and innovation. Americans accept science and technology as a

normal part of their national life. A group of experts associated with OECD concluded a 1968 report on American scientific policies with a judgment that supports and gives historical perspective to this generalization. American scientific and technical enterprise, they declared, is deeply rooted in American tradition and history and from the beginning of the republic has been one of the mainsprings of American society.[320]

Thus, the combination of resources, infrastructure and scientific spirit has made the United States the leader of world science and technology.[321] International recognition of American leadership is manifest in practical achievements in science, technology, and medicine and also in the form of prestigious awards, such as Nobel Prizes, won by Americans.[322]

It was this intellectual climate and the accompanying rewards for creative attainments that produced a magnetic "pull" so powerful that Professor Brzezinski could conclude: "America's professional attraction for the global scientific elite is without historic precedent in either scale or scope." [323]

SCIENTIFIC-TECHNOLOGICAL CIVILIZATION: SOURCE OF "PERMANENT DRAW"

The West's scientific-technological civilization, particularly that of the United States, exerts a "permanent draw," stimulating the movement of scientists, engineers, and physicians from the LDCs and less advanced countries to the more advanced. For the United States the "pull" of its unique civilization has been compelling.

Sources on brain drain reiterate themes already discussed in showing the allure of industrial America. A discontented former American student from Taiwan, suffering from insufficient reference material and a lack of stimulation from professional colleagues in Taipei, asked a former professor to find employment for him in the United States, preferably in a metropolitan area. He complained that a

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[320] Brzezinski, op. cit., pp. 28–29. Professor Brzezinski quotes from the OECD report: "Since the first hours of the Republic, the right of citizens to the 'pursuit of happiness,' formulated in the Declaration of Independence, has been one of the mainsprings of American society; it is also the foundation of a social policy inspired by the prospect of new benefits issued from the scientific and technical enterprise. How can one fail to hope that these benefits, which have in fact contributed so much to national defense or the race for world prestige, will make an essential contribution to the achievement of other great national goals? It is this propulsion which has given science, the mother of knowledge, the appearance of a veritable national resource. The enterprise is indissolubly linked to the goals of American society, which is trying to build its future on the progress of science and technology. In this capacity, this society as a whole is a consumer of scientific knowledge, which is used for diverse ends: in the last century, to increase agricultural productivity and to facilitate territorial development, and then to back the national defense effort, to safeguard public health and to explore space. These are activities which have an impact on the destiny of the whole nation, and it seems natural that all skills should be mobilized to cooperate. In this way industry and the universities and private organizations are associated with the Government project." (Conclusion of a report prepared by the Secretariat of the OECD, January 1968, as quoted by *The New York Times*, Jan. 13, 1968, p. 10).

[321] E. Piore, Vice President and Chief Scientist of IBM has stated: "The United States has become the intellectual center of the world—the center of the arts, the sciences, and economics." ("Towards the Year 2000," *Daedalus* (Summer 1967), p. 958, quoted in, Brzezinski, op. cit., p. 30.)

[322] For data on America's innovating performance as reported by the OECD analysts and other evidence of American supremacy in science, see Brzezinski, op. cit., p. 28. The American scientific establishment, for example, claims leadership in pure science and also in the field of mathematics. In noting the marked preponderance of the United States in Nobel Prizes in Physics, Chemistry and Medicine, Prof. Brzezinski states: ". . . between the years 1901 and 1939 the United States and Canada won 13 prizes, while France, Germany, Italy, Benelux, and the United Kingdom won a total of 82, Scandinavia won 8, the US.S.R. won 4, and Japan won none. Between 1940 and 1967 the respective figures were 42, 50, 6, 8, and 2." (Ibid.)

[323] Ibid., p. 30.

"longer stay would mean a more complete fossilization of my career." [324]

A medical doctor from Greece declared that money was not the main inducement to practice in New York City rather than Thessaloniki. Being able to work in the Cornell Medical Center enabled him to progress in the study of medicine and gave him "the satisfaction of associating with advanced people" in his profession.[325]

A young nuclear scientist from another Mediterranean country had been offered a leading scientific post in his country's major university with a compensating salary. He chose to remain in the United States. Having research facilities and logistical support in the United States had great appeal, but "a more important consideration" to him was the fear of isolation.

> Even if I were assured of all these facilities, I would still be wary to return. I would be afraid of being isolated from the scientific world. Here, I am at the hub of things. There, I would be confined to an ivory tower.[326]

Perhaps an English scientist best summed up the magnetic appeal of the American scientific-technological civilization for all professional manpower when he said: "This is where the action is . . . this country is the one which is going to be the leader of our own particular civilization, as far as we can see, for at least the rest of the century. And if you happen to like being in the central part, by God, you come here." [327]

A striking effect of the "pull" quality of the United States has been the attraction of foreign students and scholars to American academic institutions and, in the case of FMGs, to U.S. medical facilities. Many LDCs, especially in the Middle East, lacking graduate facilities, rely upon those in the advanced countries.[328] As Prof. John R. Niland of Cornell University wrote, "American universities have become the linchpin of higher learning for much of the developing world." [329] Symptomatic of the pull of American academic institutions in the early 1960's are the following statistics: 44 percent of the Pakistani students studying at institutions of higher learning in 15 foreign countries were studying in the United States; 59 percent of the Indians; 32 percent of the Indonesians; 56 percent of the Burmese; 90 percent of the Filipinos; 64 percent of the Thais; and 26 percent of the Ceylonese.[330] Superior training available at American universities attracts foreign students, and what Professor Zahlan said of the Middle Eastern student could be said of others from the LDCs: "To a student at AUB [American University of Beirut] or Cairo, the aura of Harvard, Princeton, and Cambridge infuses *all* foreign institutions. These graduate schools thus exert a powerful attractive force." [331]

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[324] Charles P. Kindleberger, "Study Abroad and Emigration," *In* Adams, *Brain Drain*, p. 151.

[325] Eren, op. cit., p. 11.

[326] Ibid., pp. 11–12.

[327] Nigel Hawkes, "The Scientific Mercenaries," *Science Journal*, 6 (September 1970), p. 26.

[328] Said, op. cit., p. 14.

[329] John R. Niland, *Foreign Manpower Trained in the United States: Policy Implications of Non-Return*, Industrial Relations Research Association, 23d annual meeting, Dec. 28–29, 1970, p. 296.

[330] Gunnar Myrdal, *Asian Drama* (N.Y.: Pantheon, 1968), p. 1773, cited from Brzezinski, op. cit., p. 30.

[331] A. B. Zahlan, "Problems of Educational Manpower and Institutional Development," *In*, Nader and Zahlan, *Science and Technology in Developing Countries*, p. 311.

Once under the influence of the American scientific and technological environment many students will not return home. As Mr. Henderson observed, "scientific studies have . . . become for many a device not for development but for immigration." [332]

And the temporary visas, especially student visas, that gave access to American academic institutions become "launching pads for immigration." [333] The "pull" of American academic institutions is evident by the fact that an estimated 20 percent of foreign students will not return, and those from the LDCs exceed 35 percent.[334] To cite a specific case, some 50 percent of Iranian students of moderate wealth and influence studying in the United States do not return home.[335] According to a more recent source, more than 70 percent of all professionals immigrating from Taiwan, Korea, India, and Iran are nonreturning students.[336]

FMGs among foreign exchange scholars are most vulnerable to the "permanent draw" of the American scientific environment. Plentiful opportunities to work with the most sophisticated medical equipment and in the most advanced medical facilities in the world, potentialities for advanced study far exceeding any prospects at home, and virtually unlimited opportunities to practice medicine in the metropolitan areas of the country, have proved to be an open invitation to permanent residency. A medical degree, unlike many other professional credentials, commands international recognition: it is transnational and thus transferable. And as Stevens and Vermeulen observed, "emigration is a real career alternative," [337] particularly when the allure of America is so inviting.

ADDITIVES TO "PERMANENT DRAW": ACCULTURATION, MISMATCHED TRAINING, AND DONOR INDIFFERENCE

Decision to immigrate permanently, though taken as a voluntary act after residency in the United States or some other advanced country in the West, may be influenced by a variety of cultural and intellectual "pull" forces. Three specific elements in the receiving countries often affecting the decision are: the processes of acculturation, mismatch in education and training, and donor indifference to the returnee.

Process of Acculturation.—Acculturation processes often begin before the emigrant leaves his country. Many from the LDCs, like those from the Middle East, the British Commonwealth, French Union, and the Philippines, are preconditioned by their innate admiration of Western culture. Often their own cultures, especially in patterns of education, have become infused with that of the former colonial power, creating an easy transition from one world to another,

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[332] *Selected Readings on International Education,* House, Committee on Education and Labor, 1966, p. 350.

[333] U.S. Congress, House, Committee on Government Operations, *The Brain Drain into the United States of Scientists, Engineers, and Physicians,* a staff study for the Research and Technical Programs Subcommittee, 90th Cong., 1st sess., 1967, p. 15. (Committee print) (Hereafter cited as, Staff study, House Government Operations Committee, *Brain Drain into the United States of Scientists, Engineers and Physicians,* 1967.)

[334] Niland, "Foreign Manpower Trained in the United States," p. 296. See also, John R. Niland, "A Human Capital Model for Brain Drain of Foreign Manpower Trained in the United States," *Journal of Economic Issues* 5 (September 1971), pp. 70–71, ff. 5.

[335] Naficy, op. cit., p. 67.

[336] Fortney, op. cit., p. 57.

[337] Stevens and Vermeulen, op. cit., p. 75.

and also suggesting the idea of moving from an inferior to a superior cultural environment. These attitudes give prestige to study abroad and thus add to the forces of attraction. As V. M. Dandekar described the Indian experience: "The attitude is historical in origin and is a direct consequence of a century and a half of British rule in India. It has been very deeply drilled into the Indian mind through a direct and visible demonstration of the superiority of such education and training." [338] Finally, the emigrating professional wants to emigrate; it is his free decision, and this psychologically induces a positive predisposition towards the culture he is entering.

Total immersion of the immigrant professional in the environment of the advanced Western country hastens the processes of acculturation. Students from the LDCs coming to the United States fall under the dual influence of the total society as well as of the academic curriculum. Studies made of foreign students in American universities indicate a favorable interaction with Americans, suggesting the generalization that a favorable attitude towards American society exists.[339] Within this larger social context is the academic curriculum. The foreign student enters an educational system designed primarily for the needs of American society, not that of the Asian, African, or Latin American from whence he came. Accommodations are made to some degree by offering special courses, but most foreign students must fit into the design of the American curriculum.[340]

Studies in science and technology present a special case. Science has important international characteristics and even supranational potentialities and tendencies that produce a unique cosmopolitan outlook. But science is not value free and technology is even less so. The most abstract and theoretical sciences are imbedded in particular cultures and languages from which they cannot be excised. "Both science and technology," wrote Prof. Dwight Waldo of Syracuse University's Maxwell School, "are intertwined at their margins not simply with nationalism, but with transnational value-systems represented by languages, ideologies and religions." [341] Accordingly, the education of a scholar or scientist in a particular foreign culture, the American, for example, may make him unfit as a creative element in another culture; most assuredly it makes him vulnerable to brain drain. Success for the student is often measured by the extent of his commitment, adaptation, and absorption into his studies. This attitude acts as a catalyzing agent in the social processes of acculturation.

Thus the foreign student, particularly of science and technology, comes under a dual influence: that of the American value system both in education and in society as a whole which can erode his own national

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[338] Dandekar, op. cit., p. 209.

[339] In a summary of findings on a study of foreign students, Steven E. Deutsch concluded: "To generalize from the research data, the college and university students who come to this country from abroad are mostly male graduate students from the less developed nations in the world. Two-fifths are self-supporting. One-quarter of the students are in engineering with the same proportion in the natural and physical sciences. Foreign students interact with Americans to a significant degree; one-third live with Americans. The great majority of foreign students are satisfied with their opportunities for meeting Americans, reflecting their visiting of American homes, dating, and other forms of social interaction." (Deutsch, op. cit., pp. 178–179.)

[340] Testimony of Dr. Kidd, in, Hearings, House, Government Operations Committee, *Brain Drain*, 1968, p. 50.

[341] Dwight Waldo, "Planning and Administration for Viable Policies: The Perspective of Official Responsibility," *In* Nader and Zahlan, *Science and Technology in Developing Countries*, p. 401.

cultural loyalties, replacing those with the American; and that of the value system held by the world scientific community. The effects of each can be alienation from his own native culture. Professor Zahlan poses the basic question: "An advanced country such as the United States, desirous of landing a man on the moon by 1970, must necessarily have a value system that makes specialization in space technology a most desirable activity. Will a young Turk, Egyptian, or Persian who is exposed from 4 to 10 years to this intense propaganda have an inclination to join a faculty of a university of Erzerum, Assiut or Shiraz?" [342]

Most vulnerable to the forces of acculturation are those students who remain overseas the longest. Out of touch with his own country and immersed in the American environment for a period of 4, 6 or 8 years, the foreign student is likely to become alienated.[343] They become uprooted, "detribalized by the experience of foreign study," as Professor Kindleberger put it; many never go home to stay.[344] According to Rev. William J. Gibbons, S.J., of Fordham University, if foreign students remain one or several years after completing their studies, "they are apt to remain permanently." [345] Indian and Chinese students are apparently most vulnerable. Professor Niland concluded that those who do not make a firm mobility commitment within the first 6 months usually choose the nonreturn pattern.[346]

Also vulnerable to nonreturn are foreign students with advanced degrees. Mobility tends to rise with ascending levels of training. In India, only about 1 percent of all those with college degrees are abroad compared with 10 to 20 percent with graduate degrees.[347] A study in 1967 by the National Academy of Sciences stated that approximately a seventh of all persons receiving American Ph. D.'s were foreign citizens and that the percentage had been growing. For the period 1960–66, citizens from the LDC's constituted about 65 percent of this group, compared with 49 percent in 1920–59. For the period 1960–66, doctorates awarded to foreign students were heavily concentrated in the physical sciences and engineering (42 percent), biological sciences (25 percent), and social sciences (15 percent). The percentage of those intending to remain in the United States for their first postdoctoral employment had risen steadily over the years. According to

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[342] Nader and Zahlan, Science and Technology in Developing Countries, p. 308. Dr. Dael L. Wolfle gave this description of the internationalization of a scientist: "In science, it is particularly true that the young scientist grows up with two sets of loyalties. He is loyal to the region or the nation or the home country in which he lived, in which he was born and grew up. He is tied to it by reasons of language, religion, culture and family. He grows up also in the scientific community in which he learns that the great figures of the field come from many countries. It is likely that the teachers under whom he learns his science come from many countries. As he gets into active work, he becomes friendly with colleagues from other countries, and his community in a real sense is an international one. And so he is likely to move at different stages in his career. And this is not only a movement across borders, it is a problem of movement within borders." (Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 138.)

[343] Comments by Albert G. Sims, Vice President, College Entrance Examination Board, New York, N.Y., Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 117.

[344] Kindleberger, op. cit., p. 139.

[345] Hearings, House, Government Operations, *Brain Drain*, 1968, p. 4.

[346] Niland, *Foreign Manpower Trained in the United States*, p. 301. Among the reasons why foreign students remain so long overseas are the need to learn a foreign language, failure to obtain minimum academic standards for university admission, inadequate knowledge of academic requirements of courses for which they enroll; insufficient funds. (Gardiner, op. cit., p. 195.) In some instances African students have remained as long as 15 years or more overseas to obtain academic or professional qualifications.

[347] CIMT study, p. 691.

Dr. John C. Shearer, Director, Manpower Research and Training Center at Oklahoma State University, the figure for 1964–66 was "an alarming 51 percent." Further investigation revealed that 55 percent intended to remain in the United States.[348] No doubt, the ease with which foreign graduates with advanced degrees can obtain employment in complex economic systems of advanced countries accounts for their high rate of immigration. But this tendency is quickened by the pressures of acculturation which have ample time to take effect during the many years of study required to be awarded a Ph. D.

Also vulnerable to these pressures of acculturation are the very young foreign students, particularly the undergraduates. What Habib Naficy, Minister for Cultural Affairs at the Iranian Embassy in Washington, said of Iranian students in America could well apply to other students, especially from the LDCs. He attributed the cause of brain drain to the "high adaptability" of youth: "the younger they are when they come, the greater the possibility of their remaining." [349] Prof. Eli Ginzberg, Director of Columbia University's Program for Conservation of Human Resources, expressed similar misgivings: "There is no question in my mind that if a young person is separated from his homeland for a long number of years for study in a totally different environment, the probabilities are strong that he will not return to his native land." [350]

Mismatch in Education and Training.—Another contributor to the "permanent draw" of professional manpower to the United States and other advanced countries of the West is the mismatch in education and training of foreign students and scholars. A persistent theme in brain drain literature, mismatched education probably produces one of the strongest "pull" forces in brain drain.

The LDCs are most affected by the problem of mismatched training mainly because the source of the problem is underdevelopment. Education in the United States, or any other advanced country, is designed for the needs of a developed country. Values and unique methodologies, priorities, and goals of the advanced countries permeate both the curricula and the spirit of the educational process. Success is determined according to adaptation to and the achievement of these attitudes. An American chemist, engineer, or physicist is trained to fit into the larger corporate structure of American life whether in the service of academia, private enterprise, or Government-related research. American medicine is designed to serve a society whose physical and psychological ills are unique to an advanced industrial civilization.

A graduate student or scholar from Nigeria or the Philippines enters this educational structure with an entirely different set of values and goals. Coming from a developing nation, his needs and those of his country differ from those of the United States. Yet in the reality of things these needs are not taken into account. Furthermore, the gap between the level of knowledge in science, technology, and medicine in the United States and that of the LDCs is so wide that irrelevance in training results is inescapable. Freedom of choice in studies seems

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[348] Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 22.
[349] Naficy, op. cit., p. 67.
[350] Hearings, House, Government Operations Committee, *Brain Drain,* p. 89.

only a small part of the problem, though gearing training to development would help. But the problem itself derives from qualitative disparities in civilizations.

What happens is that the student in science, technology, or medicine coming to the United States acquires some kinds of knowledge that is largely nontransferable to his own country. And the further he advances in education the wider the nontransferability gap becomes. At some point in the process the student exceeds in education and training the practical needs of his country: either he cannot be absorbed into the economy at the level for which he has been trained, or there is no place for his specialized knowledge. As a result he becomes a frustrated, marginal professional whose only escape is to return to America, if he has gone home, or never to leave in the first place.

What often occurs was described by Iran's Under Secretary for Vocational and Technical Training: "We have been sending our students with great hope to highly industrialized countries to make them middle-level technicians. But unfortunately even these boys return with Ph. D. degrees which they cannot use."[351] And it might be added that probably many of "these boys" have taken the option of immigrating to the United States.

Dr. Amador Muriel, former physics instructor at the University of the Philippines and in 1970 a research associate with NASA's Institute for Space Studies, gave the following case history that illustrates the point more graphically:

> Eduardo Padlan is a young promising crystallographer who got his doctorate from Johns Hopkins University in 1968. He is now back at Johns Hopkins, continuing his research in crystallography after spending one disappointing year in the Philippines. Padlan typifies young Filipino physicists who come to the United States to train. All are eager to go back. Some return home, then come back to the United States. . . .[352]

Medicine seems to be the most visible field for mismatch. The LDCs and advanced countries have two different sets of health problems: the former focuses on infectious disease, rural poverty, preventive care, and a youthful population; the latter on chronic disease, urban affluence, specialized treatment, and problems of the aged. The LDC needs the general practitioner and public health professional; the advanced countries produce specialized physicians and a health care system stressing specialized forms of treatment. Medical education in the United States is typically urbanized, specialized, and hospital-based. It is designed to serve the needs of industrial America, not underdeveloped Asia, Africa, or Latin America. According to Dr. Kelley West, the LDCs need physicians who can design and supervise programs stressing preventive, diagnostic, and therapeutic measures for communities. Bacterial, parasitic, and nutritional diseases have the greatest significance in developing countries. However, foreign students in American medical schools will most likely not learn about the treatment of malaria, malnutrition, amoebiasis, schistosomiasis, and leprosy; but may well learn to diagnose and

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[351] Quoted in Henderson, op. cit., p. 57.

[352] Muriel, op. cit., p. 38. Nuri Eren cites the case of Korean students: "Of the 390 Koreans who earned doctorate degrees in the United States, only sixty-four have returned. Many of them remained because there was no outlet for the employment of their advanced training at home." (Eren, op. cit., p. 12.)

manage coronary disease, which is not yet a major medical concern in the LDCs.[353]

In short, FMGs coming to the United States enter a system that is not suited to the needs of their countries. The system itself creates mismatch conditions and accordingly contributes to "permanent draw." But the situation is further exacerbated by the tendency of FMGs in residency positions to enter specialized fields of anesthesiology, pathology, physical medicine, radiology, and psychiatry—all of which have limited appeal to American medical graduates. Data drawn from the AMA's study on FMGs for 1970 gives the following figures and percentages of FMGs (excluding Canadians) in these specialities as of December 31, 1970: anesthesiology, 3,304 (or 30.4 percent of the total physicians in this category); radiology, 1,952 (14.6 percent); pathology, 3,132 (30.5 percent); physical medicine, 501 (33.9 percent); and psychiatry, 5,025 (23.8 percent).[354] Apparently with these statistics in mind. Stevens and Vermeulen concluded: "Indeed, the possibility exists that at the conclusion of their experience many foreign physicians will no longer, either professionally or culturally, be able to fit into their own countries." [355] But the FMGs have what statistics indicate to be an irresistible option, namely, immigration.

Donor Indifference.—The final factor creating a "permanent draw" attitude in the cultural-intellectual sphere is donor indifference to student returnees. With few exceptions developing countries lack adequate arrangements for informing their overseas students about employment opportunities, development needs, programs, and trends at home. Such official indifference can breed alienation. Often an undesirable gap exists between the government-sponsored student returnee who may be automatically placed upon return and the private student, who may be potentially a very valuable asset, but who is likely to be met with indifference when it comes to employment possibilities. Returnees often may be led to believe that their countries devalue their training as an asset to be used in development. Underemployment often results. Such discouraging experiences of official indifferences can effect other students abroad. As the U.N. study on brain drain said, "When these returnees then re-emigrate permanently to the country of training, their personal tales of discouraging employment experience may have an effect on the return plans of fellow nationals studying abroad." [356]

Official indifference of donor nations can also be demonstrated by restrictions placed on career choices of returnee students by outright discriminatory regulations. A case in point is that of Malaysia. In 1966, the Malaysian Government ruled that only doctors who graduated from American medical schools in universities that were members of the Association of American Universities would be allowed to stand for civil service examinations for the Public Health Service of Malaysia. This rule meant that graduates from Johns Hopkins, for example, would be accepted, but those from 41 other medical schools in the United States could not practice in Malaysia.[357] Such manifested indifference to career possibilities by governments would presumably be

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[353] Nader, *Science and Technology in Developing Countries*, p. 456.
[354] Stevens and Vermeulen, op. cit., p. 153.
[355] Ibid., p. xvi.
[356] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 38.
[357] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 88.

sufficient to encourage any excluded Malaysian FMG in the United States to establish permanent residency in this country. In the present international environment of intense competition for professional manpower, the United States welcomes such talent.

THE ALLURE OF A SCIENTIFIC-TECHNOLOGICAL CIVILIZATION

In the cultural and intellectual sphere, the reality of U.S. pre-eminence in science, technology, and medicine creates forces of "permanent draw," attracting students and scholars, scientists, engineers, and physicians from all over the world. The LDCs are now the main target of attraction. Preconditioned by the desire to come to America and to learn, they become caught up in the processes of acculturation that transform values, attitudes, and national loyalties. Influenced by the inevitable effects of mismatch in training that result from disparities in civilizations, they find resolution of their dilemma in permanent residency. Donor indifference to their future opportunities and career possibilities reinforces the decision to immigrate.

Social "Pull" Factors: Appeal of American Social Democracy

American social democracy has a special appeal for the discontented professional abroad. Despite its imperfections, the American social order offers the professional such important values as freedom of social choice and prospects for social mobility. Unlike the rigidly structured, traditionally oriented social systems existing in many LDCs and even in some advanced countries, the United States offers upward mobility for the professional who has marketable talent, well conceived career plans, and willingness to work hard. The driving force within the American social order has been a spirit of freedom and equality of opportunity. And upon this concept a national tradition has developed that values pragmatism and experimentalism, and accepts as a guiding social principle the belief that a person's worth to society is determined less by inherited social position than by ability and performance. The frontier tradition in American history embodied this concept in the simple question, "What can you do?" The Nation's experience in immigration strengthened this tradition and created an historical record that is visible proof to contemporary man.

To European or Asian professionals who feel held down by their traditional societies, the spirit of freedom and equality of opportunity in America has great appeal. "Probably one is more free in this country than one is in Europe," said one British scientist, "and it is the essential freedom that is so attractive about this country." And a German scientist made a similar observation on the social and political aspects of the American environment: "In this country there are fewer restrictions. . . . I find more possibilities of creating my style of life, and not being narrowed down." [358]

America provides a wide latitude for upward social mobility based on merit and success. Talent and achievement are respected values, whatever the age of the professional. Responsibilities are given to the young, and the rewards come quickly. "Unlike Europe," wrote Alesandro Silj, "the American system rewards talented young people well. Careers advance faster, initiative is welcomed, age and seniority

[358] Quoted in, Hawkes, op. cit., p. 25.

are not prime factors." [359] In the developing countries where the patriarchical tradition is strong, a premium is put on age. Age is the criterion of professional competence and wisdom, and young people, however well trained or qualified, find it difficult or impossible to have their talents recognized as readily as in the United States or certain other Western countries. What may ordinarily be a traditional generational conflict can be further exacerbated by student training abroad and reentry efforts after years of absence at a higher level of expectation when entry at a much lower level would conform to established tradition.[360]

Prestige can be acquired quickly in America by foreign scientists, engineers, and physicians. In some instances foreign birth can enlarge rather than diminish that prestige. Careers in these fields of study command respect in America in contrast with some other countries and cultures, so that even moderate success can open the way for achieving prestige and social status.

Another aspect of America's social egalitarianism that acts as a "pull" force is the incidence of marriage of foreign students, scholars, and other professionals with American citizens. Marriage between, for example, some traditionalist-oriented Middle Eastern men and American girls can make it impossible for them to return home and reenter their traditionalist societies.[361] British scientists with American wives have been especially vulnerable to brain drain. According to one study of the correlation between marriage to North Americans and brain drain to North America, a large majority (92 percent) of the British scientists with North American wives were

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[359] Silj, op. cit., p. 9. The following might be considered a classic example of the sort of recognition given to young professionals in America. On September 22, 1973, the writer attended a performance of Verdi's opera, "Macbeth," staged by the Opera Society of Washington and presented as part of the Kennedy Center's Shakespeare celebration. Included in the cast were stars from the Metropolitan Opera and two leading British opera singers. They were supported by a chorus of some 40 singers and a full orchestra of symphonic proportions. The Opera House at the Kennedy Center was filled to capacity. The conductor of this very difficult and substantial ensemble effort was James Conlon, a 23-year-old graduate from Juilliard. Mr. Richard D. Fletcher, music critic of *The Christian Science Monitor* made this comment on his professional competence: "The Verdi score 'Macbeth' has never sounded more vigorous to my ears, largely due to the phenomenal gifts of young James Conlon, surely destined to become one of our greatest opera conductors." (*The Christian Science Monitor,* Sept. 29, 1973, p. 12.)

[360] Fox, op. cit., p. 74. For experiences in India, see Dandekar, op. cit., pp. 205–206. Dandekar quotes Sunidar Suri, an Indian scholar who studied in the West, returned to India and then left in dissatisfaction: "It is my disillusionment with my peers in India that made of me an intellectual refugee. . . . I intend to stay in and continue to teach in Germany, the U.S.A., or Canada or Britain or some other western country, or Australia or New Zealand. I have no intention at present of returning to India to take up a permanent or long-term academic research or any other position there." Suri went on to say: "I am a drained brain."

An Italian physicist recounted his experience: "I had no opportunities, at least my future didn't look very bright. Older professor types never gave people any responsibilities. They would just give them fellowships and say you can study in the library, don't bother me for a couple of years . . . a young person had no idea what his real worth was . . . in America instead I found that they do give you responsibilities and of course you can flog them or you can find out yourself what you are." (Quoted in, Hawkes, op. cit., p. 24) "The reason I left home," said a mechanical engineer, "was not to come to America, but to leave Greece. Greece for an 18-year-old person is not the best country to be in—Greece is a wonderful country if you are 45 or 50. Here I feel quite happy because I am 35 and I couldn't think of any other country in the world where I would like to be, being 35." (Quoted in, Hawkes, op. cit., p. 24.)

[361] Said discusses the problem of intermarriage and notes the complications Middle Eastern students can create for themselves by marriage to American girls. (Said, op. cit., pp. 15 and 17.)

Habib Naficy attributes marriage between Iranian students and American girls as a cause of brain drain. He writes: "Moral indebtedness to the American wives who have supported their husbands' study in the United States and do not want to leave (frequently spurious inasmuch as the husband's gloomy view of life in Iran is usually the basis of information upon which the American wife forms her own attitude.)" (Naficy, op. cit., pp. 68–69.)

going to remain, but only 65.5 percent with British wives intended to become permanent North American residents.[362] This study regarded the marriage factor in brain drain as being "very important." [363]

American acceptance of student failure without serious social stigma encourages nonreturn among foreign students who have failed their studies. The foreign student often carries a heavy burden, not only in studies, but as Professor Kindleberger said in the "hopes of his university, family, and government." [364] In some societies failure brings disgrace, and some students are unwilling to go home. According to Habib Naficy, 90 percent of Iranian student failures in the United States will "try by every means to remain in the United States rather than return to their families in Iran with such loss of face." [365] Professor Kindleberger mentioned the extreme case of a Chinese student failure who lived in the church tower on the Michigan University campus for a year and a half.[366]

ATTRACTION OF URBAN CENTERS

The social effects of urbanization act as another force pulling emigrant professionals to the urban centers of the United States and the West. Cities are centers of culture, learning, economic activity, and social intercourse. The dynamics of urban life sets the tone, pace, and style of American life; rather than turning off the emigrant professionals these qualities have had the reverse effect of attracting them. A specific case in point is that of the FMGs who concentrate in American cities and metropolitan areas rather than serving the needs of rural and medically disadvantaged America. (Some New York City hospitals are said to be staffed almost entirely with FMGs.)

And so it is with other professionals. Emigrant scientists, engineers, and physicians would seem to agree with their British colleagues who preferred stimulation to congeniality, change to stability, and challenge to relative tranquility. Accordingly, they found in the North American urban-oriented environment a "lusty competition" in professional and economic activities that was both appealing and satisfying.[367]

Qualities like these are distinct characteristics of urban America, and along with the spirit of social and political egalitarianism and aggressive individualism create a special appeal to the urban-oriented intellectual immigrant. References to the all-inclusive term "American life-style," meaning the social and economic character of American life, recur in brain drain literature, and perhaps this expression best epitomizes the appeal of American urban life.[368] "Listen, this is a different world, with different concepts," said one Middle Easterner

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[362] James A. Wilson and Jerry Gaston, "New Light on the Brain Drain," *New Scientist* 43, (July 31, 1969), p. 236.
[363] Ibid., p. 236.
[364] Kindleberger, op. cit., p. 140.
[365] Naficy, op. cit., p. 67.
[366] Kindleberger, op. cit., p. 140.
[367] Wilson, op. cit., p. 28.
[368] Professor Nilan writes: "Long range or permanent nonreturnees . . . are more attracted by the absolute level of salaries offered in the United States, and the general life-style available." ("Foreign Manpower Trained in the United States," p. 302.)

in contrasting life in America with that in the Arab world.[369] Exposed to the social dynamics of American urban life and the spirit of egalitarianism, emigrant professionals are induced, as one Korean Ph. D. candidate put it, "to reconsider their own philosophy of life." [370] As Abdul Said, a Saudi Arabian graduate student at the University of Kansas, observed: In a social situation in which the "individual's needs are gaining priority over the feelings of sacrifice and commitment to one's nation," the transition is easy from emigrant to immigrant.[371]

"PULL" OF SOCIAL FORCES

The appeal of American social democracy holds a prominent place among the "pull" forces in brain drain to the United States. Unlike the archaic, rigidly structured social orders of traditional societies, America presents to immigrant professionals an open and fluid society where upward mobility is easy and the criteria for access to social status are ability and performance. Responsibility is often given to the young professional, and rewards come quickly to the successful. Prestige is an added reward in this society that places a high value on science, technology, and medicine. Dynamics of urban life combine with the egalitarianism of the American social order to produce a life-style uniquely attractive to many immigrant professionals.

"Pull" Factors in the Political Sphere: Search for Political Stability and Freedom of Inquiry

Political stability probably ranks with freedom of inquiry as a factor attracting emigrant professionals to the United States and other Western countries. Established democratic institutions foster orderly processes of government, promise personal safety, and in general produce a climate of physical and psychological serenity that encourages intellectual pursuits. "First and foremost" among the reasons why the great majority of Arab scholars are attracted to the West, according to Michael W. Suleiman, "is the desire for peace of mind for the individual and his family." This quality he finds within the political systems of the United States and the West. Mr. Suleiman goes on to explain: "In practical terms, it means the absence of violence or threat of violence, be it physical or psychological. Insecurity, harassment, uncertainty as to what will happen next, political instability—all these are components of an anxiety syndrome that is mentally and physically debilitating." To escape this "syndrome," he continues, "many educated Arabs have chosen to reside in the West primarily to enjoy the luxury of a happy and productive life unencumbered by worries over personal safety." [372]

Students, scholars, and other professionals from the politically turbulent areas of developing Asia, Africa, and Latin America, the major sources of brain drain, find refuge in the stable democracies of the

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[369] Said, op. cit., p. 15.
[370] Ibid., p. 10.
[371] Ibid., p. 17.
[372] Michael W. Suleiman, "The Repatriation of Arab Elites," *Middle East Forum* 67 (Autumn and Winter 1971), p. 74.

West. Many, like the Cubans, never return; others, like many Africans, wait for favorable political changes, but meanwhile become engaged by the benign influence of their democratic host country.[373]

Advanced Western societies provide a political climate where freedom of inquiry can flourish. This freedom is vital to the survival of the research scientist and other intellectuals; it is a "pull" factor in immigration. Historically, the democratic concept of intellectual freedom has been a powerful magnetic force attracting emigrant professionals. In times of persecution and political stress, the United States, Britain, France, and now West Germany and Austria, have become havens of refuge for those who insist upon intellectual freedom in pursuit of their professions.

OFFICIAL GOVERNMENT ENCOURAGEMENT

Governments of advanced countries contribute to the "pull" factor in the political sphere by adopting policies specifically designed to encourage immigration. Competing on the world market for skilled manpower, these countries have reformulated their immigration policies for the stated purpose of attracting scientists, engineers, physicians, and other emigrant professionals. In the case of the United States, legislative provisions waive some of the requirements in special cases of need and otherwise ease the adjustment to immigrant status. Dr. Frankel conceded that American immigration laws and regulations stimulated harmful flows of manpower from the LDCs. He told the Senate Subcommittee on Immigration and Naturalization that "there is . . . a prima facie case for the proposition that our new immigration policies may aggravate the problems of many countries that are seeking to progress, and that need leaders and trained people to show the way." [374]

Less direct, but still meaningful, are the R. & D. programs sponsored by the U.S. Government that have directly or indirectly generated forces of attraction for emigrant professionals whose talents in fields of science, technology, medicine, and health are thus made readily marketable. As shown above, programs in educational exchange have also set up magnetic waves of attraction. Though many of these programs were conceived in a spirit of altruism, with the intention of assisting disadvantaged peoples and nations, the effects have been to encourage immigration.

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[373] David Dickinson Henry, Director, International Office, Harvard University, gave the following description of what often takes place among African students: ". . . some returned home to welcoming governments and sure jobs. Others, the victims of harsh political change in their own countries, are still waiting here or in Africa or elsewhere in the personal limbo of the political refugee. They long for the day when their talents and training may be put to use—the Ibos whose homes had been in Western Nigeria, the Asians from East Africa, the Rhodesians—but that day has not yet arrived." (Hearings, Senate, Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 122.)

[374] Hearings, Senate, Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 17. A unione example of special efforts by the United States to encourage the immigration of skilled manpower was "Operation Paperclip." This was the designation given to the exercise designed to bring into the country 475 former German scientists at the end of the war in Europe. One of the scientists observed: "It might not be an exaggeration to say that the Paperclip program was the first in American history where an entire group of immigrants were far above average in their intellectual capacity and mental heritage." Clarence G. Lasby, *Project Paperclip: German Scientists and the Cold War*, (New York: Atheneum, 1971), p. 271.

ATTRACTION OF REASON

By offering a working environment of political stability and intellectual freedom, by creating incentives through government sponsored programs, and by facilitating entry into the country through specifically designed legislation, the United States and other advanced countries create a powerful "pull" force in the political sphere that attracts the oppressed and disadvantaged, but willing and mobile, emigrant professional. In large measure, this force constitutes an appeal to reason.

Decision To Emigrate: A Combination of "Push/Pull" Factors With "Push" the Dominant Force

The decision to emigrate is a highly personal act. The rationale can be simple, like that of the scientist who preferred the United States because "the physical range between me and my mother-in-law is ideal"; or of the French engineer at MIT who immigrated because he "had little inclination to fight the Algerian War" and because he "wanted to see the Grand Canyon and New York"; or the Dutch scientist who found it difficult to explain his motivation, except that it was "simply because we were curious and there was an opportunity to come, so we came." [375]

But more likely the rationale is very complex and is generally affected by comparative considerations of "push/pull" factors described above. Enrique Oteiza of the Instituto Torcuato Di Tella at Buenos Aires described the process this way: "It is the comparison of the potential migrant's situation in his country of origin with the situation of persons with similar qualifications in the country of destination that enters into his decision." [376]

"Push/pull" factors thus intertwine. Conditions at home, ordinarily accepted as inevitable, become intolerable when elsewhere in the same field the situation by contrast is better. In a world environment of rapidly improving communications, transportation, and awareness, a comparative analysis can be made of coexisting realities and a decision reached. The determining factor is reward—to the individual, in terms of economic, cultural-intellectual, social, and sometimes political benefit. Moral issues tend not to intrude strongly if at all, nor is the decision necessarily perceived as a political act.[377]

In the present state of world development, the advanced countries offer the highest rewards. W. M. Besterman, a specialist on manpower problems, speaks of the "unfortunate discrepancy" that often exists between the marginal social product of a skilled worker's labor and the rewards for it. "In the developing countries," he continues, "the marginal social product is great but the rewards are often low; in the advanced countries, the marginal social product is relatively small but the rewards are great." He then concludes: "Migration flow is . . .

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[375] Hawkes, op. cit., p. 24.
[376] Otelza, op. cit., p. 126.
[377] James A. Wilson discusses the moral and political aspect of the decision in his article on the emigration of British scientists. The "vast majority" of 85 percent of scientists surveyed denied any sense of guilt about leaving the United Kingdom. Nor did they perceive their decision as a political act. (p. 27)

toward countries where individual rewards are greatest rather than to countries where needs are most acute." [378]

Accordingly, as most students of brain drain hold, the "push" factors predominate in decisions to leave the developing countries, the advanced countries play the primary role of providing an alternative.[379] Leslie Aldridge Westoff, co-author of a work on world demography, summarized vividly the comparative considerations of "push/pull" factors and the rationale for immigrating in the following hypothetical but representative case of an Iranian FMG:

> It has probably never occurred to the Iranian peasant to be psychoanalyzed. He is concerned with healing his sores and breaks so he can keep working. But the Iranian doctor does not want to heal sores out in the villages. It is more attractive to come to the United States, marry an American woman and get a visa to stay. Here his salary is in still-beautiful dollars, more negotiable than the pint of sheep's milk the peasant might pay him for setting a broken leg. As he prospers, the needs of the wretched peasant back home can disappear from memory surprisingly quickly.[380]

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[378] Quoted in Henderson, op. cit., p. 87.
[379] Ibid, p. 146.
[380] Leslie Aldridge Westoff, "A Nation of Immigrants: Should We Pull Up the Gangplank?" *The New York Times Magazine*, Sept. 16, 1973, p. 80.

V. Effects of Brain Drain: A Range of Possibilities

The complexities of brain drain as a general problem in contemporary affairs become more apparent when considering the possible effects. Wide disparities among nations frustrate attempts at constructing clear-cut categories that might permit reasonably accurate analysis.

Difficulties in Assessing Effects

Political, social, cultural, and economic conditions, and levels of development—factors that fundamentally determine migration—vary in every nation and in every region of the world. Similarly variable are the state of science and technology and development of education. By nature the subject matter is elusive and unstructurable.

In addition to this complexity is the fact that statistics on departures tell only part of the story. The statistical approach or a cost-benefit, "balance of payments" approach, establishing a ledger of losses and gains, fails to take into account the many intangibles, such as negative and positive effects on prestige and morale within respective scientific cadres and communities.[381] Losses and gains are often concealed or intermixed, further complicating the problem of attempting to isolate one from the other and drawing up a neat balance sheet in the manner of an accountant.[382] As Dr. Frankel explained, the impact of the brain drain on other countries "varies widely."

> Even from the point of view of other countries [he continued] it cannot be assumed that the "brain drain" is invariably a problem calling for a remedy. To say that a skilled person has come to our country is not necessarily to say that some other country has suffered a loss. We do not know if his skills were needed or whether, if needed, they would actually have been used. The impact on each country has to be considered on a case-by-case basis. Indeed, even the types of skills that should be counted as part of a "drain" will be different from country to country, and from one time to another.[383]

Nor is the problem made any less complicated when, as in this study, stress is given mainly to the LDCs in the belief that they experience the greatest outflow of skilled manpower and seemingly experience, therefore, the greatest loss, in contrast with the advanced countries

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[381] Rev. William J. Gibbons discusses this aspect of brain drain in, Hearings, House Government Operations Committee, *Brain Drain*, 1968, pp. 9–10.

[382] A report of the U.N. Secretary General on brain drain said: "It would appear from the evidence in the various studies that in no country can the outflow of trained personnel be regarded as having an entirely beneficial or entirely adverse effect. There are fundamental differences between countries and groups of countries, and between professions and occupations as well as differences with regard to the dimensions of the problem, the available local resources and potential to solve it and the approaches required in each case to remedy the situation." United Nations Economic and Social Council, "Outflow of Trained Personnel from Developing to Developed Countries." Report of the Secretary General, Jan. 27, 1971, 9 pp. (United Nations Economic and Social Council. E/4820, Summary.)

[383] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 14.

which have recuperative energies sufficient to reconstitute manpower losses.[384]

These complexities seem to justify the assessment of Gregory Henderson, who declared: "In valuing or even assuming 'loss' to development and to developing countries the analyst thus faces an essentially unstatistical, unmeasurable problem which lies close to the actual core of development as a process: different expectations concerning the problem-solving capability of the trained or educated man when faced with the environment of development." [385]

INTERNATIONALIST AND NATIONALIST MODELS

Literature on brain drain provides a full range of views as to whether talent migration is a positive or negative force for donor and receiving nations and for the world as a whole, but without resolving the question. The most prominent division among analysts for analysis, in what Professor Niland terms this "most disputed of areas," is in two models, the "internationalist" and the "nationalist." [386]

The internationalist model is essentially universalist. It views talent migration in global dimensions, judging its effects against the criterion of whether it adds to the economic and social welfare of the world at large. This view perceives brain drain in the context of the operations of the international market for one particular factor in production, namely, human capital. Such capital, according to this view, will tend to move to those regions and occupations where its productivity is high and away from those where it is low. So long as human capital is free to seek its highest reward, that is, an income equal to the value of its marginal product, and bears the cost of its own movement, it will automatically tend to flow to areas where its contribution is the largest and where it can do the most good. The calculus of the marketplace thus distributes advantages in all directions, though not necessarily on an equal basis.[387]

Advocates of the internationalist view assert that the migration of talent enhances the value and increases the output of the world economy but does not necessarily impair that of the donor nation. Indeed, migration can be advantageous to both the donor and receiving countries. As Philip H. Coombs wrote: ". . . we can cite cases—even of Nobel prize winners—who by not going home were enabled, with the

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[384] A report of the U.N. Secretary General on brain drain from the LDCs stated: "On the basis of the available statistics it would seem that the balance of trained manpower exchange between developed and developing countries, in numbers at least, may be adverse to the latter. . . . At the same time it is most difficult, if not impossible, to evaluate this exchange in terms of the quality of manpower." (Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 22.)

The report of the House Government Operations on brain drain stated: "Advanced countries may suffer flights of talent, but they usually have the advantage of large reserves. Also, they possess financial and other resources with which they can offset outflow by attracting back migrants, by draining talent from others, or by increasing domestic supply." (Report, House Government Operations Committee, *Scientific Brain Drain from the LDCs*, 1968, p. 5.)

H. G. Johnson suggests that no loss occurs to advanced countries as a result of migrations among themselves: "This analysis suggests that international migration of educated professional people, at least among the advanced countries, is extremely unlikely to produce world losses, and is on the contrary likely to produce substantial increases in potential world economic welfare." (Johnson, op. cit., p. 80.)

[385] Henderson, op. cit., p. 150.

[386] Niland, op. cit., p. 7.

[387] H. G. Johnson gives the most complete explanation of the internationalist model, in Adams, *Brain Drain*, chapter 5. Dr. Adams summarizes the essence of this model on p. 4. Professor Niland gives a more complete summary in his *Asian Engineering Brain Drain*, pp. 7–9.

aid of advanced laboratory equipment in a richer nation, to make major scientific discoveries or technical advances which will ultimately benefit all nations, their own included." [388]

Accordingly, internationalists, like Prof. H. C. Johnson, minimize the possibilities of loss to the LDCs in talent migration. Indeed, they contend that even the possibility of world loss is "highly questionable." [389] Development is an integrated process, Johnson explains, both of accumulating capital in the broad sense (that is, material, human, and intellectual) and of evolving a culture that places a high premium on the efficient use of such capital and promotes the habit of constantly seeking to improve the efficiency of its use. In his view, development "is not likely to be promoted by concentrating attention and economic policy on the accumulation of one type of capital on the assumption that all else will follow." [390]

In contrast, advocates of the nationalist position, probably representing without exception all of the LDCs, view talent migration within a much narrower frame of reference, specifically, the nation-state. For them the nation-state is the basic political unit in international affairs, deserving the highest priority and accordingly superseding all others including internationalists' concerns for the world economy. They regard certain levels of human capital as indispensable to the nation's economic development. Should the nation fall below this minimum through emigration, they see the consequences not merely as raising the marginal productivity of the remaining human capital, but rather of jeopardizing the growth potential of the nation.[391]

For the nationalist, losses are far less tolerable and acceptable than what the internationalist would allow. Loss of key skills that may trigger cumulative "external" effects in other sectors of the society disturbs them. Loss of high-level professional manpower, trained as a public investment, is looked upon as a "gift"—some say "unrequited gift"—from the LDC donor nations to the advanced countries.[392]

Consequently, the effects of talent migration are felt very personally by adherents of the nationalist view. They resent the flight of scientists, engineers, physicians, and other professional talent which they regard as indispensable to their nation's economic development. From their perspective, absence from the country deprives the nation of an expected and deserved manpower contribution. A genius whose work benefits all mankind is recognized as an exception, but they ask, as did Professor Shearer: "What about the hundreds of thousands of nongenius doctors, nurses, engineers—the people who make the wheels

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[388] Coombs, p. cit., p. 61.

[389] Johnson, op. cit., p. 86.

[390] Ibid. Harold E. Howland gave the following internationalist view of brain drain to the United States: "Let us not condemn ourselves and our institutions for providing for foreign scientists, doctors, and students an atmosphere of free inquiry for study and research which may, one day, well enrich not only America but the world. All humanity benefits when an Italian, an Englishman, or an Indian researcher unravels one of nature's mysteries in an American laboratory. What appears in the short run to be a brain drain from a country—and therefore its loss—may be, in truth, one of that country's unique contributions to the world's cultural common market. The brain *drain* from one country today may well be the brain *gain* of the world of tomorrow." (Quoted in, Deutsch, op. cit., p. 31.)

In arguing for the importance of student exchange, Under Secretary of State Rostow appealed to the internationalist view when he said: "In one sense, the universities of the world constitute a single community, helping to bind the human family together." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 4.)

[391] Adams, op. cit., pp. 4–5.

[392] Ibid., p. 5.

turn and can build roads at home in the jungles, rather than work for the Ohio Highway Commission?" [393]

CRITERION: NEEDS OR DEMANDS?

The internationalist and nationalist models create polar opposite positions and thus offer no solution to this very complex problem. Still, they establish some criteria as a guide to analysis. Another criterion suggested in the literature for judging the effects of brain drain, and, indeed, for determining whether brain drain exists at all, is the relationship of brain drain to a nation's needs and demands.

The heart of the brain drain dilemma lies in this relationship between needs and demands. Briefly, in manpower terminology "needs" mean the number of persons required to attain some agreed national goal; demands mean the existing number of jobs filled and unfilled.[394] If a nation's needs are defined in terms of a national goal to raise development levels, then the needs or requirements of the LDCs for a variety of professional and skilled services are very great.[395] To achieve desirable development goals, the LDCs *need* doctors, engineers, lawyers, agricultural extension agents, plant geneticists, economists, science teachers for secondary schools, and all other kinds of skilled manpower for nation-building. From this perspective, shortages in such manpower are highly visible and failure to have adequate supply can have serious negative effects. (In this study the criterion for "need" is defined in terms of developmental requirements.)

However, structural maladjustments that produce brain drain are readily apparent when the problem is viewed from the demand side. Briefly, the demand is insufficient to justify existing manpower resources; the developing economy cannot absorb them. The LDCs, even with aid, cannot support the employment of specialists and professionals so that they can effectively administer the needs of the nation and also obtain a satisfying return on their educational investments. The gap between need and effective economic demand reflects a lack of purchasing power, inadequate mobility of professional labor within the country, or the insufficiency of labor or capital. This gap constitutes a serious development problem and rather than narrowing seems to be widening.[396]

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[393] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 20. The report of the U.N. Secretary General on brain drain from the LDCs elaborated on this important distinction: "Many high-ranking scientists, including Nobel Prize winners, were probably to achieve eminence only by emigrating. The question, however, arises as to the extent to which this argument applies in relation to present migration. Of the 10,506 professional immigrants into the United States from developing countries in 1967, only 1,472 were natural scientists. As in all professional categories, these represent higher and lower levels of occupation. The argument would apply with little force to the majority with lower level skills and it is therefore unlikely that it applies to more than a very small minority of the present professional migration." (Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5. 1968, p. 47.)

[394] Alice W. Shurcliff, "Manipulating Demand and Supply of High-Level Manpower," *International Labor Review* 101, (February 1970), p. 133.

[395] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 42.78.

[396] Ibid. According to 1966 estimates by J. G. Scoville of the International Labor Organization, the net requirements for manpower in professional occupations in developing countries between 1970–1980 will be 16.9 million, compared with 5.3 million in the previous decade. Some earlier projections and estimates, according to the U.N. report on brain drain, have been in various categories still higher. The report adds that brain drain raises the question as to whether professionals in such numbers can be absorbed.

An example of the needs-demands issue is that of the situation in Istanbul, Turkey. The demand for physicians is so low in Istanbul that the average M.D. sees fewer than 40 patients a week and cannot earn an acceptable livelihood. Yet, the need, if defined in terms of bringing health care in Istanbul up to European urban standards, is such that all physicians working to capacity would hardly begin to meet it.[397] Such disparities in demands and needs are not uncommon in the LCDs.

Thus the seriousness of brain drain lies within the eye of the beholder. Viewed from the LDC perspective of need, the effects are serious because the leadership in the developing country perceives the larger requirements of developing and nation-building. Viewed from the demand side, commensurate with the interests of the advanced countries, the effects are not serious: Brain drain is an asset, relieving the LDCs of surplus manpower which are regarded as a wasteful expenditure of human resources. What appears to be brain drain, as George Baldwin wrote, is really "overflow," and emigration of a surplus elite becomes a safety valve for unwanted but unavoidable social pressures.

The essence of the differing perspectives seems to rest on the question of whether or not the viewer takes the long-term or short-term view of development. For the short-term, demand-oriented viewer, brain drain can have only positive effects. As Mr. Baldwin said: "Clearly the latter [that is, the economy's effective demand] is the more relevant and realistic test to apply." [398] But for the long-term viewer from the need-oriented perspective, brain drain can have serious negative effects, specifically, impairing future development. As Deena R. Khatkhate, an Adviser in India's Central Banking Service, explained:

> The phenomenon of brain drain is a consequence partly of the prevailing tendency in some of the less developed countries to overproduce graduates and partly of the social inertia in these societies preventing a full use of the available trained manpower. Unavoidable though it is, it may not . . . be harmful, at any rate in the long run, as it hastens the social, psychological, and attitudinal changes in the economies of the emigrating countries which can be conducive to more productive use of skilled manpower and other resources.[399]

Supporters of the long-term need perspective would further point out that a manpower reserve force of professionals of which Khatkhate speaks, even though underemployed and overtrained, constitutes a reserve pool for the future if and when demand may increase with progress in development. In cases in which a surplus of a particular profession exists—for example, medical doctors in the Philippines and India—the reduction of the "pull" factor in the United States by building sufficient medical schools, thus satisfying domestic needs and demands with American manpower, would compel readjustments in the Filipino and Indian manpower market. In this case the market itself would have its own corrective mechanism—and remedy for medical brain drain. For the Filipino and Indian doctor (in-being or aspiring), closed off from access to the American market, would prob-

[397] Shurcliff, op. cit., p. 133.
[398] Baldwin, op. cit., p. 362.
[399] Deena R. Khatkhate, "The Brain Drain as a Social Safety Valve," *Finance and Development* (March 1970), p. 39.

ably have two real options: either to adjust his career plans so that he would have a marketable profession (for example, engineering, agronomy, or some other career essential for nation-building), or to leave the urban centers and practice in the countryside where medical need is great and where he can fulfill his career expectations as a doctor.

(In recent years such a shift in career plans has occurred in the American professional manpower market. With the decline in demand for engineers, many engineering students and graduates shifted to the medical field where demands and needs were greater and career prospects brighter. Many unemployed space scientists and engineers have also been "retooled" for other careers.)

In this way, therefore, reduction of "pull" factors in the receiving country can act as a positive influence on the labor market in the sending LDC: It can contribute to reducing brain drain and to aiding long-term development, at least potentially, by closing off opportunities in the advanced country and by compelling acceptance of a new reality, a new set of options within the LDC.

What ultimately makes the need-demand issue significant in considerations on brain drain is that the issue exposes the riddle of development, namely, how to create an effective demand in the LDCs that in turn will stimulate sufficient creative forces to satisfy the nation's needs, for, in circular fashion, the needs of society are satisfied only by creating demands, and demands are created by raising the level of development.

Efforts of Brian Drain Within the LDCs: Gains and Benefits From an Educated Elite

Returning foreign students and scholars of the LDCs' trained in the United States and other advanced countries of the West, have contributed a great deal to the development of their countries. In accenting the positive values of talent migration, some American observers have gone so far as to deny any serious negative effects, and to assert that the study of foreign students in the United States even contributes to a diminution of brain drain.[400] Despite increasing emigration, the foreign educated have also been increasingly returning home, and accordingly have aided the flow of knowledge, techniques, science, and

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[400] Dr. Frankel pointed out that in fiscal year 1966 only one-sixth of the total of skilled persons who immigrated—30,039—were temporary visitors (students, exchanges, etc.) who had adjusted their status to that of immigrants. And he added: "Indeed, study by foreigners in this country, far from increasing the 'brain drain,' probably contributes to its diminution. The overwhelming number of the people who are trained here return home to help the development of their own countries. They thus help to alleviate the conditions that are the fundamental reasons for emigration from their countries." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 14.)

Under Secretary of State Rostow stated with regard to the increase in immigrants from Asia: ". . . there is no evidence . . . that such increases have been dramatic, or that the number of students, scientists, scholars, and other professional men who come as visitors, and are given permission to remain as permanent immigrants is causing a significant drain of talents and skills to the United States from other countries." He went on to explain further: "It is questionable, in any event, whether visitors from other countries form a significant part of whatever 'brain drain' to the United States there may be. . . . Most of the men and women trained here, sooner or later, return to their homes to take a leading part in building strong institutions there. They have a much better knowledge, a more intimate knowledge of the United States than most of their countrymen, and most of them remain for the rest of their lives among our best friends abroad. Their experience here as students or as workers in one or another of our intellectual industries makes a vital contribution to every aspect of the development of their own countries." (Ibid., p. 5.)

administration from developed to developing countries. Henderson has described this inflow as "inestimable in its value." [401]

Speaking for Iran, Habib Naficy said: ". . . it is certainly beyond any argument that the modernization process could not have been sustained without the work of Western-trained Iranians, however significant may have been the contributions to this process by outsiders working in the country and the modernizing influence of other factors." [402]

That other Middle Eastern countries have also benefited from American education is shown by the success of some student returnees who with maturity moved on to leadership positions. Ahmad Zaki al-Yamani, who at 42 years old is one of Saudi Arabia's leading political figures, studied law at Harvard University. As Minister of Petroleum Affairs, Sheik Yamani is the principal negotiator for Saudi Arabia and the other Arab countries with the West over the future of the Middle East's oil resources. For 13 years an adviser to King Faisal, Yamani is also the main force behind Saudi Arabia's modernization. He is assisted by Hisham Nazir, an economist with a Master's Degree from the University of California at Los Angeles, who heads the country's planning organization, and by Dr. Bakr Bakr, Dean of Petroleum College. Dr. Bakr is a graduate petroleum engineer from the University of Texas and a graduate from the Stanford Graduate School of Business; he also holds a doctorate in quantitative analysis and management from the University of Southern California.[403]

Another case of an Arab LDCs benefiting from a student returnee is that of Mahmud Sulayman al-Maghribi, a leading figure in Libya's revolutionary government. A Ph. D. from George Washington University, al-Maghribi became a leader of the Libyan oil workers' union, a petroleum lawyer for ESSO, and held such leading positions in the Qaddafi government as Prime Minister, principal oil negotiator for Libya, and the Libyan Ambassador to the United Nations.[404]

The United States has played a primary role in educating many of the young Arab oil elite. William F. Penniman, a petroleum consultant, recalled for the House Foreign Affairs Committee in hearings on Middle East negotiations in May 1973, that on one occasion he had participated in oil negotiations with the Kuwaitis, five of whom had

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[401] Henderson, op. cit., p. 127. Dr. Charles V. Kidd, expressed the following views on this matter that are held by many students of brain drain: "Advanced training in advanced countries by students from less-developed countries is on balance an indispensable means for supplying trained talents to the less-advanced countries." After describing the risks to the LDCs and the estimated losses of some 10 percent, he concluded: "All in all, the price paid by less-developed countries in terms of migration of students does not seem excessive." (Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 50.)

That Norway, a victim of brain drain, has gained substantially through the American educational exchange program, was evident in the roster of "Leading Former Fulbrighters" whose names and occupations were appended to a letter from U.S. Ambassador to Norway Thomas R. Byrne to Senator J. William Fulbright (D–Ark.) dated Oct. 3, 1973, and inserted in the Congressional Record. Among those "former Fulbrighters" who returned home to contribute their talents to Norway after receiving advanced education in the United States rather than remain in this country are Members of Parliament, cabinet officials, leaders in Norway's Ministry of Foreign Affairs and other government departments, leaders in industry, publishing, education, medicine and law. The list reads like a veritable "Who's Who in Norway." (See, Educational exchange program. *In* Remarks by J. William Fulbright, *Congressional Record*, Nov. 15, 1973, pp. S20442–S20443.)

[402] Mr. Naficy goes on to cite the negative effects. See, Naficy, op. cit., p. 69.

[403] Juan De Onis, "Mastery Over World Oil Supply Shifts to Producing Countries," *The New York Times,* Apr. 11, 1973, pp. 1 and 28.

[404] Information provided by Clyde R. Mark, Analyst in Middle Eastern Affairs, Foreign Affairs Division, Congressional Research Service, Library of Congress.

Ph. D.'s from Stanford, Texas, Harvard, and Oklahoma Universities. Mr. Penniman viewed such educational training as a valuable foreign policy asset and encouraged its expansion.[405]

Egypt, though a loser from brain drain, has also benefited from the return of its students from America. Two of its most prominent political leaders, Aziz Sidky and Sayyed Marei, were American educated, and its newly appointed Ambassador to the United States, Ashraf Ghorbal, received his Ph. D. at Harvard.

Sidky is Prime Minister. He studied at the University of Oregon and Harvard University, where he was awarded a masters degree and a Ph. D. in engineering. Described as an American-educated engineer turned statesman, Sidky worked closely with the Russians in building the Aswan High Dam and in launching Egypt's industrialization and electrification programs. Sidky is regarded as a powerful force in Egypt today, particularly in its economic development and in political relations with the USSR.

Sayyed Marei is Secretary General of the Arab Socialist Union (ASU). An American-educated agriculturalist, he inspired much of Egypt's efforts to raise food and cotton production. Marei has been referred to in the press as Egypt's "strongest figure in 1970." [406]

Finally, Ashraf Ghorbal, the newly designated Egyptian Ambassador to the United States (to serve when diplomatic relations are formally established) and a long-time high ranking official in the Egyptian Government, is an American-educated student returnee. A graduate of Cairo University, Ambassador Ghorbal was one of the first Egyptian students sent to the United States in 1946. He returned to Egypt after receiving a Ph. D. at Harvard. A number of others among the 300 Egyptian students coming to the United States at that time subsequently were to become ministers in the Egyptian government.[407]

The esteem with which Ambassador Ghorbal is held by his government and his value as an interpreter of the American scene is apparent by the fact that his appointment comes at a most crucial time in the aftermath of the Arab-Israeli October war.[408]

ADVANCEMENT OF KNOWLEDGE

The LDCs can benefit from the discoveries made by emigrant scientists of first rank. By placing their productive skills in well-equipped institutions and by associating with other highly trained staff, they may be able to maximize their contribution to the general advancement of knowledge and to its dissemination through learned books and articles, or in improvements spread by foreign and commercial aid.[409]

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[405] Personal notes taken during the joint hearing of the Subcommittee on the Near East and South Asia and the Subcommittee on Foreign Economic Policy, May 14, 1973. (Notebook Journal of Joseph G. Whelan, No. 3, p. 116.)

[406] John K. Cooley, "Egypt Still Debates Expulsion of Soviets," *The Christian Science Monitor*, Nov. 9, 1972, p. 2.

[407] Jonathan C. Randal, "The Return of an Old American Hand," *The Washington Post*, Nov. 18, 1973, p. L1.

[408] That Egyptians have a special preference for the United States and its educational institutions is evident in a recent press report from Cairo. In an article entitled, "Many ties still bind U.S., Egypt," it said: "In the first seven months of 1973, 2,285 Egyptians went to the United States as tourists or students and an additional 617 obtained visas to emigrate to the United States. As many Egyptians have studied at Harvard, Princeton or Yale as at Cambridge or Oxford." (*The New York Times*, Nov. 7, 1973, p. 10.)

[409] Henderson, op, cit., p. 127.

Moreover, the LDCs can gain the fruits of discoveries by their nationals in the advanced countries without high investment costs to themselves. Discoveries benefit them by the availability of better-quality and lower-cost products.[410]

QUESTION OF IMPAIRING ECONOMIC DEVELOPMENT

Hla Myint of the London School of Economics and Political Science makes a case against the thesis that brain drain impairs economic development. The essence of the argument is that brain drain may not necessarily be a plus factor to the LDCs, but it is also not necessarily a grave minus factor either. Professor Myint concludes his "Less Alarmist View" of brain drain: "So far it is difficult to substantiate the fear that the brain drain from the underdeveloped countries is likely to have a serious effect in retarding their economic development." [411]

Recognizing the difficulty of assessing the effects of emigration of academics from the LDCs on their economic development, Myint nonetheless offers three reasons why "it is likely to be small and uncertain." First, the loss to the donor country is exaggerated because the productivity of brain drain academics is likely to be much higher in the advanced countries than in the LDCs where they must work in unfavorable conditions. Second, academic productivity (or the absence of it) may be in areas of study that have little relevance to economic development. And third, even if relevant, the important factor for economic development is not results of pure academic research, which the LDCs could obtain from abroad, but the practical application and utilization of the results. "Even distinguished academics," Myint argues, "are not usually noted for their entrepreneurial and practical qualities." Moreover, Myint minimizes the developmental effect of medical brain drain from the LDCs. The social welfare effect rather than the economic development effect, he claims, is "probably more important." [412]

EMIGRATION AS AN ECONOMIC AND POLITICAL ASSET

Some students suggest that talent migration, far from being a serious cost factor, is actually an economic asset for the LDCs. Relatively high unemployment among certain categories of professional and skilled persons as a result of oversupply and underdemand characterizes many LDCs. India has a surplus in civil engineers, thousands of whom are unemployed. The Philippines have surplus doctors, many of whom are either unemployed or underemployed. Hong Kong, Taiwan, Dahomey, and a few other countries have a fairly high rate of unemployed professional and skilled persons. In strictly economic

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[410] Johnson, op. cit., p. 83. Rev. Gibbons observed: ". . . those favoring free movement of the high-level personnel, including scientists, engineers, the physicians, are apt to defend their position on the grounds that such a policy costs developing countries no significant amount and that in any case they are the beneficiaries in the long run because of the accretions that occur in the overall, worldwide body of scientific knowledge." (Hearings, House Government Operations Committee, Brain Drain, 1968, p. 10.)

In a letter to Senator Walter F. Mondale, Thomas J. Mills of the National Science Foundation declared, without giving an example: ". . . a foreign engineer employed by an American construction company might make an infinitely greater contribution to the economy of his native country than to the U.S." (Mills to Mondale, Sept. 22, 1966. In *Congressional Record*, Oct. 13, 1966, p. 26503.)

[411] Myint, op, cit., p. 244.

[412] Ibid., p. 244.

terms, the unemployed represent a loss to the economy of the country. Migration, therefore, relieves the country of an economic liability and produces a positive gain.[413]

Emigration of surplus talent also carries benefits derived from both an income distribution point of view and an increase in output. The increase in marginal production of the remaining professionals can be substantial. According to Prof. George Coutsoumaris of the Athens Graduate School of Economics and Business Administration, productivity for certain professions in Greece would be much less if there were not an average annual outflow of nearly 25 percent of new graduates during the past decade. Removal of pressure from excess supply, Coutsoumaris argues, also allows for more efficient organization and use of remaining resources.[414]

Not to be overlooked are the compensating economic benefits derived from remittances sent home from immigrant professionals. In the case of the Philippine Republic alone, $46 million has been added to the country's foreign exchange reserve in personal remittances between 1955 and July 1969.[415] Acceleration of professional inflows to the United States in the last 4 years have no doubt increased this figure substantially. Total remittances from all other LDC immigrant professionals to their home countries would no doubt reach a sizeable sum.

Finally, donor LDCs gain from the relief in political pressures building up from economic manpower conditions of oversupply and underdemand of professionals. Alessandro Silj gave the following explanation of the safety valve thesis: "The U.S. market . . . works as a sort of decompression valve for all the dissatisfactions, frustrations, and ambitions of the scientists and engineers of the rest of the world." [416]

IMPROVED POSSIBILITIES FOR SOCIAL CHANGE AND PROGRESS

Finally, brain drain can act as a primary catalyst, stimulating a nation to initiate social change and self-renewal; it can provide incentive to modernize and adapt to the exigencies of powerful international market forces.[417]

Loss of prime talent can provoke self-examination by a nation and generate an appraisal of established national institutions. As Professor Don Patinkin of Hebrew University, Jerusalem explained: "To the extent . . . that fears of the 'brain drain' force countries to work against internal interests and pressure groups in order to try to generate similar conditions within their own borders, it is only for the best." [418]

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[413] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 43.84.

[414] Coutsoumaris, op. cit., pp. 178–179.

[415] UNITAR, *Brain Drain from Five LDCs*, 1971, pp. 107–108.

[416] Silj, op. cit., p. 10.

[417] Professor Adams discusses this matter in, Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 54.

[418] Patinkin, op. cit., pp. 98–99. Abdul Said made a similar observation. He concluded his study of brain drain: "One cannot however, disregard the fact that many nations are beginning to have a second look at themselves, their institutions, and the Brain Drain phenomena may thus be considered a positive force." (Said, op. cit., p. 26.) See also comments by Deena R. Khatkhate, op. cit., p. 38.

The emigrant professional can also be a conduit for bringing about social change. Acting as a communicator in his special field between his nation of origin and his adopted country, the successful professional can stimulate his fellow countrymen in the LDCs to enter and work hard at similar professions. Such a motivation may tend to perpetuate emigration, but it can simultaneously stimulate needed social change.[419]

A SUMMING UP OF GAINS FOR LDC'S

Thus, the LDCs are not without some benefits from talent migration. Lacking institutional resources for developing an educated elite, they resort to the ready-made and available academic institutions of the United States and other advanced Western countries. They can reap dual benefits: Directly from the many returnees who contribute their share to nation-building, and indirectly from the successes of their nationals abroad who participate in advancing knowledge. Loss to economic development may be exaggerated, but even so, emigration brings compensating benefits by eliminating the economic liability of oversupply, effecting rational manpower management, increasing productivity, and releasing social pressures of dissatisfaction. Finally, emigration can contribute to social change that in turn can act as a corrective to the basic problem of underdevelopment.

Losses and Costs for LDCs

Losses through brain drain vary among the LDCs. Some countries like India, Pakistan, the Philippines, Colombia, and Ecuador have suffered heavy losses. Others like Brazil, Peru, and Venezuela have not been so adversely affected. In between, however, are the many who have paid some price for the loss of high-level manpower, varying in degree, but, in Gregory Henderson's words, "still painful" to experience.[420]

LOSS OF GENERAL PROFESSIONAL MANPOWER

Running through the literature on brain drain is the dominant theme that all LDC losers, great and small, share a common loss of an elite human resource that is important for development. The UNESCO report on the application of science and technology to development in Latin America described the relationship between this resource and development in these words:

> The possibilities for the development of any country depend to a great extent on the human resources available in that country. In fact the human element is at the same time the origin, the actor, and the end of all activity. Its importance is therefore greater than that of any other single vital element for development.[421]

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[419] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 48.91.

[420] *Selected Readings on International Education*, House Committee on Education and Labor, 1966, p. 349. For other evaluations on the impact of brain drain, see Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, pp. 78–79, and report on brain drain from Latin America, Pan American Health Organization, 1966, pp. 13–15.

[421] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America*, 1965, p. 142.

What makes the case of brain drain from the LDCs so serious is that the loss is not merely in human resources but rather in an educated elite that is essential, even vital, for development.

An educated elite plays a primary role in society, and the social loss to the LDCs from its drain can have adverse effects far beyond the impact of specialized disciplines.[422] In general, highly skilled manpower is part of the larger infrastructure of a social elite that is necessary for development. Beyond their specialized areas the scientist, engineer, and physician contribute to a nation's political, social, and cultural development. They help set the tone of society, and establish national values and goals; where science and technology are assigned a highly visible prestige status in society, their influence can be inestimable. As Dr. Claire Nader wrote: "In a profound sense, medical and other scientifically trained persons occupy pivotal positions in that they help change values, a necessary condition for changing institutions." [423]

Social scientists, historians, and students of the humanities, archeology, and business administration—all the non-scientific-technologi-

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[422] Section III contains abundant data to show the size of the talent migration into the United States and other advanced countries. Commentaries and analyses on particular cases of brain drain are instructive. The report of the U.N. Secretary General on brain drain observed: "The 10,308 professionals immigrating into the United States of America between 1962 and 1967 represented over 1.7 percent of Latin America's estimated total number of university-level professionals in 1965."

"Colombia is considered to have had a net loss of 11,000 professionals between 1958 and 1964 and to have professional emigration of about 1,000 persons a year equal to 15–20 percent of those graduating annually from Colombian universities, of which 80 percent proceed to the United States of America. In the case of Argentina, the number of engineers who emigrated to the United States between 1950 and 1964 corresponded to 14.3 percent of the total number of engineers working in industry in the country in 1962. Nearly 10 percent of India's medical doctors are working in foreign countries, mainly the United Kingdom and the United States, while in India a large number of vacancies for physicians in government clinics remains unfilled." (Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, pp. 40.73–74—41.)

A UNITAR study on brain drain from the Philippines estimated an annual rate of professional emigration at 30 percent or 6,000. "Such figures," the study stated, "would constitute substantial percentages of the annual crop of university graduates of Philippine institutions of higher learning. On the basis of research carried out in 1967, less than half of the undergraduate population between 1962 and 1965 is in fields other than teacher training. Therefore, even if the annual number of college graduates would exceed 100,000 a year, the projected rate of professional emigrants would constitute roughly 10 percent of the annual output of university graduates. What is even more significant is that the emigrants would probably represent the cream of the crop." (UNITAR, *Brain Drain from Five LDCs*. 1971, p. 102.)

President James A. Perkins of Cornell wrote: "The drain from Asian nations, particularly Taiwan and Korea, is the most serious: it is estimated that over 90 percent of the Asian students who come here to study never return home." (Perkins, op. cit., p. 617.) A report in the New York Times on July 14, 1968 stated that a recent study showed that over 80 percent of Taiwan's college graduates leave their country for the United States and less than 5 percent return. (Cited in, Deutsch, op. cit., p. 28.) The State Department has stated that the percentage of students adjusting to immigration status was approximately 8.3 percent. Senator Mondale claimed that this estimate was misleading, suggesting a closer percentage as being 10.4 percent and applied to Asia would amount to 28.1 percent. (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, pp. 91–92.)

[423] Nader, *Science and Technology in Developing Countries*, p. 457. Prof. Steven Deutsch made a similar comment on the value of an educated elite. He wrote: "Education serves as, among other things, a conveyor of national culture and ideology. Not only do educated members of a society serve as a technical elite helping to lead the society into higher levels of economic organization and output, but they play critical roles in terms of the cultural and political life of the society." (Deutsch, op. cit., p. 23.)

The report of the U.N. Secretary General made the following assessment of the relationship between the educated elite and society: "The most important losses . . . which cannot be quantitatively measured are the contributions trained persons make to development not only professionally, but also creatively and in terms of leadership. It is the loss of talent to meet the demands of leadership, planning and imaginative management. In a sense, the total effect of the outflow cannot be assessed since the potential contribution did not take place." (Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 44.83.)

cal intellectuals—are also part of this same societal infrastructure.[424] And while in many areas of the LDCs they constitute a large part of the trained manpower surplus, still their emigration represents the social loss of a potential if not real leadership elite. As Dr. Kidd explained in his commentary on the long range value of an educated elite to development:

> Developing countries need not only specific skills but also leadership and organizing ability. A continuing drain of highly trained people can over the long run add to a sense of national frustration, generate a contagious movement, lower the sense of worth of those who remain [that is, the "left-behind" syndrome], reduce further the small group of potential political and administrative leaders, and reduce the cadre of technically trained people who must be at hand when the process of development gathers momentum.[425]

And as Dr. Sprague acknowledged in commenting on the practice of recruiting FMGs to close the deficit created by the doctor shortage:

> In a sense this is a brain drain in that we are actively recruiting some of the best educated and among the most talented group of people the foreign country

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[424] The value of the educated man in the LDCs was underscored by Dr. William C. Thiesenhusen of the University of Wisconsin. He wrote: "Immediately upon becoming literate, a person in a less developed country takes on value as a productive resource. He has been the recipient of investment and is able to understand and respond to more economical forms of communication than the spoken word. The Population Reference Bureau reports that the literate man is even scarcer than previously assumed. A global total of 924 million—equal to about 42 percent of the world's population over 15 years—is illiterate. As population burgeons, the numbers of people who can read and write are increasing. But the number of the world's illiterates has grown also—by 40 million between 1950 and 1960. A recent forecaster has claimed that by 1972 the number of adult illiterates in this hemisphere will be 20 million more than when the Alliance for Progress began. Thus the Malthusian phenomenon can appropriately be restated to read: Population tends to outrun society's ability to educate it." (Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 27).

The CIMT study summed up the value of the educated person to development in these words: "Persons with highly developed talent have several indispensable roles to play in the development process: (1) they constitute the intellectual bridge to the developed world, that is, they assess and adapt relevant ideas and technologies originating elsewhere; (2) they develop, maintain, and manage the productive processes, the resources, and the complex structures of modern society; (3) as the intellectual elite, they bring about the structural and institutional changes necessary if a nation is to become a modern state; and (4) their irreplaceable efforts, and the standards they set, heavily influence the educational and other institutions that shape future generations of educated persons." (CIMT study, pp. 689–690.)

Some students of brain drain tend to downgrade the value of the liberal arts education to development and thus are inclined to write off those immigrating students of the liberal arts and humanities as not being a serious loss in nation-building. President Theodore D. Lockwood of Trinity College, Hartford, Conn., expresses a point of view on the liberal arts education and its value to society. He wrote: ". . . I would not argue that the function of a liberal arts institution is the training of leaders, though I would hold that it remains an important by-product of our enterprise. Nor would I insist that we are preparing professionals and corporate managerial personnel; but again, many liberal arts graduates do choose those careers. Certainly we cannot guarantee employment for graduates of liberal arts institutions, though we do provide assistance in that respect.

"The raison d'etre of a liberal arts education is not that it is relevant to any specific career, but to life in general in a rapidly-changing, confusing, and sometimes frightening world. It is our task to teach individuals to better understand that world so that they may make intelligent judgments about themselves, their society, and the international community in which they must live.

"Life in the late twentieth century promises to present challenges of unprecedented proportions.

"It is not enough just to survive in such a tumultuous world. Survival alone is worthless if, in the process, we lose the knowledge and creativity that have characterized the human species. We must preserve and cultivate the capacity for 'critical thinking' . . . in an environment that often boggles the mind.

"One must know how to recognize problems, where to find the necessary resources to solve them, and how to make judgments that incorporate both practicality and morality. One must know more than how to cope with life; he must be prepared to live his life fully, intelligently, and actively. These are the capacities we seek to foster in a liberal arts education." Trinity College, Hartford, Conn., *Trinity Reporter* 3 (December 1972), p. 4.

[425] Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 48.

may have. This is particularly true of many of the developing countries where a disproportionate number of the most able and best educated go into the medical profession.[426]

The LDC is the loser, if not in the short run, then in the long run, for the erosion of a nation's educated elite saps its manpower reserve, weakens the intellectual fabric of the nation, sows frustration and demoralization, reduces the possibilities of institutional change, and prevents a type of environmental buildup for creating and propagating a spirit of intellectualism and scientism so necessary for modern development.[427] For, as the CIMT study observed, "The talent elite, small in numbers but potent in influence, provides an effective and forward looking third force—including, eventually a new type of politician and bureaucrat." [428] "This top fraction of a country's labor force is vital to the modernization process," the CIMT study said. Less educated manpower elements work far below their capacity if the superstructure of high-level manpower is weak and thin. "Without a generous leaven of educated men who combine natural leadership qualities with the skills and values conferred by education," the study concluded, "the structure of human resources can never become a prime mover in modernization." [429] It is axiomatic that development must come from within, and if the skilled human resources are drained off, then it follows that development will be arrested.[430]

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[426] Ibid., p. 66.

[427] Under Secretary of State Rostow acknowledged that brain drain adversely affected development in the LDCs. In Senate testimony he said: "In some instances, we know, this phenomenon weakens those countries, and threatens their capacity for development." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 43.)

In a study of brain drain of Palestinian and Jordanian Arabs to the United States, Lafi Ibrahim Jaafari concluded: "The Middle East homeland can only suffer from the continuous drain upon its pool of potentially highly qualified manpower. In the long run, whatever regime may be in power, only a scientifically and technologically trained body of national residents will be able to engage in the necessary development of the region." (Jaafari, op. cit., p. 129.)

That the Arabs are becoming increasingly concerned about the loss of professional talent to the West was revealed by a study recently published in *Commerce du Levant* of Beirut. According to the study, the Arab world is one of the areas suffering most severely from brain drain to the industrialized West. It showed that between 1962–1968, 37,603 Arab "brains" emigrated to the United States, which attracted the largest number. Of those, 6,560 were technicians, 1,283 were qualified engineers, 481 biologists, 483 doctors, 202 nurses, and 79 sociologists. The major sources were Jordan (9,548), Egypt (9,315), Lebanon (8,191), Iraq (4,192), Morocco (2,473), and Syria (2,406). Another 15, 207 emigrated to Canada between 1962–1967, and France, the leading European recipient, accepted 456 Arab specialists between 1962–1966. (*Middle East Economic Digest* 18 (Jan. 18, 1974) p. 88.)

[428] CIMT study, p. 691.

[429] Ibid., p. 690.

[430] Dr. Daniel Bell, professor of sociology at Harvard University, gave the following appraisal of the value of talent in modernization: ". . . It means that the health and strength of the intellectual community is not only a matter of a general concern to society, but a necessity in the organization of change. It means the sources of innovation in the society come from the intellectual institutions, the universities, the research institutes, the research corporations. It means moreover that the scarcest resource to the society is essentially talent (or human capital in the words of the economists) and the husbanding of human capital, the identification of talent is a much more different cycle than that of financial capital." (Daniel Bell, "The Management of Information and Knowledge," *In*, U.S. Congress, House, Committee on Science and Astronautics, *The Management of Information and Knowledge*, 1970, p. 15.)

In the United Nations' most current appraisal of brain drain from the LDCs (Jan. 18, 1974), Secretary General Waldheim gave the following assessment of the loss of professional talent and its impact upon development:

"34. The financial loss suffered by a developing country due to the outflow of trained personnel is only the visible tip of the iceberg. The effects upon the process of development are as important, if not more so. The capacity of developing countries to achieve the progress associated with development depends upon the existence of structures within which this progress can take place and upon the existence of trained persons who can organize these structures and play key leadership roles within them. The structures include government, industries, agriculture and the social services; the trained persons include engineers, scientists, teachers, doctors and nurses. These persons can function only in the context of organized structures. Conversely, the structures are useless without the trained personnel to make them run. When therefore these trained personnel emigrate, the operation of the structures is seriously disrupted unless replacements are found from a

Leadership Qualities of Emigrant Professionals.—The characteristics of emigrant professionals suggest leadership qualities that are generally found in ruling elites throughout the world. They are the talented of the LDCs, the highly educated, trained in leading professions, and generally possessing dynamic personal traits. More assertive and adventurous than those remaining behind, they are less likely to endure sacrifices at home and are more inclined to accept attractive new challenges. "These migrants take from their home countries ancillary contributions that are not adequately measured by counting migrants," concluded the CIMT study. "The ferment is lessened when these people move. The quality of leadership may decline." [431]

Professor Moravcsik pursued the same line of argument in disputing the Baldwin thesis that the migration of the critical elite would be roughly proportional to the total number of professional migrants. He recounted his observations from personal experience that "it is often exactly the most talented, and the most aggressive that leave the country." In the highly competitive international market, "naturally the best people get picked up first." Moreover, the "most aggressive and management-wise, most adroit individuals also have a higher chance of success in acquiring for themselves a suitable position abroad." Thus, Moravcsik concludes: "the fraction of the professional personnel that migrates abroad represents, from the point of view of future developments of science and technology, a rather crucial element in quality, even though perhaps not in quantity." [432]

And then there is the age factor. The emigrant professional departs as a young adult at a time in life when his potentialities both professionally and as a general contributor to society are just being realized. This is an incalculable loss to the LDCs. Approprimately 50 percent of all FMGs coming to the United States since the 1960's have been less than 40 years old.[433] In 1970, nearly one-half (49 percent) of the scientists and engineers immigrating to the United States were under 30; another 46 percent were between 30 to 44. The youngest came from the LDCs of Asia and Africa, which together accounted for 64 percent of the total inflow in 1970. Of the Asians, 54 percent were under 30; of the Africans, 52 percent were under 30.[434]

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continuing pool of similarly trained persons. The loss of such leaders therefore causes serious damage to programmes of development.

"35. The nature of the damage varies with the category of personnel emigrating from the developing country. The loss of scientists and engineers impairs the capability of the country to adapt and absorb current technologies as well as to innovate new technologies. The loss of educators affects the training of new personnel, and the loss of physicians and nurses adversely affects the health services. In all these cases, the effects arise because the outflow of trained personnel reduces the nationally important cadre of people vital to industrial, agricultural, governmental, university and medical leadership."

(United Nations, Committee on Science and Technology for Development, *Outflow of Trained Personnel from Developing to Developed Countries*, Report of the Secretary General, New York, United Nations, 1974, pp. 11.34–12.35 United Nations Document E/C.8/21, Jan. 18, 1974.)

[431] CIMT study, p. 695. Senator Mondale remarked: "These skilled professional men are almost ideally the type of people needed in the developing nations to bring political stability as well. Trained and skilled in their own professions, to be sure, they are also the kind of people who can provide indispensable leadership in the critical area of political development of these nations." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 96.)

[432] Michael J. Moravcsik, "Communication Among Scientists and Its Implications to Developing Countries," Article based on a lecture delivered at the Research and Development Management Seminar organized and sponsored by the Scientific and Technical Research Council of Turkey in cooperation with the Technical Assistance Programme of the Organization for Economic Cooperation and Development, held in Istanbul, May 1970, p. 5.

[433] AMA, *FMG Study*, 1971, p. 7. The percentage for 1963 was 50.7 percent, for 1967, 51.8 percent.

[434] NSF, *Survey of Scientists, Engineers, and Physicians from Abroad*, 1972, p. 9.

LOSS OF SPECIFIC PROFESSIONAL MANPOWER

Within this generalized professional elite is the specialized professional, the scientist, engineer, and physician, those who in conjunction with specialists in other fields constitute the vital human resources for development. It is this group that provides the kinetic energy for institutional change and national development. It is widely observed, and in any case virtually self-evident, that without this essential core of talent progress can be arrested.

Effects of Loss of Vital Talent.—It is commonplace that future technological development in the world depends on scientific and engineering manpower. Scientists are the pointmen for the advancement of knowledge; engineers, as a nation's problem solvers, translate that newly acquired knowledge into practical use.[435] But, as Dr. Steven Dedijer, a Yugoslav scientist, observed, world science and technology are already concentrated in the advanced countries. The LDCs are the dispossessed. Between 15 and 30 of the 120 countries in the world, with less than one-third of its population, possess practically all its science, spend 95 percent of the world's research and development funds, and gain most of the benefits therefrom. Some 100 of the world's nations, he said, have "either in an absolute or in a relative but very significant sense, no science." [436]

And the needs of the advanced countries are growing, thus magnifying the imbalance in technical manpower resources. Future projections of American requirements, for example, suggest that shortage rather than surplus of technical manpower may characterize this century from the late 1970's or early 1980's on.[437] To satisfy these needs, the advanced countries complement their own indigenous stock with emigrants from the LDCs.

Yet, the LDCs cannot afford this "unrequited gift" of technical manpower. as some specialists term brain drain, because it jeopardizes their essential human resources for development. Professor Moravcsik explained the relationship between science and development in these few words: "Excellence in science is mainly based on excellence in scientific manpower, just as manpower is the key to almost any other type of undertaking also." [438] And with equal brevity he and Prof. Francis E. Dart explained the effect of this loss in technical manpower on development: "Shortage of adequately trained manpower is one of the most important obstacles in the development of the emerging countries. In fact, many believe that as far as the development of science is concerned, it is *the* most important obstacle." [439] Dr. Kidd

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[435] U.S. Congress, House, Committee on Science and Astronautics, Report on the National Science Board, *The Role of Engineers and Scientists in a National Policy for Technology*, 92d Cong., 2d sess., 1972, pp. 9–10. (House doc. No. 92–281.) (Hereafter cited as, *Report of the National Science Board*, 1972.)

[436] Quoted in Henderson, "Foreign Students: Exchange or Immigration?" *Selected Readings on International Education*, House Committee on Education and Labor, 1966, p. 350.

[437] *Report of the National Science Board*, 1972, p. 22.

[438] Moravcsik, *Basic Scientific Research in Developing Countries*, p. 4.

[439] Francis E. Dart, and Michael J. Moravcsik, *The Physics Interview Project*, University of Oregon, Eugene, Oreg., p. 1. (typescript, undated)

The final report of the UNESCO conference at Santiago, Chile made the same general observation: "The international conferences held to study the conditions necessary for speeding up the economic and social development of underdeveloped countries have unanimously recognized that the shortage of adequately trained scientific and technical personnel is one of the main obstacles to the carrying out of any development plan." (UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America*, 1965, p. 27.)

termed the loss of highly trained scientists from the LDCs a "national catastrophe." "This movement," he said, "constitutes in effect, an irreplaceable loss of a most valuable resource available to developing nations—scientific and technological brain power." [440]

What is most significant about brain drain as a negative force in development is that the number of scientists, engineers, physicians, and other professionals who make up this key talent resource is not very great. Effects must, therefore, be measured against qualitative rather than quantitative criteria. The CIMT study estimated that in the 1960's worldwide migration from the LDCs to the advanced countries was around 300,000 a year. About 15 percent of this total, or 50,000, were estimated to have had professional or technical training. By applying a strict criterion of value to development the number could be reduced to 25,000. Assuming that 1 in 10 had exceptional ability, then the core loss was between 3,000 to 5,000 a year, but these were persons with the highest ability and training. The loss of this vital cadre of talent, the study concluded, "can be particularly harmful" to development because it is this exceptional group that can contribute the most.[441]

Statistics on the migration of scientists, engineers, and physicians from the LDCs to the United States suggest that losses among the especially talented of some countries are probably not an exceptional occurrence and perhaps increase proportionately with the increase in immigration.[442] Such losses are, however, difficult to document, and most students of brain drain seem to approach this problem with caution, at best generalizing on the degree of loss or just recording statistics and percentages on immigrant professionals that in themselves imply or infer the dimension of loss.[443] That losses to this elite are in-

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[440] Quoted in, United Nations Educational, Scientific and Cultural Organization, *The Problem of Emigration of Scientists and Technologists,* Preliminary report prepared at the request of the Advisory Committee of the Economic and Social Council on the Application of Science and Technology to Development, Paris, Feb. 29, 1968, p. 12. (Hereafter cited as, UNESCO, *Problem of Emigration of Scientists and Technologists,* February 1968.)

The late Lloyd V. Berkner, Director of the Graduate Research Center of the Southwest, gave the following appraisal of the relationship between intellectual power and development: "Only those regions will be economically healthy that have the intellectual power to exploit the new science and the consequent industry. Most certainly, those regions that fail intellectually will fail economically and become chronically poor and colonial to the intellectually advanced regions. This is the social certainty that the technological revolution of our century has made clear." (Quoted in, UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 181.)

[441] CIMT study, p. 671. The UNESCO report on development in Latin America made the following observations on the effect of scientific and technological brain-drain from Latin America: "The most serious consequence of this constant drain is evident in the difficulty—and, in some cases, the impossibility—of ensuring the training, in each branch of science and technology, of the *critical mass* of specialists and research workers capable of producing a real impact on the community. Society does not take account of science as it does not 'see results', and science, in turn, is bereft of the resources and support of society. A possibly paradoxical result of this situation is to be seen in the fact that Latin American countries have to seek experts from the very countries to which their own scientists and experts emigrate, and often in the same fields." (UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, pp. 29–30.

[442] Mr. Baldwin discusses the loss of what he terms "key men," which he places at about 5–10 percent of all professional migrants. He notes the difficulty in assessing such losses, particularly in establishing criteria. "No one has made such studies on more than a casual basis and it seems very improbable that anyone will," he wrote. Accordingly, he assumes that migration of the critical elite would be "roughly proportional to the total number of professional migrants." Losses of key men have risen with the rise in total migration, he said, but adds that these losses are considerably offset by the rapidly growing supply of key men being generated by expanding education at home and abroad. (Baldwin, op. cit., pp. 362–63.)

[443] Professor Skolnikoff cited the case of only 5 percent of the 2,000 Taiwanese a year returning from graduate study abroad. The absolute numbers involved are relatively small compared to emigration from scientifically advanced countries, but he noted that "the loss of even a few highly trained personnel can have more serious effects on a less-developed nation's scientific and industrial activities." Professor Skolnikoff acknowledged that "the significance of this loss to a small struggling nation is hard to evaluate," but noted that elements of loss had to remain "open questions." (Skolnikoff, op. cit., p. 95.)

curred in the LDCs is evident in studies on brain drain from Latin America and the Middle East. A report by the Pan American Health Organization discussed the function of the vital cadres of talent for development and the difficulties generated for Latin American countries by the loss of this elite; and then made the following generalization: "Informed people in virtually every Latin American country can name persons of outstanding talent who have migrated to the United States. The numbers vary from country to country and they are small, but they constitute a serious blow to development." [444]

The UNITAR study on brain drain from Lebanon asserts categorically that losses in the Middle East have adversely affected the development of its universities. According to the study, 70 percent of the scientists from the area who have studied in Europe and North America emigrate. It concludes: "This outflow of highly trained personnel has retarded the development of the universities in this area over the last 10 years." [445] This conclusion infers that the cadre of vital manpower has been impaired and development as a whole thereby impeded.[446]

Social Costs of Medical Brain Drain.—The social costs of emigrating physicians from the LDCs constitute a long-term negative factor in development. Unprovable in an absolute sense, this loss can be measured partly by the ratio of M.D.s-to-population and by considering social needs rather than demand.

Doctor-to-population ratios illuminate the disparity of medical care in the LDCs and the advanced countries, and point to the conclusion that the LDCs suffer adversely from medical brain drain. In the United States, the heaviest user of FMGs from the LDCs, the ratio nationally is about 1.7 doctors for every 1,000 inhabitants. In New York State, which has the highest concentration of FMGs, the ratio

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[444] *PAHO, Migration of Health Personnel, Scientists, and Engineers from Latin America,* 1966, p. 8. The report stated: "The problem cannot be assessed statistically, and there is no point in attempting to do so. The critical fact is that the dimension of quality must be borne explicitly in mind when statistics are examined." A case in point is the migration of 700 Argentine engineers to the United States over the period 1951–1961. This number, the report stated, equaled 8 percent of the total number of new engineers graduating over that 10-year period. (p. 4.)

Luis Giorgi estimates that Latin America loses 8 percent of the annual number of graduates in the scientific and engineering professions as a result of brain drain. He placed the cost at about $14 million per year, that is, direct cost of training those emigrants, but he added: "If account is taken of all the many consequences—almost impossible to evaluate in figures—the loss is very much greater." Presumably, he was suggesting losses to development. (See, UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 172.)

Losses of the critical elite seemed to be inferred in data presented to the House Government Operations Committee during its study on brain drain. The Committee's study cited the case of the Dominican Republic which sent the United States 78 physicians in 1962, yet this figure constituted a third of the country's additions to manpower stock in that year. Moreover, 44 emigrating Dominican engineers were more than two-thirds of the country's new graduates. Chile's 18 engineers immigrating to the United States were equivalent of a fifth of its additions through new graduates. With regard to Israel, the study noted that Israel's 30 physicians were "an astounding 41.7 percent of its additions to the physician population of the country." (Staff study, House Government Operations Committee, *Brain Drain into the United States of Scientists, Engineers and Physicians,* 1967, p. 7.)

[445] UNITAR, *Brain Drain from Five LDCs,* 1971, p. 84. In the period 1962–1967, 2,229 Lebanese professionals were admitted to the United States.

[446] The report on the Ditchley Park Conference stated that several speakers had difficulty putting quantitative value to all economic factors in brain drain and the other non-economic factors which are also important. The report said: "The real loss to the community is the loss of leadership which highly qualified manpower represents. One example was given of a school for technicians in Pakistan which was delayed for 4 years due to the migration of one man. The influence of Homi Bhabha on the development of Indian science was cited as an example of the effect of a man of international stature who did not migrate." (*Report, Ditchley Park Conference on Brain Drain,* 1968, p. 13.)

is 1.9 doctors for every 1,000 residents. In some areas of the country the ratio is lower. The basic Federal Government criterion is one M.D. for every 1,500.[447]

The doctor-to-population ratio for other advanced nations is also high. In 1960, Austria had 560 inhabitants for every doctor; Belgium, 700; West Germany, 650; Italy, 610; and France, 840.[448]

The ratio for the LDCs is in sharp contrast with those from the advanced countries. In 1960, the doctor-inhabitant ratio in the LDCs of Africa was one M.D. for every 10,100 inhabitants; Asia, 5,700; and North and South America, excluding the United States and Canada, 1,800.[449]

LDCs with the lowest ratios were Burma with 11,700 inhabitants for every M.D.; India, 5,800; Iran, 3,220; Indonesia, 35,000; Haiti, 15,000; Ecuador, 5,100; Bolivia, 3,680; Ethiopia, 69,000; Ghana, 21,000; Nigeria, 32,000; Tunisia, 9,400; Pakistan, 6,400; Thailand, 8,600; Korea, 2,850; China (Taiwan), 2,420; Colombia, 2,470; Peru, 2,230.[450]

The above ratios do not necessarily reflect the actual ratios for specific areas within the LDCs. In rural areas the ratio is much lower than in the urban areas where physician concentration is the highest. Sources on brain drain combine ratios in unique ways that show the actual situation and suggest the pressing needs of the LDCs. "We have 1,250 doctors for 25.4 million people in East Java," explained Dr. Wogsokusumo Bahrawi, who directs health care in East Java, Indonesia. "That sounds like one doctor for every 20,000 people, but it's a distortion because most of them are in big cities. So really, in rural areas, there is only one doctor for every 180,000 people."[451] Closer scrutiny of ratios for the Philippine Islands reveals a similar imbalance. Manila has a ratio of 1 physician for 671 people. In the rural areas the ratio lowers to 1 for every 4,979; and for Southern Mindanao, the ratio drops still further to 1 for every 10,700.[452] Similar imbalances would no doubt be revealed if the ratios for other heavy losers in medical brain drain among the LDCs were broken down regionally or according to specific areas.

Undoubtedly the imbalance would be accentuated still more sharply if only native doctors were counted in ratios rather than including

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[447] *The New York Times*, June 15, 1973, p. 33 and May 27, 1972, p. E16. For a discussion of the influx of FMGs into the United States, see Chapter II. According to Margulies and Bloch, in 1969 approximately 75 percent of the FMGs came from the LDCs of Africa, Asia and Latin America. (p. 9) In many instances the LDCs with the lowest ratios are the highest contributors. Of the 14, 828 FMG trainees (residents and interns) in the United States at the close of 1967, four-fifths came from 15 countries and 56 percent came from 6 developing Asian nations: Philippines (25.5 percent); India (11.9 percent); Korea (6.8 percent); Iran (4.4 percent); Thailand (4.4 percent) and Taiwan (3.1 percent). See below for the ratios of M.D.s-to-inhabitants. (Henderson, op. cit., p. 63.)

[448] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, Table III, pp. 70–71.

[449] Ibid., p. 40. In commenting on the shortage of physicians and health workers in Africa, Prof. Claire Nader referred to Dr. Alfred Quenum, African regional director of the World Health Organization, and his statement that in Africa the ratio was one M.D. for 25,000 to 50,000 persons and this includes foreign physicians and missionaries. (Nader, *Technical Experts in Developing Countries*, pp. 455–456.)

[450] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, Table III, pp. 68–71.

[451] *The New York Times*, Mar. 21, 1973, p. 12. In underscoring the inadequacy of health care, the reporter, writing from Triwung Kidal, Indonesia, observed: "There is a good chance that no one in this village will see a doctor this year. It is almost certain that no one will appear to teach the people about the virtues of sanitation and hygiene."

[452] UNITAR, *Brain Drain from Five LDCs*, 1971, p. 103.

those who are expatriates and missionaries from the advanced countries of the West.

The correlation of the imbalance in ratios of doctors-to-population with apparent and declared social needs throws further light on medical manpower deficiencies in the LDCs and the negative impact of medical brain drain. That the medical needs of the LDCs are not adequately satisfied is evident by the accumulated cases in the brain drain literature. In 1963, Nigeria graduated 19 M.D.s from its one medical school; during the same year, 16 Nigerian doctors were working in American hospitals,[453] in effect a net gain for Nigeria of only three physicians. To comprehend the full meaning of these statistics, it is important to bear in mind that in 1960 Nigeria had a total of only 1,777 doctors, or a ratio of 1 doctor for every 32,000.[454] In the case of Cameroon between 1961 and 1968, about 38 qualified Cameroonian professionals remained in the United States. Of these professionals, nine were medical scientists.[455] At first glance this figure may seem insignificant, but it is substantial when placed in the context of need: Only 47 native Cameroonian doctors were said to be practicing in their country to serve a population of some 5.8 million—a ratio of 1 for every 123,000.[456]

Similar cases have been recorded for Asia. In India, 60 percent of the rural clinics in East Punjab (pop. 13.5 million) and presumably elsewhere are unmanned by doctors, while nearly 10 percent of India's medical doctors are working in foreign countries, mainly the United States and the United Kingdom.[457] On August 15, 1974, a report from New Delhi appearing in *The Christian Science Monitor* disclosed that recently 125 students graduated from a medical college in Gujarat, north of Bombay, India; 85 of them promptly chartered a bus and arrived several days later at the U.S. consulate in Bombay to apply for visas.

On one occasion, virtually the entire first graduating class of a new medical school in Chiengmai, Thailand, chartered an airplane and flew off to the United States.[458] Thailand has a doctor-to-population ratio of 1 for every 8,600.[459] Moreover, one-fourth of Thailand's 4,000

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[453] Testimony of Senator Mondale. Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 87.

[454] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 70.

[455] UNITAR, *Brain Drain from Five LDCs*, 1971, p. 117. Sixteen were engineers, 3 natural scientists, and 10 social scientists.

[456] Eren, op. cit., p. 10. One hundred were working in France. The small medical cadre in Cameroon is evident by the few students studying abroad in 1969: Canada, 9; France, 44; and the United States, 16. (UNITAR, *Brain drain from five LDCs*, 1971, p. 162.) Cameroon has no medical school at its Federal University. Founded in 1962, the university has faculties in law and economics, humanities, and science with a teaching staff of 260 and a student body of 3,277. The university library has only 40,000 volumes. In 1972, the university began postgraduate courses. In 1969, the University Center of Health Sciences was opened, and at the present time has 27 teachers and 132 students. Thus, it would seem that Cameroon has the barest minimum of an institutional infrastructure for learning and must send its students abroad for any advanced training. By the same token it can least afford the loss of any of its overseas intelligentsia, for it is axiomatic in brain drain from the LDCs that the narrower the professional manpower base, the greater the loss to the nation. Loss of a physician from an advanced country would have little negative impact on medical services, but the same loss in Cameroon where the need is great and the ratio very low could be devastating. For information on advanced education in Cameroon, see *World of Learning, 1972–73* (London; Europa Publications Ltd., 1972), v. 1, p. 217.

[457] Report, *Ditchley Park Conference on Brain Drain*, 1968, p. 16, and Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 40.74. Punjab has 768 medical institutions, including 117 hospitals, 3 Ayuyvedic hospitals, 126 primary health centres and 522 dispensaries. *The Stateman's Year-book, 1972–73* (London: Macmillan-St. Martin's, 1972), p. 378.

[458] Dublin, op. cit., p. 875.

[459] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 1968, p. 68.

doctors are now in the United States; yet, according to Stevens and Vermeulen, outside Bangkok, physician services are "woefully inadequate." And they add, "There are more Thai graduates in New York than there are serving Thailand's rural population of 28 million." [460] A somewhat similar story could be told of Korean M.D.'s. Between 1962–68, 1,914 Korean doctors came to the United States, but only 49 had returned by early 1969. Between 45–60 percent of the graduates of Korea's 11 medical schools find employment abroad. Meanwhile, only 1,000 doctors are practicing in rural areas where about half (some 15 million) of the South Korean population lives, or by including some small towns and a slightly different doctor definition, 5,400 doctors for a population of 20 million.[461] Much the same could be said for Iran, Lebanon, and Turkey. There are more American-trained Iranian doctors in New York than all of Iran, yet Iran has a doctor-to-population ratio of only 1 for every 3,220.[462]

In appraising medical brain drain from Lebanon, the UNITAR study declared:

> The need for medical personnel has become even greater with the rapid population increase. The loss of physicians with residency training has seriously affected the health service as well as the establishment of new medical schools. Hence, the outflow to the United States of eighty-nine physicians and surgeons, twelve dentists and sixty-two nurses over a five-year period has had a great effect on the health system.[463]

Lebanon has a doctor-to-population ratio of 1 for 1,320.[464]

In Latin America, the essentials are the same; only variations here and there. The Pan American Health Organization study (PAHO) provides abundant evidence to show the negative effect of medical brain drain on Latin America, though it varies from country to country. Quantitative losses, the report states, are "highly significant but not catastrophic." [465] Every year an estimated 300 medical doctors emigrate to the United States from Latin America, representing about 8 percent of the annual output of all medical schools. The social loss is magnified by the fact that 25 percent of those emigrating are potential scientists and professors, that is, the builders of a nation's scientific infrastructure. According to a survey by PAHO, "The academicians in the United States who are Latin American graduates believe that their countries are losing some of their best physicians through migration to the United States." [466]

Most students of brain drain seem to concur in the judgment that the LDCs suffer serious social and economic losses from medical brain drain. Dr. Margulies told the House Government Operations Committee:

> There is no way to estimate the costs just as there are no hard facts on the size or character of the brain drain. Certainly, for some countries the costs are heavy, particularly when they include the loss of talented leaders and the assump-

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[460] Stevens and Vermeulen, op. cit., pp. 49–50.

[461] Henderson, op. cit., p. 63.

[462] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 68.

According to Stevens and Vermeulen, Iran produces 600 medical graduates a year. At least 100 of each of the graduating classes from 1960 through 1969 are now in the United States. Many, if not most, they said, will remain; in 1970 alone, 806 Iranian medical graduates took the American licensing examinations (p. 50).

[463] UNITAR, *Brain Drain from Five LDCs*, 1971, p. 91.

[464] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 68.

[465] *Report on Brain Drain from Latin America*, Pan American Health Organization, 1966, p. 34.

[466] Ibid., pp. 34 and 17.

tion of Western values which are inappropriate to local problems. Physicians are lost at the very time they can be most useful but after they have been expensively educated. The short-term effects are measured by preventable disease and death, the long-term by retarded development of institutions and health services, both highly undesirable.[467]

In their study on FMGs, Margulies and Bloch summarize the positive aspects of the inflow, but render this critical judgment:

While these and other events were occurring, no one was measuring the results. There seems to have been a benevolent assumption that nobility of purpose leads inevitably to a happy ending. What did happen has now become evident, even with some of the information still lacking. The United States has been siphoning off medical manpower from areas of the world which can least afford such losses, returning to them physicians with inapplicable skills and doubtful professional careers at home.[468]

In their U.S. Government-sponsored study, Stevens and Vermeulen concluded:

. . . the majority of foreign medical graduates in internship and residency positions in this country—whatever their initial intentions—elect to remain in the United States. Thus, this country is the recipient of substantial "reverse foreign aid." The United States is reaping the rewards of investments made by other countries in the education of physicians, and those countries are suffering a long-term loss of physician services.[469]

Awareness of the price paid by the LDCs for medical brain drain is often expressed in terms of moral guilt. For Dr. G. Halsey Hunt, who found this dependency a "depressing and humbling experience" and in the long run completely untenable, it "ill becomes us to depend indefinitely on other countries for the production of medical manpower to provide services to American patients." [470] For Dr. Irene Butter of the University of Michigan's School of Public Health, "A permanent loss of doctors from the poorest to the richest nations is the most disturbing aspect of the medical brain drain." [471] And Professor H. Myint, who tended to minimize the effects of brain drain, acknowledged that,

From the welfare point of view, the migration of doctors from the underdeveloped countries, where the ratio of doctors to the total population is so low, to the advanced countries where the doctors are relatively more numerous, is the most disconcerting aspect of the brain drain, whatever its effect or lack of effect on the economic development of the underdeveloped countries.[472]

Thus, the imbalance in doctor-to-population ratios indicates that the LDCs may have an oversupply of physicians to meet the demands of urban dwellers—or at least of those with money to pay for physicians'

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[467] Margulies to Mrs. Edna Gass, Jan. 19, 1968, *In* Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 91.

[468] Margulies and Block, op. cit., p. 86. The authors noted that the 40 Nicaraguan physicians in the United States approximate the total medical school output of Nicaragua for 2 years, and that the 328 physicians for the Dominican Republic represent their medical school output for 4 years. "If the United States lost 60,000 of its own medical graduates to other countries, the equivalent of Iran's or Thailand's loss to this country, for even brief assignments," they wrote, "there would be widespread cries of shock and outrage. If we added to that migration the repatriation of all FMGs now in this country, the total number of physicians remaining would be reduced from 300,000 to 200,000. Even so, we would still have 1 physician for every 1,000 people, an enviable goal for the less developed countries." (pp. 80–81.)

[469] Stevens and Vermeulen, op. cit., p. xl.

[470] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills,* October 1966, pp. 126–127.

[471] Butter, op. cit., p. 23.

[472] Myint, op. cit., p. 235.

services—but the social needs of the country as a whole for such services, described by the CIMT study as "overwhelming," are clearly not satisfied. From this perspective of need the flight of M.D.'s from the LDCs to the advanced countries may be seen more as brain drain than overflow.[473]

Loss of Students Through Nonreturn.—Depletion of reserve professional manpower resources in the LDCs can result from loss of students studying in the United States and other advanced countries. Data on this aspect of brain drain are discussed above in chapter II. Briefly, the United States educates approximately one-fourth of the foreign students who study abroad.[474] Estimates of student nonreturn vary. Officially, the U.S. Government has cited 8.3 percent.[475] A United Nations study on brain drain states that in 1967 the overall rate of student nonreturnees from both developed and developing countries from the United States was between 15 and 25 percent. The percentage for Asians students, which constitutes approximately one-third of all foreign students in the United States, was 30 percent.[476]

Estimates for specific countries have been higher. Of the 7,913 scientists, engineers, and physicians immigrating into the United States from the LDCs in 1967, 3,772, or 48 percent, had originally entered the country as students with declared intentions of obtaining education or training and then returning home. The high overall 48 percent average ratio of student to total scientific immigration conceals even higher ratios for individual countries, namely, 89 percent for Taiwan; 80 percent for Korea; 78 percent for India; and 71 percent for Iran.[477] Among nonreturnees it was further estimated that " an alarming 51 percent" of foreign recipients of Ph. D.'s planned to remain in the United States and "an even more alarming 60 percent" intended to take jobs in this country.[478]

Whatever the variables in numbers and percentages and however valid the purposes of international educational exchange, the fact remains that a high percentage of foreign students, notably from the LDCs, remain in the United States, and, thus deprive their countries of important manpower resources, real or potential.[479] This deprivation is felt most keenly when countries have schemes of planned development and the flow of manpower has to be orchestrated according to prearranged plans.[480]

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[473] CIMT study, p. 698. The LDCs also pay a high cost in the loss of trained nurses and midwives who play an important role in health care. It is estimated that between 25–40 percent of all 256,000 nurses working in the British National Health Service were born outside the British Isles, almost 75 percent in developing Commonwealth countries. About 43 percent of the midwives practicing in England and Wales were born outside the U.K. (For details on nurses and midwives from the LDCs, see Henderson, op. cit., pp. 58–60.)

[474] Testimony of Reverend Gibbons, *In,* Hearings, House, Government Operations Committee, *Brain Drain,* 1968, p. 11.

[475] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills,* 1968, pp. 91–92.

[476] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs,* Nov. 5, 1968, p. 32.58.

[477] Report, House Government Operations Committee, *Scientific Brain Drain from the LDCs,* 1968, p. 7.

[478] Ibid., p. 8.

[479] Professor Patinkin explained this point: "It is frequently impossible to detect the outstanding scholars at a young age. Hence the loss involved in the flow of young Ph. D.'s abroad is greater than usually considered: for it decreases the probability that the country in question will really have the pick of its people." (Patinkin, op. cit., p. 103.)

[480] Professor Gardiner discusses various aspects of this matter as it applies to Africa. (Gardiner, op. cit., p. 196.)

The cost of manpower loss increases when the country has to meet its manpower demands by drawing on foreign resources. A case in point is Iran. In 1966, according to Habib Naficy, there were some 6,000 paid foreign experts working in a variety of fields and positions and also hundreds of foreign experts who were "graciously" sent to Iran by the Peace Corps and different technical assistance agencies. "Their places could be taken by qualified Iranians who have not returned," said Mr. Naficy; "the brain drain of young Iranians is, indeed, a very real problem." [481]

In such instances the LDC suffers a dual loss. Yet, the LDCs, like those in Africa which have limited advanced training facilities for their nationals, must accept great risks in losing an estimated 20 percent or more of their students sent abroad for advanced study.[482]

Loss of National Prestige.—Finally, the LDCs suffer a loss of national prestige when their professional elite leaves the country for residency in the advanced West. Prestige is a difficult factor to measure in international politics. Though intangible and elusive, it is nonetheless a reality; it is recognized as such, and does affect a nation's standing in the world community. This effect is particularly strong in the LDCs where the search for a new national identity generates a special awareness of value and worth in the eyes of other nation-states.

"The natural scientist is one of the most sought-after people in the world," wrote Dr. James A. Wilson, a social psychologist at the University of Pittsburgh, and Jerry Gaston, a sociologist at the Southern Illinois University. "It is widely believed that he represents a currency which can be translated into domestic and international wealth and prestige." Though difficult, if not impossible, to put a figure on losses caused by the migration of scientists (and for that matter other components of the professional elite), such migration, they said, "does impoverish the source country appreciably." They explained: "The prestige of a nation's scientific establishment tends to be weakened by extensive, permanent migration, although the relationship which connects prestige, emigration, and the 'base number' of scientists in that country is far from clear." [483]

Not all students agree with this view. Jagdish Bhagwati, an Indian intellectual who after years of residency abroad returned home but commutes between both worlds, contended that Indians working abroad are enhancing the prestige and reputation of their country. In arguing for an open door policy on education and work abroad, he said: "The work of many mathematicians, physicists, statisticians, and economists at foreign universities while they are working abroad,

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[481] Naficy, op. cit., p. 70.

[482] That Africans are aware of these risks is shown in the final report of the Organization of African Unity (OAU) conference in Nairobi during July 1968. The report acknowledged that there were only three or so universities where postgraduate studies were given. These institutions were very expensive to establish, and, the candidates usually available in each state were few in number. Otherwise, all postgraduate studies were taken outside Africa. The OAU reviewed this problem and decided in the interests of Member States that centers of excellence be established in Africa to serve postgraduate needs. (Organization of African Unity, UNESCO, *Final Report: Conference on Education and Scientific and Technical Training in Relation to Development in Africa,* Nairobi, July 16–27, 1968, p. 60.)

[483] Wilson and Gaston, op. cit., p. 234.

has in many cases transformed our reputation abroad, which was previously low in academic circles. This itself is prestigious." [484]

Professor Dandekar took the opposite point of view: "Bhagwait knows better," he replied in rebuttal, "and knows it too well that whatever the prestige of the individual Indian scientists abroad may be, it is the scientists working in their own countries, often anonymously, in poor conditions, improvising with native genius to overcome several handicaps in resources and equipment, who are bringing effective prestige to their countries in the world community." [485]

What Dandekar seems to be implying is that the greatest prestige is institutional, not individual: prestige is to be gained not through the individual who succeeds abroad but rather in the success of native scientific institutions and the scientific community that he helps to create and represents. Loss of this prestige-producing potentiality can be a serious, but incalculable, blow to the LDCs.

LOSS OF PROFESSIONAL MANPOWER INVESTMENT

Assessment of investment costs is perhaps the most difficult task in judging effects of brain drain on the LDCs. Emigration statistics cannot tell the full story of costs: they provide a factual framework for analysis, but they neither define migration as a problem nor explain the effects on development. Migrating professionals have a value in themselves. Whatever that value may be, it is added to the receiving country, and correspondingly withdrawn from the sending country. On the surface this is a simple, commonsense judgment. But that value is not so easily determined. It varies widely in both time and place, especially in science and technology, with their unique transnational characteristics. Accordingly, no agreed totals of economic costs and prices have yet been fixed to migration, nor in view of its complexities does it seem likely that this can ever be done.[486]

How is it possible to measure the "externalities" of the educated person, that is, his total value as a human being to society? Loss of new knowledge or improved methods of production and management is a matter upon which *a priori* reasoning, as Professor Johnson states, "can throw no light," and thus provides no realistic means for measuring loss.[487] Students of brain drain, like Reverend Gibbons, must generalize on economic and social costs in a diffuse and impressionistic way—"In a modernizing society or economy, it scarcely is a propitious beginning to have large percentages of the more trained minds move abroad and to abandon the task of handing on the torch of learning to their compatriots. The assumed net loss will be, under such circumstances, presumably greater than the dollar cost of having trained the individuals who migrate." [488] Or they attempt to put some quantitative value on advanced education of the migrant professional, hoping in

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[484] Quoted in, Dandekar, op. cit., p. 227.
[485] Ibid., p. 227.
[486] Gregory Henderson discusses this problem in UNITAR's, *Emigration of Highly-Skilled Manpower from the Developing Countries,* 1970, pp. 1b–1c.
[487] Johnson, op. cit., pp. 84–85.
[488] Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 8.

this way at least to fix *some* measure of cost to the sending nation, however imprecise.[489]

Estimated Costs of Emigrant Scientists and Engineers.—The House Government Operations Subcommittee for Research and Technical Programs, the United Nations, the Pan American Health Organization, and others have tried to estimate the costs of emigration of scientists and engineers from the LDCs to the United States and other advanced countries of the West. (Estimates have been based on the narrow consideration of limited educational costs; not taken into account are the investments of people and capital in the LDCs from outside private and public sources.)

Taking Dr. Kidd's figure of $20,000 as a minimum cost per person in education and training in the LDCs, the House Government Operations Committee study calculated that the 4,390 scientists, engineers, and physicians emigrating from the LDCs in fiscal year 1966 represented a "contribution" of some $88 million to the United States.[490] Applying the same figure of $20,000 to the 1967 scientific immigration to the United States of 7,913 persons, the Committee's report stated, results in an investment loss of 1 year of more than $150 million by the LDCs.[491]

Estimates by the United Nations indicate a substantial financial loss in educational investment to the LDCs through brain drain to the West. According to a report of the Secretary General, dated 1968, the cost to the LDCs of educating professionals who emigrated to the United States from the LDCs since World War II (using the base figure of $20,000 per person) would be on the order of slightly over

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[489] James A. Wilson cites the following economic cost to the British in their brain drain of scientists to North America: "There is the loss of the actual products of the research of the lost scientists; and with these, the profits that could have been gained to the British economy. The worst has already happened—not once but many times: British institutions have had to pay licensing fees and such upon patented techniques produced by British scientists abroad." (*The Value Pattern of Productive Scientists, as Reflected in the Contemporary "Brain Drain" from Britain to North America,* op. cit., p. 6.) The British experience could be very well duplicated among the LDCs.

For an elaborate economic analysis of the costs of nonreturning foreign students, see, Herbert G. Grubel, "Nonreturning Foreign Students and the Cost of Student Exchange," *International Educational and Cultural Exchange,* U.S. Advisory Commission on International Educational and Cultural Affairs (Spring 1966), pp. 20–23. Grubel argues from the internationalist perspective, minimizes the costs of student nonreturn and concludes: "The analysis and computation in this paper lead to the following conclusions. . . . Since it is difficult to establish a valid argument about reductions in the welfare of people in the country from which a person emigrates, there exists a strong presumption that the nonreturn of foreign students increases, overall world welfare. . . ." (p. 29.)

Professor John C. Shearer of Pennsylvania State University takes issue with Grubel in his article, "In Defense of Traditional Views of the 'Brain Drain' Problem," *International Educational and Cultural Exchange,* U.S. Advisory Commission on International Educational and Cultural Affairs (Fall 1966), pp. 17–25. Shearer makes a point-by-point refutation of Grubel's article, the main thrust of which is to underscore the high social and economic costs to the sending countries.

Dr. Thomas F. Jones, President of the University of South Carolina, argued in favor of foreign students remaining in the United States and at one point in his argument addressed himself to the matter of costs of investment in human resources. He believed that it was reasonable to hold the view that the resource belongs to each country in proportion to the part developed in the respective country. Thus, he argued, the United States "can claim major interest in a person who obtains a B.S. in a developing country ($180,000 human resource) and spends 4 years getting a doctorate in the United States ($380,000 total human resource, or an increase of $200,000). This argument is further enhanced by the fact that engineering graduate students, including those from abroad, are almost always supported by the host institution through teaching or research grant funds—domestic funds." (Thomas F. Jones, "Should the Foreign Engineering Student Return to His Native Land to Practice His Profession?" *In, Selected Readings on International Education,* House Committee on Education and Labor, 1966, p. 365.) Critics of this point of view might point out that both the individual and the institution are beneficiaries of teaching and research grants.

[490] Staff study, House Government Operations Committee, *Brain Drain into the United States of Scientists, Engineers and Physicians,* 1967, p. 7.

[491] Report, House Government Operations Committee, *Scientific Brain Drain from the LDCs,* 1968, p. 5.

$4 billion, an annual average of over $45 million a year. Its value in terms of American education, the report said, "would be still higher." While the value of professionals absorbed into all other industrialized countries was "even less known," the report stated that taken together, "it may approach" the American figure. The report continued:

> In developed economies, the cost of educating a professional is a very small percentage of the value of this output over twenty-five man years of his working life. Hence the projected value of such immigrant professionals to the countries to which they go would be several times greater than the value of their education. To this, the value of sub-professional skills must be added. Thus it is possible that the above evaluation, with all the reservations which must be made about it, is an underestimation.[492]

In citing the particular case of India, the Secretary General's report declared that the aggregate costs of education lost to India due to emigration of professionals to Canada, France, and the United States (before 1966) "would have been over many years in excess of $1.7 million per annum." Assuming that India lost the equivalent in cost of a degree for each of the professionals lost to the United States in 1967, as well as nurses lost to the United States and other countries, the total loss for that year in educational costs alone would be about $5.5 million. "Compared with Africa and Latin America," the report stated, "Indian costs would appear to be exceptionally low." [493]

In his UNITAR study on emigration of professionals from the LDCs, Gregory Henderson cites other specific cases of investment loss in education through brain drain. Putting a value of $20,000 on a Turkish university graduate in 1965, Turkey's annual loss of 575 professionals is estimated to cost $11,555,000 or 2–3 percent of total capital formation annually in the educational system.[494]

Colombia's average annual loss in educational expenses for emigrating professionals from 1955–68 was estimated (on a basis of $10,000 per person) to be on the order of $25 million, plus $4,958,000 for intermediate personnel. For these professionals who emigrated, "educational expenses for 14 years to 1968," he said, "were equivalent to considerably more than the sum allocated for educational expenses in the national budget for 1969." In addition, the amounts consumed in foreign exchange by those students abroad who failed to return were $57,100,000 in foreign exchange for the 14-year period.[495]

Henderson also cites the case of Cameroon, which sponsors about 250 persons for higher education in France each year. About one-third fail to return, causing an estimated loss in supporting costs alone of $7 million a year.[496]

The June 1970 report of the Secretary General on the outflow of trained personnel from the LDCs to the developed countries further documents the loss in educational investment. In the case of Lebanon, the overall costs of those emigrating in 1967 after receiving elementary education or secondary and university training was estimated at $40 million annually. The loss to Jordan was placed at about 66 percent of this figure. For Cameroon, the loss incurred by the emigration of

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[492] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, pp. 48.93 and 49.94.
[493] Ibid., p. 43.82.
[494] Henderson, op. cit., p. 116.
[495] Ibid., p. 117.
[496] Ibid., p. 117. Henderson makes other projections on pp. 118–119.

middle- and high-level personnel to France alone was estimated at CFAF520,497,506 ($2,081,990) for 1967–69. Colombia incurred a loss of investment for middle-level cadres as high as $14.7 million and over $164 million for high-level personnel between 1955 and 1968. In Trinidad and Tobago, an estimated $21.2 million was lost in 1968 because of the drain of qualified and skilled manpower.[497]

UNITAR's study on brain drain from five developing countries records a total estimated cost in education to the Philippines for the loss of emigrating professionals to the United States at $5,238,300 for 1967, $1,488,300 for migrating physicians and $3,750,000 for all other professionals.[498] From the 85 professionals who migrated to the United States in 1967, Lebanon suffered a total loss estimated at $1.5 million. The annual outflow of capital from Lebanon invested in education and training was placed at $40 million.[499]

Latin America has incurred substantial losses in educational investment because of the migration of professionals to the United States. A report published by the Pan American Health Organization estimates that about 4,000 university-educated persons emigrated to the United States from Latin America during 1960–65. About three-fourths, or some 3,000, were believed to be permanent immigrants. Placing the cost of training one person at a "conservatively estimated" figure of $20,000, the loss of the 3,000 measured solely in terms of education cost is about $60 million for the 5 years.[500]

Dr. Luis Giorgi, President of the Pan-American Federation of Engineering Societies, observed in a report to a UNESCO-sponsored conference that Latin America loses the equivalent of approximately 8 percent of the annual number of graduates in the higher levels of the scientific and engineering professions. He estimates that an average of 404 engineers and 144 scientists emigrate from Latin America annually. Migration at this rate costs the Latin American countries about $14 million a year, that is, in direct costs of training, $10 million for engineers and $4 million for scientists. The loss would be "very much greater", he said, if all the other many consequences, almost impossible to quantify, were taken into account. Dr. Giorgi estimates that Latin America has a total of 95,000 engineers and that it costs $20,000–$30,000 to train an engineer in Latin America.[501]

Dr. Kidd calculates that about 3,000 university-trained scientists, engineers and physicians migrated permanently to the United States from all Latin America during 1961 through 1965, or an average of 600 a year. This estimate takes into account a 25 percent return rate from the total of 4,000. Assuming the costs of education "conservatively" at $20,000, Dr. Kidd measures the loss to Latin America in educational costs alone at around an average of $12 million a year.[502]

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[497] Report of U.N. Secretary General, *Outflow of Trained Personnel from Developing to Developed Countries*, June 9, 1970, p. 23.

[498] UNITAR, *Brain Drain from Five LDCs*, 1971, p. 160.

[499] Ibid., pp. 87–88.

[500] *Report on Brain Drain from Latin America*, Pan American Health Organization, 1966, p. 6.

[501] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America*, 1965, pp. 172 and 180.

[502] But the real costs, Dr. Kidd said, are higher and the losses relate primarily to the loss of the "crucial few highly qualified professional people—particularly university teachers and investigators." "It is the loss of these people in my judgment," he said, "rather than absolute numbers, which generates a problem in Latin America." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, pp. 76–77.)

TABLE 23.—ESTIMATED EDUCATIONAL COST TO SENDING NATIONS OF IMMIGRANT SCIENTISTS, ENGINEERS, PHYSICIANS, AND SURGEONS ENTERING UNITED STATES FROM LDC'S AS IMMIGRANTS, FISCAL YEAR 1971

Area	Scientists/ engineers	Estimated educational cost	Physicians/ surgeons	Estimated educational cost	Total scientists/ engineers/ physicians/ surgeons	Total educational cost
All countries	13, 102	$262, 040, 000	5, 743	$114, 960, 000	18, 850	$377, 000, 000
All LDCs [1]	11, 102	222, 040, 000	5, 213	104, 260, 000	16, 315	326, 300, 000
West Europe: Greece	165	3, 300, 000	52	1, 040, 000	217	4, 340, 000
Latin America [2]	836	16, 720, 000	542	10, 840, 000	1, 378	27, 560, 000
Asia	9, 423	188, 460, 000	4, 380	87, 600, 000	13, 803	276, 060, 000
Near and Middle East	602	12, 040, 000	434	8, 680, 000	1, 036	20, 720, 000
Far East	8, 821	176, 420, 000	3, 946	78, 920, 000	12, 767	255, 340, 000
China	897	17, 940, 000	207	4, 140, 000	1, 104	22, 080, 000
India	4, 226	84, 520, 000	1, 057	21, 140, 000	5, 283	105, 660, 000
Korea	450	9, 000, 000	999	19, 980, 000	1, 449	28, 980, 000
Pakistan	630	12, 600, 000	161	3, 220, 000	791	15, 820, 000
Philippines	1, 528	30, 560, 000	1, 040	20, 800, 000	2, 568	51, 360, 000
Other	1, 090	21, 800, 000	482	9, 640, 000	1, 572	31, 440, 000
Africa	589	11, 780, 000	222	4, 440, 000	811	16, 220, 000
Egypt	387	7, 740, 000	146	2, 920, 000	533	10, 660, 000
Other	202	4, 040, 000	76	1, 520, 000	278	5, 560, 000
All other areas	89	1, 780, 000	17	340, 000	106	2, 120, 000

[1] LDCs are intended to include the following countries and areas listed in the NSF report: Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[2] Latin America is intended to include those areas listed in the NSF report as North and Central America (excluding Canada) and South America.

The statistical data in this table on number of immigrants are drawn from, NSF, "Highlights, Immigrant Scientists and Engineers, Aug. 20, 1973," p. 2.

This table uses the figure of $20,000 as the cost of education per person. This figure was used 7 years ago (in 1967) by Dr. Kidd and the House Government Operations Committee. Some sources say the estimate is high; others say it is conservative. Thus, the estimate ought to be regarded as only an approximation of cost to the sending nations.

The table is based upon 2 assumptions, (1) that the $20,000 of education cost per person is a reasonable estimate; and (2) that those professionals entering as immigrants are remaining and establishing permanent residency.

TABLE 24.—ESTIMATED EDUCATIONAL COST TO SENDING NATIONS OF IMMIGRANT SCIENTISTS, ENGINEERS, PHYSICIANS, AND SURGEONS ENTERING UNITED STATES FROM LDC'S AS IMMIGRANTS, FISCAL YEAR 1972

Area	Scientists/ engineers	Estimated educational cost	Physicians/ surgeons	Estimated educational cost	Total scientists/ engineers/ physicians/ surgeons	Total educational cost
All countries	11, 323	$226, 460, 000	7, 143	$142, 860, 000	18, 466	$369, 320, 000
All LDCs [1]	9, 550	191, 009, 550	6, 462	129, 240, 000	16, 012	320, 240, 000
West Europe: Greece	114	2, 280, 000	76	1, 520, 000	190	3, 800, 000
Latin America [2]	756	15, 120, 000	523	10, 460, 000	1, 279	25, 580, 000
Asia	8, 155	163, 100, 000	5, 558	111, 160, 000	13, 713	274, 260, 000
Near and Middle East	556	11, 120, 000	683	13, 660, 000	1, 239	24, 780, 000
Far East	7, 599	151, 980, 000	4, 875	97, 500, 000	12, 474	249, 480, 000
China	660	13, 200, 000	274	5, 480, 000	934	18, 680, 000
India	3, 567	71, 340, 000	1, 802	36, 040, 000	5, 369	107, 380, 000
Korea	546	10, 920, 000	810	16, 200, 000	1, 356	27, 120, 000
Pakistan	491	9, 820, 000	260	5, 200, 000	751	15, 020, 000
Philippines	1, 540	30, 800, 000	831	16, 620, 000	2, 371	47, 420, 000
Other	795	15, 900, 000	898	17, 960, 000	1, 693	33, 860, 000
Africa	433	8, 660, 000	259	5, 180, 000	692	13, 840, 000
Egypt	239	4, 780, 000	115	2, 300, 000	354	7, 080, 000
Other	194	3, 880, 000	144	2, 880, 000	338	6, 760, 000
All other areas	92	1, 840, 000	46	920, 000	138	2, 760, 000

[1] LDCs are intended to include the following countries and areas listed in the NSF report: Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[2] Latin America is intended to include those areas listed in the NSF report as North and Central America (excluding Canada) and South America.

The statistical data in this table on number of immigrants are drawn from, NSF, "Highlights, Immigrant Scientists and Engineers, Aug. 20, 1973," p. 2.

This table uses the figure of $20,000 as the cost of education per person. This figure was used 7 years ago (in 1967) by Dr. Kidd and the House Government Operations Committee. Some sources say that the estimate is high; others say it is conservative. Thus, the estimate ought to be regarded as only an approximation of cost to the sending nations.

The table is based upon 2 assumptions, (1) that the $20,000 of education cost per person is a reasonable estimate; and (2) that those professionals entering as immigrants are remaining and establishing permanent residency.

TABLE 25.—ESTIMATED EDUCATIONAL COST TO SENDING NATIONS OF IMMIGRANT SCIENTISTS, ENGINEERS, PHYSICIANS AND SURGEONS ENTERING UNITED STATES FROM LDC'S AS IMMIGRANTS FISCAL YEAR 1971 AND 1972

Area	Fiscal year 1971		Fiscal year 1972		Total fiscal years 1971 and 1972	
	Scientists/ engineers/ physicians/ surgeons	Educational cost	Scientists/ engineers/ physicians/ surgeons	Educational cost	Scientists/ engineers/ physicians/ surgeons	Educational cost
All countries	18, 850	$377, 000, 000	18, 466	$369, 320, 000	37, 316	$746, 320, 000
All LDCs [1]	16, 315	326, 300, 000	16, 012	320, 240, 000	32, 327	646, 540, 000
West Europe: Greece	217	4, 340, 000	190	3, 800, 000	407	8, 140, 000
Latin America [2]	1, 378	27, 560, 000	1, 279	25, 580, 000	2, 657	53, 140, 000
Asia	13, 803	276, 060, 000	13, 713	274, 260, 000	27, 516	550, 320, 000
Near and Middle East	1, 036	20, 720, 000	1, 239	24, 780, 000	2, 275	26, 852, 000
Far East	12, 767	255, 340, 000	12, 474	249, 480, 000	25, 241	504, 820, 000
China	1, 104	22, 080, 000	934	18, 680, 000	2, 038	40, 760, 000
India	5, 283	105, 660, 000	5, 369	107, 380, 000	10, 652	213, 040, 000
Korea	1, 449	28, 980, 000	1, 356	27, 120, 000	2, 805	56, 100, 000
Pakistan	791	15, 820, 000	751	15, 020, 000	1, 542	30, 840, 000
Philippines	2, 568	51, 360, 000	2, 371	47, 420, 000	4, 939	98, 780, 000
Other	1, 572	31, 440, 000	1, 693	33, 860, 000	3, 265	65, 300, 000
Africa	811	16, 220, 000	692	13, 840, 000	1, 503	30, 060, 000
Egypt	533	10, 660, 000	354	7, 080, 000	887	17, 740, 000
Other	278	5, 560, 000	338	6, 760, 000	616	12, 320, 000
All other areas	106	2, 120, 000	138	2, 760, 000	244	4, 880, 000

[1] LDCs are intended to include the following countries and areas listed in the NSF report: Greece, North and Centra America (excluding Canada), South America, Asia, Africa, and "All other areas."

[2] Latin America is intended to include those areas listed in the NSF report as North and Central America (excluding Canada) and South America.

The statistical data in this table on number of immigrants are drawn from, NSF, "Highlights, Immigrant Scientists and Engineers, Aug. 20, 1973," p. 2.

This table uses the figure of $20,000 as the cost of education per person. This figure was used 7 years ago (in 1967) by Dr. Kidd and the House Government Operations Committee. Some sources say the estimate is high; others say it is conservative. Thus, the estimate ought to be regarded as only an approximation of cost to the sending nations.

The table is based upon 2 assumptions, (1) that the $20,000 of education cost per person is a reasonable estimate; and (2) that those professionals entering as immigrants are remaining and establishing permanent residency.

In recent years educational losses to the LDCs from the emigration of professionals have continued on an upward swing. The most recent NSF data on the admission of scientists and engineers (physicians will be considered below) indicates that some 11,102 entered the United States from the LDCs as immigrants in the fiscal year 1971. (See Table 23.) This total figure represents 165 from Greece; 836 from Latin America; 9,423 from Asia; 589 from Africa; and 89 from other areas of the world. Excluded in these figures are immigrants from what appeared to be the developed countries of Western and Eastern Europe and Canada. By taking Dr. Kidd's 1967 conservative estimate of $20,000 per person, the total educational cost to the LDCs for the fiscal year 1971, assuming that these immigrants remain, is $222,040,000. (See Table 23.) The total educational cost, including physicians and surgeons, is $326,300,000. For Latin America, the cost for 836 immigrant scientists and engineers totals $16,720,000; the total cost including physicians and surgeons is $27,560,000. For Asia, the educational cost for the 9,423 immigrant scientists and engineers amounts to $188,460,000; including physicians and surgeons brings the total to $276,060,000. India's 4,226 immigrant scientists and engineers cost an estimated $84,520,000; including physicians and surgeons brings the total to $105,660,000. The cost of 1,528 immigrant scientists and engineers from the Philippines comes to an estimated $30,560,000, and including the physicians and surgeons increases the costs to $51,360,000.

And Africa's 589 immigrant scientists and engineers cost some $11,780,000, and including physicians and surgeons increases educational costs to $16,220,000.

Estimates of educational costs to the LDCs for the fiscal year 1972 are similarly considerable. In the fiscal year 1972, 9,550 immigrant scientists and engineers entered the United States from all LDCs. (See Table 24.) The estimated educational cost is $191,009,550. Total educational costs, including physicians and surgeons and using the same assumptions as noted above, is $320,240,000. This total figure represents 114 from Greece; 756 from Latin America; 8,155 from Asia; 433 from Africa; and 92 from all other areas in the world. Excluded from these figures are immigrants from what appeared to be the developed countries in Western and Eastern Europe and Canada. Individual costs remain high. For Latin America, the cost for 756 immigrant scientists and engineers totals $15,120,000, and including physicians and surgeons brings the total cost to $25,580,000. For Asia, the educational cost for 8,155 immigrant scientists and engineers amounts to $163,100,000; including physicians and surgeons increases costs to $274,260,000. India's 3,567 immigrant scientists and engineers cost an estimated $71,340,000; including physicians and surgeons brings the total to an estimated $107,380,000. The cost of 1,540 immigrant scientists and engineers from the Philippines comes to an estimated $30,560,000, and including physicians and surgeons increases costs to $47,420,000. And Africa's 433 immigrant scientists and engineers cost some $8,660,000, while including physicians and surgeons brings the total to $13,840,000.

The combined estimated educational cost to sending nations of immigrant scientists, engineers, physicians, and surgeons entering the United States in the fiscal years 1971 and 1972 clearly indicates that the LDC contribution is considerable. The total for 1971 and 1972 amounts to an estimated $646,540,000 for the incoming 32,327 scientists, engineers, physicians, and surgeons from the LDCs. (See Table 25.) This estimate is based on the same assumptions as noted above. Those coming from Latin America (2,657) cost an estimated $53,140,000. However, the bulk came from Asia, 27,516 at an estimated cost of $550,320,000; and specifically the Far East, 25,241 at an estimated cost of $504,820,000. India's 10,652 cost an estimated $213,040,000; Korea's 2,805, cost $56,100,000; Pakistan's 1,542, $30,840,000; and the estimated educational cost of some 4,939 incoming Filipinos amounted to $98,780,000. Africa's incoming 1,503 scientists, engineers, physicians, and surgeons cost an estimated $30,060,000. The figure on educational costs to the sending LDCs would be much higher if costs for primary and secondary education, and for M.D.s undergraduate training, were included in the computation.

Estimated Costs of Emigrant Physicians.—Emigration of physicians from the LDCs to the United States and other advanced countries represents a substantial loss in educational investment. Some of the estimates cited above include physicians. Other estimates have been made, focusing specifically on the loss of educational investment through medical brain drain. Many of these estimates are structured so as to indicate or imply the value of replacing this imported professional manpower into the United States.

The National Advisory Commission on Health Manpower appointed by President Johnson in 1965 made an estimate of comparable costs for the United States to replace FMGs who had been licensed during 1961 and 1965. The estimated minimal cost was said to be somewhere between $855 and $925 million.[503]

At a conference on brain drain sponsored by the State Department in 1966, Dr. Kelly West discussed the role of FMGs in American medical research, noting particularly the fact that about three-fourths came from the LDCs and that their immigration accounted for 18 percent of annual additions to American manpower. To underscore the heavy U.S. dependency on FMGs, he stated that to produce the professional manpower equivalent in this country from native stock the United States would have had to build and operate about 12 medical schools at an operating cost of some $8 million a year for each medical center. "In other words," he said, "the value of this migration may be estimated at something of the order to us of $100 million per year, which exceeds somewhat the total value of our foreign aid in the medical field." [504]

In 1969, Dr. West was quoted as saying that the annual immigration rate of M.D.s exceeded 2,000, that these immigrants constitute about 16 percent of the entries into the American medical profession, and that it would require 16 new medical schools to produce the equivalent number of M.D.s now supplied by imported manpower.[505]

The PAHO report also portrayed investment losses to Latin America in terms of costs to the United States in producing the equivalent manpower resource. The report noted that every year some 300 physicians emigrate from Latin America to the United States. This number, it said, is equivalent to the annual output of three large American medical schools and would cost at least $60 million to build three teaching medical centers and more than $15 million a year to operate them. "In these terms," the report concludes, "the value of the physicians coming to the United States is roughly equal to that of all U.S. medical assistance to Latin America." [506]

Stevens and Vermeulen make similar parallel comparisons in their study on FMGs in the United States in an effort to indicate investment losses to the LDCs. In 1971, India lost 821 physicians who established permanent residence in the United States. This was the equivalent of graduates from 8 or 10 American medical schools.[507] They also cited a United Nations study which calculated that the Philippines contributed $1.5 million to the U.S. economy annually, the estimated annual cost of a loss of one-fourth of all physicians. An Indian study estimated that the long term capital investment of a donor country in 1,000 M.D. emigrants (rather less than the number of Indian M.D.s entering the United States in 1971) is as much as $35 million, taking into account their economic potential.[508]

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[503] Stevens and Vermeulen, op. cit., p. 68.

[504] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 40.

[505] Adams, *Talent That Won't Stay Put*, p. 79.

[506] *Report on Brain Drain from Latin America*, Pan American Health Organization, 1966, p. 16. Dr. Kidd discusses the loss to Latin America in, Hearings, Senate Judiciary Committee, International migration of talent and skills, 1968, p. 77.

[507] Stevens and Vermeulen, op. cit., p. 70.

[508] Ibid., p. 8.

Educational investment losses to the LDCs resulting from emigrating physicians continue to be heavy. The most recent NSF data on the admission of immigrant physicians and surgeons indicate that 5,213 entered the United States from all LDCs in the fiscal year 1971. (See Table 23.) The total figure represents 52 from Greece; 542 from Latin America; 4,380 from Asia; 222 from Africa; and 17 from other areas of the world. Excluded from these figures were immigrant M.D.s from what appeared to be the developed areas of Western and Eastern Europe and Canada. By taking Dr. Kidd's estimate of $20,000 per person, the total educational cost to the LDCs for 1971, again assuming that the immigrants remain as permanent residents, is $104,260,000. The cost of Latin America's 542 M.D.s comes to an estimated $10,840,000. The 4,380 M.D.s entering from Asia cost an estimated $87,600,000. India's 1,057 entering physicians cost $21,140,000; Korea's 999 cost $19,980,000; and the Philippines' 1,040 cost an estimated $20,800,000. And the cost of Africa's 222 entering physicians comes to $4,440,000.

In the fiscal year 1972, entering immigrant physicians and surgeons increased in number to 6,462, representing an estimated educational investment loss of $129,240,000. (See Table 24.) Latin America's 523 immigrant M.D.s represents a loss of $10,460,000. Asia's 5,558 entering M.D.s represents an estimated loss of $111,160,000. India incurred a loss of $36,040,000 in educational investment for its entering 1,802 physicians. The cost to Korea of its entering 810 M.D.s amounted to $16,200,000. The 260 M.D.s from Pakistan cost an estimated $5,200,000. The Philippines incurred a loss of $16,620,000 in educational costs for its 831 entering M.D.s. And Africa's 259 immigrating M.D.s came to a $5,180,000 estimated educational loss.

The combined estimated educational cost to the LDCs for the fiscal years 1971 and 1972 is substantial: the total of 11,675 physicians and surgeons cost an estimated $233,500,000. Asia carried the major burden of cost with an estimated $198,760,000 for 10,938 incoming M.D.s. India, the largest individual contributor, among all nations, suffered an estimated $57,180,000 loss in educational investment costs from its 2,859 M.D.s immigrating to the United States.

These estimates of educational costs to the LDCs for training FMGs would be substantially higher if costs in primary and secondary education and undergraduate training were included in the computation.

Qualifying Aspects and Perceptions of LDCs' Investment Loss.—Estimates of investment costs and losses to the LDCs unavoidably lack precision. Some of the immigrant professionals entering the United States and recorded in the above NSF statistics may not establish permanent residency, and hence will not constitute a permanent investment loss in education. The estimate of $20,000 in education cost per individual may also be excessive for some areas of the world; yet if total education costs, including primary, secondary, undergraduate, and graduate schools, are taken into account, it may be too low, as would certainly be the case for the United States. (A recent report by the Association of American Medical Schools estimates that it costs between $16,300 to $26,400 a year to educate a medical student in the United States; on the average the cost to the student is about $2,200

a year in tuition, roughly $600 in laboratory and other fees, and at least $1,800 a year for living expenses, making a total of $4,600.) [509]

By including value of future earnings foregone and potential contribution to national development, losses would understandably multiply manyfold, far beyond strictly the educational costs. Yet, there appear to be some offsetting factors; but even they must be qualified. One is the remittances from emigrants residing abroad. Lebanese send home between $130 million and $200 million annually, an amount estimated to be between 10 and 15 percent of its gross national product. Remittances by Filipinos abroad amounted to $102 million for the period January 1955 and July 1969.[510] For Cameroon, an estimated $13,812 was remitted during 1965–67.[511]

Figures on remittances do not, however, classify emigrants according to unskilled and professionals. Thus, for even those countries where figures are available, they do not accurately reflect the true picture.[512] Moreover, laws in receiving countries like the United States encourage the immigration of relatives of permanent immigrants, including not only wives and children but frequently parents and other relatives. And, as the U.N. report said: "This would mean, in effect, the retention in the developed country of the funds formerly remitted." [513]

The same ambiguity is evident in the apparent offsetting factors of American medical students studying abroad. One survey indicated that 2,343 Americans were studying in 16 foreign medical schools. Mexico seems to be the only country generally classified as "developing" where substantial numbers of American students attend medical school. In 1969, there were an estimated 572 American students enrolled. For these schools, the presence of American students represents, in Stevens and Vermeulen's words, "substantial benefits," particularly in terms of American fees from dollar incomes.[514] Yet, by accepting American medical students they forego places for nationals and thus sacrifice a long-term future investment. Stevens and Vermeulen conclude that each of these schools, for the most part government subsidized, was "making a substantial contribution to American medical education (or, assuming that many of the Americans did not complete the courses, was wasting part of its resources)." [515]

However complex and ambiguous it may be to assess investment costs and losses to the LDCs, the judgment of Stevens and Vermeulen on the extraordinary inflow of FMGs into the United States from the LDCs supports a commonly held belief among students of brain drain that ". . . this country is the recipient of substantial 'reverse foreign aid.' The United States is reaping the rewards of investments made by other countries in the education of physicians, and those countries are suffering a long-term loss of physician services." [516]

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[509] *The New York Times*, Oct. 11, 1973, p. 7.

[510] Report of U.N. Secretary General, *Outflow of Trained Personnel from Developing to Developed Countries*, June 9, 1970, p. 33.

[511] UNITAR, *Brain Drain from Five LDCs*, 1971, p. 119.

[512] Henderson, op. cit., p. 120.

[513] For example, 8,907 such "preference relatives" were adjusted to permanent status in the United States in 1967 alone and several thousand more appear to have entered as relatives under other categories. (Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 46.88.)

[514] Stevens and Vermeulen, op. cit., p. 21.

[515] Ibid., p. 22.

[516] Ibid., p. xi.

The LDCs bear the investment cost of trained manpower that benefits the advanced countries. And they can least afford it. Without large talent reserves, without money and institutional resources for attracting foreign talent, and faced with competing demands for public and private investments, the LDCs, especially the poorer ones, are not likely to assign a first priority to enlarging domestic output of professionals requiring long and costly training. In such cases, therefore, as the House Government Operations Subcommittee brain drain study concludes, "departure of professionals like scientists, engineers, and physicians is often an 'unrequited' export—an involuntary gift of valuable resources to other countries." [517] And this "involuntary gift" of manpower, most often produced at government expense and thus much public sacrifice, is in most cases an irremediable loss. The first effect of this loss is to impair national progress and development. As Habib Naficy pointed out:

> . . . brain drain is a direct threat to the prospects of the country's continued progress. The non-returnees represent a tremendous loss of time and money (invested since birth) in terms of the country's available resources. As a unit necessary to the national development, the highly skilled manpower leaked away in the brain drain means an altogether irreplaceable loss which cannot be compensated some other way. [518]

LOSS THROUGH "MISMATCH" IN EDUCATION AND TRAINING

Mismatching advanced education and training with needs has often had detrimental effects which resulted in serious losses to the LDCs. The developing countries lose if the returning professional is unable to match his advanced training with national requirements; finding himself a marginal or superfluous man, he becomes unhappy, and frustrated, and decides to emigrate permanently.[519] And they lose also if the returning professional, overtrained and unsuited to the needs of his environment, moves into activities irrelevant to the basic needs of national development.

Scientific and technological priorities of the developed countries differ from those of the LDCs, so that scientists and engineers from the LDCs trained in the former are often unable to make an optimum contribution in their own developing countries. LDC scientists, specialized in essentially esoteric fields or committed to irrelevant lines of research, thereby become unserviceable for other research efforts which might be more immediately helpful for national development. The withdrawal of talent from the national pool in this way obstructs advanced planning for education and training, designed with the requirements of national development in mind, and deters the develop-

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[517] Report, House Government Operations Committee, *Scientific Brain Drain from the LDCs*, 1968, p. 5.

[518] Naficy, op. cit., pp. 69–70. The U.N. Secretary General also made the point of loss in government investment in the study on brain drain: "The migration of trained personnel means the loss to the country of its expenditure on the person's education and other services provided without the prospect of receiving the benefits of his services. A large part of the cost of education in developing countries is government-subsidized. Higher education provided by new nations tends to be costly because of the high cost involved in equipment, books and teaching staff." (Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 43.)

[519] Eli Ginzberg of Columbia University discusses this problem of mismatch in a letter to Congressman Henry S. Reuss, *In* Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 89.

ment of techniques and knowledge for exploiting the natural resources of the LDCs, a body of knowledge not necessarily purchasable abroad.[520] In all cases, the LDC loses.

LDCs also incur losses from the pursuit of unrealistic and irrelevant priorities, more suited to advanced countries than to those at the developing stage. In "too many instances," writes Professor Nader, poor LDCs follow the style and content of science and technology found in the advanced countries and become caught up in the "scientific fashions" of the times to the detriment of the priorities and needs of their own countries. Professor Nader cites the case of Pakistan, which for over 5 years had devoted 10 times more money to nuclear research than to applied research for the production and manufacture of jute or for the exploitation of Pakistan's large fishing resources, even though both resources earned over $300 million in foreign exchange. Proponents of nuclear research on the Planning Commission (presumably native scientists trained in the West) argued successfully that nuclear research and its many actual and potential peaceful uses were the "wave of the future" and that participation in the race of contemporary science and technology compelled funding of nuclear research. (It is possible that this apparent misdirection of scientific effort may be intensified as a response to the achievement of a nuclear capability by the Government of India.) For such mismatched allocation of resources the developing country can lose, for as Dr. Nader commented disapprovingly:

> Apparently, these advocates were more vocal and better trained than investigators in less eye-catching subjects, such as suitable varieties of crops, of industrial and agricultural technology, or fishery resources from which fish protein concentrate can be obtained, or other subjects more directly relevant at the present time to the potential growth of the country.[521]

Loss to the LDCs through mismatched medical training is another aspect of this same problem. Dr. Kelly M. West once observed in a study of FMG researchers at the National Institutes of Health that the training of FMGs from the LDGs was directed away from areas of high priority for their countries, even if they did return home. Instead of their going into public health practice and rural health programs, the most pressing needs of the LDCs, he said, they would most likely remain in research (or presumably go into urban practice). According to Stevens and Vermeulen (writing 6 years later), "these observations are still valid." [522]

GENETIC LOSS

Unique among the negative effects of brain drain on the LDCs are the possible genetic implications. The question is raised as to whether the flight of a high percentage of a nation's intellectual elite could cause a genetic deterioration of the population. If true, then progress and national development could be deterred.

Prof. Richard Lynn, a member of the Economic and Social Research Institute at Dublin, Ireland, explores the question of possible genetic

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[520] Nader, *Science and Technology in Developing Countries*, 1969, p. 453.
[521] Ibid., p. 452.
[522] Stevens and Vermeulen, op. cit., p. 15.

effects of a prolonged brain drain from England, citing historical examples to buttress his case.[523] Dr. Lynn begins his argument with an assertion that intelligence is principally determined by inheritance and notes previous investigations to document his point. He correlates the production of intelligent children with intelligent people, observing that environmental advantages of intelligent parents reinforce the genetic effects. This suggests to Lynn that "if intelligent people emigrate in large numbers there is likely to be a diminution in the number of intelligent children born into the next generation."

Professor Lynn also states that intelligence is closely associated with a person's occupation. People in professional and executive occupations generally have IQs between 120 and 160, and he asserts that "it is doubtful whether it would be possible to do most professional or executive jobs with an IQ of less than around 115." According to Lynn, 115 is about the level at which British children pass the 11-plus examination, and about 20 percent of the population have IQs above this figure. He cites examples of psychological studies made, correlating IQs and occupation, and concludes that this close correlation can be used as a reasonably reliable index of intelligence. And this index in turn allows some estimate of intelligence loss in brain drain. Lynn cites emigration figures from Britain to show that there is a "fairly substantial bias towards the more intelligent"—24 percent, but he believes this to be on the low side. The significance of this loss can be measured by the fact that the numbers of highly able people leaving Britain is about 15–30 percent of the annual output from the universities.

While it would be "hazardous" to estimate "too precisely" the effect of this loss on the genetic quality of the population, Professor Lynn nonetheless, contends that "there seems a high probability that it will be substantial." He proceeds to explain the phenomenon of "regression to the mean" and notes that Britain was losing substantial numbers of both types of family from which highly intelligent children were born. "The implication seems to be," writes Lynn, "that the genetic quality of the population is likely to deteriorate."

Never had there been such a mass migration of talented people across national frontiers as occurred in the postwar decades, Lynn continues. And he proceeds to cite historical cases in which emigration of intellectual elites have had "severely damaging effects." He cites the destruction of Constantinople in 1453 and the "ensuing exodus of scholars to the West" which had "effectively ended 1,000 years of civilization and brought corresponding benefits to western Europe." The expulsion of the Jews and Moors from Spain at the end of the 15th century, the "backbone of the trading community," had "severely detrimental effects on the commercial strength of the country." And he cites the recent case in which Germany's scientific achievements had been impaired by the loss of a large number of able scientists who fled during the Hitlerian period. Still it is doubtful, he says, whether there is any historical parallel to the scale of the present brain drain.

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[523] Richard Lynn, "Genetic Implications of the Brain Drain," *New Scientist* 41 (Mar. 20, 1969), pp. 622-625.

He examines the case of brain drain within and from Scotland and correlates this process with its subsequent decline in achievements to illustrate his thesis, adding that Britains should regard Scotland as a warning. "The deterioration it has suffered in both cultural achievement and economic prosperity," he concludes, "could well be due to a prolonged brain drain, and the next victim could be Britain as a whole."

It is not the purpose here to judge the validity of this thesis, but only to admit the question and to suggest the following generalization: If the case of Britain, which by virtue of strong and long established institutions and traditions has enormous recuperative powers, could be judged to be so adversely affected by the brain drain of its intellectual elite, how much more seriously affected might be the LDCs which lack these regenerative powers?

WIDENING GAP BETWEEN LDC'S AND ADVANCED COUNTRIES

Perhaps more plausible than genetic degeneration as a negative effect of brain drain is the disputed assertion that brain drain from the LDCs widens the gap of development between the developing and advanced countries. Internationalists among brain drain specialists minimize, and some even deny, the negative impact of the gap on development. Perceiving criteria for judging the welfare of the developing countries in the larger context of world welfare, they tend to concern themselves more with the latter at the expense of the former. For Professor Johnson, development is an integrated process of accumulating material, human, and intellectual capital and evolving a culture that promotes its efficient use. To assert that there is a simple and quick road to development, as he seems to imply brain drain critics contend, by substituting human for material capital as a crucial element in the developing process, is to resurrect a myth.[524] Professor Grubel states categorically that "research has thus far failed to produce reliable estimates of the number of persons in the brain drain flows, nor has it yielded meaningful empirical measures of the welfare losses of the population in the losing countries." [525] The migration of highly skilled persons to the United States, he contends, "only rarely reduces the welfare of individuals remaining in the emigrant's native country and often may even increase it." [526] And Baldwin, viewing the problem from the internationalist perspective of overflow rather than brain drain, concludes an analysis of Indian manpower: "There is practically no one, in India or outside, who feels that India's economic growth is being held back because the country has lost educated manpower." [527]

Other specialists contend, with varying force, that brain drain does indeed impair progress in the developing countries and that it

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[524] Johnson, op. cit., p. 86.

[525] Herbert G. Grubel, "The Reduction of the Brain Drain: Problems and Policies," *Minerva* 6, No. 4, (Summer 1968), p. 558.

[526] Grubel, "Nonreturning Foreign Students and the Cost of Student Exchange," p. 25.

[527] Mr. Baldwin continues: "Indeed, government officials have more than once said they hoped that educated Indians in large numbers would *not* return, since the country has no way of putting them to work." (Baldwin, op. cit., p. 365.)

does widen the gap of development between the LDCs and the advanced countries.[528]

Perhaps the most judicious assessment appears in the CIMT study. The authors of this study state outright that they had "uncovered no cases where retardation of development could be unequivocally traced to migration of exceptional people," and concluded that the assertion by "careful observers" that "it is impossible to prove losses of exceptional people have in fact inhibited development" was correct. Nevertheless, "such assertions are inherently unprovable, and inability to produce examples does not mean that serious adverse effects have not been produced by migration." Accordingly, an answer must be sought, they say, "in judgment rather than proof," and it was their judgment that "a continuing loss of intelligent and highly trained people is likely to have adverse effects on national development. . . ." [529]

The same judgment was made by the UNESCO-sponsored conference in 1965 on the application of science and technology to development in Latin America. The report of the conference connected the expansion of scientific and technological manpower with national development and implied that loss of this manpower impairs development and widens the gap between the less developed and the advanced countries. Speaking generally, the report stated that international conferences "held to study the conditions necessary for speeding up the economic and social development of underdeveloped countries have unanimously recognized that the shortage of adequately trained scientific and technical personnel is one of the main obstacles to the carrying out of any development plan." [530]

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[528] The following are a selection of assessments on this matter:

Dr. Perkins quotes approvingly the statement of Professor John C. Shearer in which he concluded that the movement of high-level human resources "may, to a great extent, account for the persistent and ever-widening gaps between rich and poor areas." (Perkins, op. cit., p. 618.)

Professor Seltzer urges that brain drain be considered a problem because "it is a barrier to socio-economic development in selected areas." (Seltzer, op. cit., p. 56.)

In the preface to the Ditchley Park Conference report on brain drain, the Provost of Ditchley expressed the view that on balance a net export of "brains" lies with the LDCs and a net import with the most advanced countries. This would imply, he said, that the imbalance was "a factor enlarging still more the gap between rich and poor." The acknowledged aim of the United States, Britain, and all "responsible nations" was, he declared, "to strive to narrow that gap." (Report, *Ditchley Park Conference on Brain Drain,* 1968, p. 5.)

Senator Mondale observed that while the loss of students may not be the most important element of brain drain, still "it would be a serious mistake to conclude that it does not make a substantial contribution to the 'talent gap' between the rich and poor nations." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills,* p. 92.)

A UNESCO report observed regarding the relationship between brain drain, development, and economic independence: "By adding to the imbalance in the distribution of the world's scientific resources, the 'brain drain" helps to accentuate the dependence of the developing countries on the advanced ones; the increase in the technological gap between these two groups of countries create, for the under-privileged countries, additional obstacles to progress towards national economic independence, and it can be the cause of tensions and conflict between the loser and winner countries." (UNESCO, *Problem of Emigration of Scientists and Technologists,* February 1968, p. 20.)

The report of the U.N. Secretary General on brain drain observed that trained and educated men have come to be regarded universally as "a vital component of development." "Should the present trends in the outflow of trained personnel continue," he said, "the results might adversely affect development in the developing countries." (Report of the U.N. Secretary General, *Outflow of Trained Personnel from LDCs,* Nov. 5, 1968, p. 5.5.)

Gregory Henderson offered the cautious assessment that migration "may not be one of the more major causes of under-development or of presently widening gaps between rich and poor countries; yet it certainly contributes to such gaps, probably to an appreciable, though minority, extent." (Henderson, *Emigration of Highly-Skilled Manpower from the Developing Countries,* 1970, p. 136.)

[529] CIMT study, p. 692.

[530] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 27.

The conference report expanded on this theme. Science and technology were considered the key to development, but the "constant drain" of native scientists and technologists creates "the most serious consequence" which is "evident in the difficulty—and, in some cases the impossibility—of ensuring the training, in each branch of science and technology, . . . of specialists and research workers capable of producing a real impact on the community." [531]

Eduardo Frei Montalva, then President of Chile, explained. "No one can help but be aware that the development of contemporary civilization depends on science and technology," he began his opening address to the conference. He continued: ". . . countries not involved in this process of research or unable to perceive and adapt it to their own reality are irrevocably doomed." President Frei pointed out the connection between the advance of knowledge and advances in the human condition, and the cause-and-effect relationship and the process of acceleration in applying new discoveries and their impact on the life of man. He emphasized the requirements of building a scientific-technological infrastructure and then came directly to the point of the negative impact of brain drain on development: "Hence, while it is true that all mankind benefits from the immense progress that science and technology have bestowed on man, it is no less evident that the differences between highly developed and developing peoples, instead of diminishing—as apparently might be thought—are increasing considerably with the increase in knowledge and the power it brings with it." Chilean and North American pioneers used the same wagon to conquer their frontiers, he went on to illustrate his point, but today Americans construct space-ships, while Chileans could barely turn out a small range of minor items of machinery at high cost and of indifferent quality. "This is why," he continued, "we can say that the gap between the highly developed and the developing countries lies not so much in economic and financial resources as in human resources, which are quantitatively and qualitatively conditioned by the education we are able to give them." It was not just a question of eliminating illiteracy, he insisted, "but of producing generations equipped and able to accede to that higher knowledge that today marks the limits of the superiority and inferiority of strength and weakness." [532]

If these and other observations made in the conference report are indicative of prevailing attitudes, then it is apparent that Latin Americans perceive brain drain as a formidable barrier to national progress, as deterring development, and thus as widening the gap with the advanced countries. Critics of brain drain who maintain the same general stance would no doubt apply similar judgments to other developing areas of the world.[533]

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[531] Ibid., pp. 29–30.

[532] Ibid., p. 67.

[533] For specific cases of injury to Latin American countries by talent migration, see the Pan American Health Organization, *Report on Brain Drain from Latin America*, 1966, pp. 12–14.

The LDCs are not the only countries concerned about technological and developmental gaps. Professor Adams writes: "Even the industrialized nations of Western Europe fear a widening technological gap between themselves and the United States, which will condemn them to dependency on patent licenses, or product and processes hand-me-downs." (Adams, op. cit., pp. 3–4.) On another occasion Adams referred to British Prime Minister Wilson's concern for the impact of American technological predominance on Europe and his warning that continued nationalistic policies would lead to an "industrial helotry" under which Europe would produce only the conventional apparatus of a modern economy while relying on the United States for the products of the sophisticated, science-

Effects of Brain Drain Within the United States

"Without foreign scientists and engineers, American technology and economy would not be what they are today." So wrote Alessandro Silj in 1969.[534] Perhaps this brief statement best sums up the enormous contribution of foreign scientists and engineers to the United States in recent years. Data presented above on the number of immigrant scientists and engineers from both the advanced countries and the LDCs and evidence of their strong representation in the American scientific-engineering establishment, correlated with vast outlays in research and development for defense and space, and the success achieved in those areas of national endeavor, suggest the validity of this judgment. Clearly, these immigrant professionals provided much of the underpinnings of U.S. economic expansion and development in this country's defense-space establishment in the postwar era.

BENEFITS FROM INCREASED MANPOWER SUPPLY OF SCIENTISTS AND ENGINEERS

Savings to the United States from this vast professional resource are suggested in the above references on cost in education and training to the LDCs. These data are complemented by estimates contained in various sources on brain drain. Gregory Henderson calculated an average educational cost per professional at some $10,000. He acknowledged that the figure was low but reasoned that it would allow for the contributions which advanced countries made to the more expensive portions of the education undertaken. On this basis, he estimated the educational value contributed by developing nations to the 75,000-

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based industries which will "call the industrial tune in the 1970's and 1980's." (Adams, "Talent That Won't Stay Put," 1969, p. 77.)

Such statements as these as well as many others on this subject suggest that fear of "falling behind' or "never catching up" in a highly competitive world lies at the heart of brain drain concerns.

A unique reaction to brain drain and its impact on development is the case of East Germany. After January 1972, when restrictions on East-West contacts were eased in the GDR, some 3,000 East German scientists, engineers, and physicians fled to West Germany, according to an authoritative East German source. The source explained that this departure of talent had adversely affected the "most vulnerable parts of the GDR economy" and that "something will have to be done" since the economy is "the main instrument for establishing economic unity with the East," that is, the Soviet bloc. The source, ordinarily dignified, affable and composed, became visibly upset when discussing this matter because brain drain from the GDR meant for him the loss of "workers in key positions" and accordingly would impair the nation's economic development. (Journal Entry by Joseph G. Whelan, Notebook No. 3, Sept. 25, 1973, pp. 166–175.)

In his survey of Jordanian and Palestinian professionals and students in the United States, Lafi Ibrahim Jaafari noted that 74 percent of the respondents agreed with the statement that "the departure of high level personnel will decrease the welfare of home countries and retard their development, thereby frustrating the international efforts to narrow the gap between the richer and poorer countries." The majority also realized the help that they were denying to their country by not returning. (Jaafari, op. cit., p. 125.)

[534] Silj, op. cit., p. 10. Recently Leslie Aldridge Westoff made a similar assessment: "There is little doubt that the foreign brains we've hired have helped put America on top in many ways—atomic science, space technology, medicine, engineering and so on. (Among American Nobel Prize winners, 41 percent were foreign-born, and one quarter of the National Academy of Science members were also born abroad.)" (Westoff, op. cit., p. 80.)

A mid-1970 survey by the National Science Foundation of some 8,000 alien scientists and engineers who were permanent U.S. residents in January 1969 reported that over one-half were in research (31 percent) or development (20 percent), compared with a 34 percent rate for the United States. Abroad, only 38 percent had been involved in R. & D. activities. The survey also reported that private industry employed 77 percent of the immigrant scientists and engineers, and colleges and universities about 13 percent. These sectors accounted for about 70 percent and 14 percent respectively of all scientists and engineers in the United States. Finally, 28 percent of the immigrants held doctoral degrees and another 29 percent had masters degrees. Only about 10 percent of all scientists and engineers in the United States have doctoral degrees and 20 percent have masters degrees. Furthermore, about one in five were enrolled in full- or part-time graduate training at the university level. Of those enrolled, over one-quarter sought Ph. D.s, nearly one-half masters degrees, and 10 percent sought professional degrees or postdoctoral training. (NSF, *Study of Characteristics and Attitudes of Immigrant Scientists and Engineers in the U.S.*, 1973, p. vii.)

odd scientists, engineers, and medical personnel entering the United States from 1953–69 to be on the order of $750 million or $132 million in the fiscal year 1968 alone. He also calculated that the value of those going to the other advanced countries taken altogether might reach or exceed this figure. By taking the $20,000 estimated average educational cost per professional suggested by Dr. Kidd and used by the House Government Operations Committee, the total figure, according to Mr. Henderson, would reach or exceed $1 billion for the total inflow from the developing countries to the United States. Former Deputy Assistant Secretary of State Harold Howland estimated that the inflow of the nearly 100,000 scientists and engineers constituted "at least $4 billion" in savings to the United States in total educational costs.[535]

Henderson observed that costs of educating professionals in the United States are much higher than the conservative estimates given per person. Even putting the cost in the area of $20,000–$40,000 during the years concerned, such costs, he noted, would be "on the order of upwards of $2–$3 billion." For 1968 alone, they would be on the order of magnitude of half a billion dollars.[536]

Tables 26 through 29 provide data that give some impression of the magnitude of estimated educational savings to the United States from immigrant scientists, engineers, physicians, and surgeons entering the country from the LDCs. Again, these tables assume that the incoming immigrants will remain and they are computed on various estimated costs of education in this country. Not included in the computation are costs of primary and secondary education and undergraduate training for FMGs. Their inclusion would add substantially to the saving. In the fiscal years 1971 and 1972, 20,652 scientists and engineers entered from the LDCs at an estimated educational saving to the United States of $749,254,560. The Far East was the largest contributor with 16,420 entering at a saving of an estimated $595,717,600. (See Table 26.) The total estimated savings to the United States in educational costs of the 32,327 immigrant scientists, engineers, physicians, and surgeons entering the country from the LDCs in the fiscal years 1971 and 1972 amounts to $1,718,279,560. (See Table 29.) The Far East was the highest contributor with its 25,241 entering immigrants; the total estimated educational savings for the United States is $1,327,860,600. India ranks first among all countries with 10,652 entering, thus saving the United States an estimated $520,027,040 in educational costs.

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[535] Henderson, op. cit., pp. 131–132.
[536] Ibid.

TABLE 26.—ESTIMATED SAVINGS TO THE UNITED STATES IN EDUCATIONAL COSTS OF IMMIGRANT SCIENTISTS AND ENGINEERS FROM LDC'S, FISCAL YEAR 1971 AND FISCAL YEAR 1972

Area	Fiscal year 1971		Fiscal year 1972		Total	
	Scientist/ engineer	Estimated educational savings	Scientist/ engineer	Estimated educational savings [1]	Scientist/ engineer	Estimated educational savings
All countries	13,102	$475,340,560	11,323	$410,798,440	24,425	$886,139,000
All LDCs [2]	11,102	402,780,560	9,550	346,474,000	20,652	749,254,560
West Europe: Greece	165	5,986,200	114	4,135,920	279	14,258,040
Latin America [3]	836	44,588,120	756	27,427,680	1,592	57,757,760
Asia	9,423	341,866,440	8,155	295,863,400	17,578	637,729,840
Near and Middle East	602	21,840,560	556	20,171,680	1,158	42,012,240
Far East	8,821	320,025,880	7,599	275,691,720	16,420	595,717,600
China	897	32,543,160	660	23,944,800	1,557	56,487,960
India	4,226	153,319,280	3,567	129,410,760	7,793	282,730,040
Korea	450	16,326,000	546	19,808,880	996	36,134,880
Pakistan	630	22,856,400	491	17,813,480	1,121	40,669,880
Philippines	1,523	55,435,840	1,540	55,871,200	3,068	111,307,040
Other	1,090	39,545,200	795	28,842,600	1,885	68,387,000
Africa	589	21,368,920	433	15,709,240	1,022	37,078,160
Egypt	387	14,040,360	239	8,670,920	626	22,711,280
Other	202	7,328,560	194	7,038,320	396	14,366,880
All other areas	89	3,228,920	92	3,337,760	181	6,566,680

[1] This table uses the figure $9,070 as representing an approximation of the annual average cost per student. The figure, relating specifically to estimated real costs of higher education for the year 1971–72, was computed by Howard R. Bowen and Paul Servelle in a study published by the American Association for Higher Education. In presenting the data, the authors state: "These estimates are crude and should be used only to indicate rough orders of magnitude. Even so, the table shows how heavily the real costs of higher education bear upon students and their families." (Howard R. Bowen, and Paul Servelle, "Who Benefits From Higher Education—and Who Should Pay?" Prepared by the ERIC Clearinghouse on Higher Education, George Washington University (Washington, D.C., American Association for Higher Education, 1972), pp. 31–33. The figure on educational savings was computed on a basis of 4 years using the estimate of $9,070 as representing the annual average cost per student.

[2] LDCs are intended to include the following countries and areas listed in the NSF report: Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[3] Latin America is intended to include those areas listed in the NSF report as North and Central America (excluding Canada) and South America.

The statistical data in this table on number o f immigrants is drawn from, NSF, "Highlights, Immigrant Scientists and Engineers," Aug. 20, 1973, p. 2.

TABLE 27.—ESTIMATED SAVINGS TO THE UNITED STATES IN EDUCATIONAL COSTS OF IMMIGRANT SCIENTISTS, ENGINEERS, PHYSICIANS AND SURGEONS ENTERING UNITED STATES FROM LDC'S AS IMMIGRANTS, FISCAL YEAR 1971

Area	Scientist/ engineer	Estimated educational savings [1]	Physician/ surgeon	Estimated educational savings [2]	Total	
					Scientist/ engineer/ physician/ surgeon	Estimated educational savings
All countries	13, 102	$475, 340, 560	5, 748	$477, 084, 000	18, 850	$952, 424, 560
All LDCs [3]	11, 102	402, 780, 560	5, 213	432, 679, 000	16, 315	835, 459, 560
West Europe: Greece	165	5, 986, 200	52	4, 316, 000	217	10, 302, 200
Latin America [4]	836	44, 588, 120	542	44, 986, 000	1, 378	89, 574, 120
Asia	9, 423	341, 866, 440	4, 380	363, 540, 000	13, 803	705, 406, 440
Near and Middle East	602	21, 840, 560	434	36, C22, 000	1, 036	57, 862, 560
Far East	8, 821	320, 025, 880	3, 946	327, 518, 000	12, 767	647, 543, 880
China	897	32, 543, 160	207	17, 181, 000	1, 104	49, 724, 160
India	4, 226	153, 319, 280	1, 057	87, 731, 000	5, 283	241, 050, 280
Korea	450	16, 326, 000	999	82, 917, 000	1, 449	99, 243, 000
Pakistan	630	22, 856, 400	161	13, 280, 000	791	36, 136, 400
Philippines	1, 528	55, 435, 840	1, 040	86, 320, 000	2, 568	141, 755, 840
Other	1, 090	39, 545, 200	482	40, 006, 000	1, 572	79, 551, 200
Africa	589	21, 368, 920	222	18, 426, 000	811	39, 794, 920
Egypt	387	14, 040, 360	146	12, 118, 000	533	26, 158, 360
Other	202	7, 328, 560	76	6, 308, 000	278	13, 363, 560
All other areas	89	3, 228, 920	17	1, 411, 0C0	106	4, 639, 920

[1] This table uses the figure $9,070 as representing an approximation of the annual average cost per student. The figure relating specifically to estimated real costs of higher education for the year 1971–72, was computed by Howard R. Bowen and Paul Servelle in a study published by the American Association for Higher Education. In presenting the data, the authors state: "These estimates are crude and should be used only to indicate rough orders of magnitude. Even so, the table shows how heavily the real costs of higher education bear upon students and their families." (Howard R. Bowen, and Paul Servelle, "Who Benefits From Higher Education—and Who Should Pay?" Prepared by the ERIC Clearinghouse on Higher Education, George Washington University (Washington, D.C.: American Association for Higher Education, 1972), pp. 31–33.) The figure on educational savings was computed on a basis of 4 years using the estimate of $9,070 as representing the annual average cost per student.

[2] Total savings is arrived at by using the estimated figure of $83,000 per person for educational costs of a physician. Cited in Henderson, "Emigration of Highly Skilled Manpower From the Developing Countries," 1970, p. 132. Mr. Henderson cites this figure for surgeons who are, as he says, "the most expensive." However, the figure of $83,000 per person is not excessively high as Mr. Henderson suggests. According to a recent report by the AAMC, the annual cost per medical student in the undergraduate medical educational program leading to the M.D. degree is estimated to range from a low of $16,300 to a high of $26,400. Over 4 years this would amount to $65,200 and $105,600 respectively. The average total annual cost from 12 selected schools amounts to $21,350 per student, or a 4-year total of $85,400. The estimate, figured in 1972 dollars, was based upon a study of the 12 medical schools. The components used in computing costs were: instruction, research, clinical activity, other administrative, scholarly, and professional activities. The report indicated that even this figure represents only a part of the total cost of preparing a physician for independent practice. (Association of American Medical Colleges, Report of the Committee on the Financing of Medical Education, "Undergraduate Medical Education: Elements—Objectives—Costs." (AAMC, 1973), pp. 1–2.)

[3] LDC's are understood to mean the following areas and countries listed in table L of NSF "Highlights:" Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[4] Latin America is understood to mean those areas and countries listed in table of NSF "Highlights" as North and Central America (excluding Canada) and South America.

The statistical data in this table relating to the number of immigrants and areas are drawn from, NSF, "Highlights, Immigrant Scientists and Engineers," Aug. 20, 1973, p. 2.

TABLE 28.—ESTIMATED SAVINGS TO THE UNITED STATES IN EDUCATIONAL COSTS OF IMMIGRANT SCIENTISTS ENGINEERS, PHYSICIANS AND SURGEONS ENTERING UNITED STATES FROM LDC'S AS IMMIGRANTS, FISCAL YEAR 1972

Area	Scientist/ engineer	Estimated educational savings [1]	Physician/ surgeon	Estimated educational savings [2]	Total: Scientist/ engineer/ physician/ surgeon	Total: Estimated educational savings
All countries	11,323	$410,798,440	7,143	$592,869,000	18,466	$1,003,667,440
All LDCs [3]	9,550	346,474,000	6,462	536,346,000	16,012	882,820,000
West Europe: Greece	114	4,135,920	76	6,308,334	190	10,444,254
Latin America [4]	756	27,427,680	523	43,409,000	1,279	70,836,680
Asia	8,155	295,863,400	5,558	461,314,000	13,713	757,177,400
Near and Middle East	556	20,171,680	683	56,689,000	1,239	76,860,680
Far East	7,599	275,691,720	4,875	404,625,000	12,474	680,316,720
China	660	23,944,800	274	22,742,000	934	46,686,800
India	3,567	129,410,760	1,802	149,566,000	5,369	278,976,760
Korea	546	19,808,880	810	67,230,000	1,356	87,038,880
Pakistan	491	17,813,480	260	21,580,000	751	39,393,480
Philippines	1,540	55,871,200	831	68,973,000	2,371	124,844,200
Other	795	28,842,600	898	74,534,000	1,693	103,376,600
Africa	433	15,709,240	259	21,497,000	692	37,206,240
Egypt	239	8,670,920	115	9,545,000	354	18,215,920
Other	194	7,038,320	144	11,952,000	338	18,990,320
All other areas	92	3,337,760	46	3,818,000	138	7,155,760

[1] This table uses the figure $9,070 as representing an approximation of the annual average cost per student. The figure relating specifically to estimated real costs of higher education for the year 1971–72, was computed by Howard R. Bowen and Paul Servelle in a study published by the American Association for Higher Education. In presenting the data, the authors state: "These estimates are crude and should be used only to indicate rough orders of magnitude. Even so, the table shows how heavily the real costs of higher education bear upon students and their families." (Howard R. Bowen, and Paul Servelle, "Who Benefits from Higher Education—and Who Should Pay?" Prepared by the ERIC Clearinghouse on Higher Education, George Washington University (Washington, D.C.: American Association for Higher Education, 1972), pp. 31–33.) The figure on educational savings was computed on a basis of 4 years using the estimate of $9,070 as representing the annual average cost per student.

[2] Total savings is arrived at by using the estimated figure of $83,000 per person for educational costs of a physician. Cited in Henderson, "Emigration of Highly Skilled Manpower from the Developing Countries," 1970, p. 132. Mr. Henderson cites this figure for surgeons who are, as he says, "the most expensive." However, the figure of of $83,000 per person is not excessively high as Mr. Henderson suggests. According to a recent report by the AAMC, the annual cost per medical student in the undergraduate medical educational program leading to the M.D. degree is estimated to range from a low of $16,300 to a high of $26,400. Over 4 years this would amount to $65,200 and $105,600 respectively. The average total annual cost from 12 selected schools amounts to $21,350 per student, or a 4-year total of $85,400. The estimate, figured in 1972 dollars, was based upon a study of the 12 medical schools. The components used in computing costs were: instruction, research, clinical activity, other administrative, scholarly, and professional activities. The report indicated that even this figure represents only a part of the total cost of preparing a physician for independent practice. (Association of American Medical Colleges, Report of the Committee on the Financing of Medical Education, "Undergraduate Medical Education: Elements—Objectives—Costs." (AAMC, 1973), p. 1–2.)

[3] LDCs are understood to mean the following areas and countries listed in table 1 of NSF "Highlights": Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[4] Latin America is understood to mean those areas and countries listed in table of NSF "Highlights" as North and Central America (excluding Canada) and South America.

The statistical data in this table relating to the number of immigrants and areas are drawn from, NSF "Highlights Immigrant Scientists and Engineers." Aug. 20, 1973, p. 2.

TABLE 29.—TOTAL ESTIMATED SAVINGS TO THE UNITED STATES IN EDUCATIONAL COSTS OF IMMIGRANT SCIENTISTS, ENGINEERS, PHYSICIANS AND SURGEONS ENTERING UNITED STATES FROM LDC'S AS IMMIGRANTS, FISCAL YEAR 1971 AND FISCAL YEAR 1972

	Fiscal year 1971		Fiscal year 1972		Total fiscal years 1971 and 1972	
	Scientists/ engineers/ physicians/ surgeons	Estimated educational savings [1]	Scientists/ engineers/ physicians/ surgeons	Estimated educational savings	Scientists/ engineers/ physicians/ surgeons	Estimated educational savings
All countries	18,850	$952,424,560	18,466	$1,003,667,440	37,316	$1,956,092,000
All LDCs [2]	16,315	835,459,560	16,012	882,820,000	32,327	1,718,279,560
West Europe: Greece	217	10,302,200	190	10,444,254	407	20,746,454
Latin America [3]	1,378	89,574,120	1,279	70,836,680	2,657	160,410,800
Asia	13,803	705,406,440	13,713	757,177,400	27,516	1,462,583,840
Near and Middle East	1,036	57,862,560	1,239	76,860,680	2,275	134,723,240
Far East	12,767	647,543,880	12,474	680,316,720	25,241	1,327,860,600
China	1,104	49,724,160	934	46,686,800	2,038	96,410,960
India	5,283	241,050,280	5,369	278,976,760	10,652	520,027,040
Korea	1,449	99,243,000	1,336	87,038,880	2,805	186,281,880
Pakistan	791	36,136,400	751	39,393,480	1,542	75,529,880
Philippines	2,568	141,755,840	2,371	124,844,200	4,939	266,600,040
Other	1,572	79,551,200	1,693	103,376,600	3,265	182,927,800
Africa	811	39,794,920	692	37,206,240	1,503	77,001,160
Egypt	533	26,158,360	354	18,215,920	887	44,374,280
Other	278	13,363,560	338	18,990,320	616	32,353,880
All other areas	106	4,639,920	138	7,155,760	244	11,795,680

[1] The figure for the estimated educational savings for immigrant scientists ,engineers, physicians and surgeons is comcomputed on the basis of $9,070 as representing an approximation of the annual average cost per student and $83,000 per person for medical undergraduate school costs for 4 years of training. The $9,070 figure, relating specifically to estimated real costs of higher education for the year 1971–72, was computed by Howard R. Bowen and Paul Servelle in a study published by the American Association for Higher Education. In presenting the data, the authors state: "These estimates are crude and should be used only to indicate rough orders of magnitude. Even so, the table shows how heavily the real costs of higher education bear upon students and their families." Howard R. Bowen, and Paul Servelle, "Who Benefits from Higher Education—and Who Should Pay?" Prepared by the ERIC Clearinghouse on Higher Education, George Washington University (Washington, D.C.: American Association for Higher Education, 1972), pp. 31–33.)

The estimated figure of $83,000 per person for educational costs of a physician was cited in Henderson, "Emigration of Highly Skilled Manpower from the Developing Countries," 1970, p. 132. Mr. Henderson cites this figures for surgeons who are, as he says, "the most expensive." However, the figure of $83,000 per person is not excessively high as Mr. Henderson suggests. According to a recent report by the AAMC, the annual cost per medical student in the undergraduate medical educational program leading to the M.D. degree is estimated to range from a low of $16,300 to a high of $26,400. Over 4 years this would amount to $65,200 and $105,600 respectively. The average total annual cost from a selected 12 schools amounts to $21,350 per student, or a 4-year total of $85,400. The estimate, figured in 1972 dollars, was based upon a study of 12 medical schools. The components used in computing costs were, instruction, research, clinical activity, other administrative,scholarly,and professional activities. The report indicated that even this figure represents only a part of the total cost of preparing a physician for independent practice. (Association of American Medical Colleges, Report of the Committee on the Financing of Medical Education, "Undergraduate Medical Education: Elements—Objectives—Costs," (AAMC, 1973, pp. 1–2.)

[2] LDCs are understood to mean the following areas and countries listed in table 1 of NSF "Highlights:" Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[3] Latin America is understood to mean those areas and countries listed in table 1 of NSF "Highlights" as North and Central America (excluding Canada) and South America.

The statistical data in this table relating to the number of immigrants and areas are drawn from, NSF, "Highlights, Immigrant Scientists and Engineers," Aug. 20, 1973, p. 2.

Unaccounted for in these estimates of cost savings in education is the "immeasurable benefit," as Melvin J. Fox, associate director of the Ford Foundation, termed it, that accrued to the United States from programs of international educational exchange.[537] These programs virtually revolutionized American advanced education; they contributed enormously to the development of area studies in Ameri-

[537] Fox, op. cit., p. 75. Fox elaborates on the multifaceted benefits accruing to the United States from its participation in educational exchange.

can universities; they broadened the horizons of American students and educators studying abroad who were brought into direct contact with other cultures and other civilizations; they opened up the American educational environment to new and enriching influences from incoming foreign students; they provided the means for encouraging the inflow of young, energetic, new citizens whose potentialities were yet to be realized as researchers, educators, and professional workers in other fields; and, not least of all, they fostered a spirit of internationalism within a new generation of Americans.

Nor do these estimates take into account the contributions of the many thousands of immigrant professionals, ranging from the German-born space scientist Wernher Von Braun and the Nobel Prize nominee and Cuban refugee pediatric cardiologist Augustin Castellanos, to those many unknown scientists and engineers working in this country's research laboratories, striving to achieve its national purposes and to advance the frontiers of knowledge. Such contributions and benefits are of a magnitude that is indeed "immeasurable," but they are nevertheless real, and this country is much the greater and the richer for them.

EASING DOCTOR SHORTAGE THROUGH FMG'S

Benefits to the United States from FMGs derive mainly from their role in easing the doctor shortage. As noted above, for many years the United States has failed to produce sufficient numbers of doctors to meet the rising national demand of health care. Tables 30 and 31, reproduced from Rashi Fein's study for the Brookings Institution on the doctor shortage, provide historical perspective on this problem.[538]

Doctor Shortage, a Reality.—With probably few exceptions, sources on medical brain drain maintain that there is a doctor shortage in the United States. Most frequently cited are the Public Health Service figures of an estimated shortage of 50,000 physicians, 150,000 nurses, and more than 250,000 allied health care.[539] The Department of Labor reported a shortage in 1966 of 100,000 physicians in the United States. Data from the Public Health Service indicate a need for 400,000 physicians by 1975, approximately 110,000 more than there were in 1968. Other sources, including Rashi Fein, perceive a present shortage that will worsen in the future.[540] Stevens and Vermeulen note that shortages in hospital staffing are "critical," and they cite the American Hospital Association which, in collaboration with Government agencies, estimates that American hospitals are currently short 10,000 physicians, the addition needed to provide optimal patient care.[541]

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[538] Rashi Fein, *The Doctor Shortage: An Economic Diagnosis,* (Washington: Brookings Institution, 1967), p. 199.

[539] Sen. Edmund S. Muskie (D–Me.) cited these figures in an address to the National Kidney Foundation. (*New York Times,* Nov. 22, 1970, p. 40.)

[540] Margulies and Bloch, op. cit., pp. 22–23. The Preamble to an Act passed in 1972 setting up nine Federally sponsored medical schools referred to a shortage of 48,000 doctors and over 250,000 allied health and other medical personnel. (*Washington Star-Daily News,* Nov. 23, 1972, p. B–5.) The same press report cites Richard I. Johnson, a health care management consultant, as setting the shortage at about 130,000 today and projecting 130,000 by 1980.

[541] Stevens and Vermeulen, op. cit., pp. 24 and 25.

TABLE 30.—DOCTORS OF MEDICINE AND RATE PER 100,000 POPULATION, JULY 1, SELECTED YEARS [1]

Year	Number of physicians [2]	Number per 100,000 population [3]	Year	Number of physicians [2]	Number per 100,000 population [3]
1900	119,749	157	1936	165,163	129
1906	134,688	158	1942	180,496	134
1910	135,000	146	1949	201,277	135
1916	145,241	142	1955	218,061	132
1921	145,404	134	1957	226,625	132
1927	149,521	126	1959	236,089	133
1931	156,406	126	1962	257,035	136

[1] See text for differences between table III-1 and table III-3.
[2] Excludes June graduates of the year concerned.
[3] Population base includes Armed Forces overseas.

Source: Rashi Fein, "The Doctor Shortage: An Economic Diagnosis" (Washington: Brookings Institution, 1967), p. 66. (Data through 1957 from U.S. Public Health Service, Health manpower source book, sec. 9, Physicians, dentists and professional nurses (1959), p. 9. Data for 1959 and 1962 from ibid., Sec. 14, Medical specialists (1962), p. 3.)

TABLE 31.—MEDICAL SCHOOLS AND GRADUATES, SELECTED YEARS, 1880–1966

Year	Number of medical schools	Number of graduates	Year	Number of medical schools	Number of graduates
1880	100	3,241	1930	76	4,565
1890	133	4,454	1935	77	5,101
1900	160	5,214	1940	77	5,097
1902	160	5,009	1945	77	5,136
1904	160	5,747	1950	79	5,553
1906	162	5,364	1955	81	6,977
1908	151	4,741	1960	85	7,081
1910	131	4,440	1962	87	7,168
1915	96	3,536	1964	87	7,336
1920	85	3,047	1966	88	7,574
1925	80	3,974			

Source: Rashi Fein, "The Doctor Shortage: An Economic Diagnosis" (Washington: Brookings Institution, 1967), p. 67. (Data for years up to and including 1935 from R. G. Leland, Distribution of physicians in the United States (American Medical Association, 1936), p. 2; for later years from "Journal of the American Medical Association," vol. 198, No. 8 (Nov. 21, 1966), p. 88.)

The decline in the number of medical schools during 1910–15 is attributed to the raising of standards after publication of the Flexner report in 1910. See Fein's explanation on pp. 65–67.

There are 140 counties in the United States which have no physicians engaged in rendering patient care. The vast majority (108) are in the West. The 140 counties cover 138,463 square miles, or approximately 3.9 percent of the total land area of the United States. Almost one-half million (497,000) people or 0.2 percent of the total U.S. population reside in these counties.[542] In general, low-income, inner-city areas have relatively fewer physicians than the suburbs, the rural areas less than urban, and the poorer States less than the wealthier.[543] Such shortages are apparent to the casual reader of Sunday's edition of *The New York Times*, which invariably carries one-to-two full page advertisements on medical and hospital employment opportunities.[544]

Thus the United States is a debtor nation in terms of its current supply of M.D.s, and the evidence suggests that the doctor shortage will persist. This view is held by most specialists on health matters despite a national program to increase student enrollment in existing medical schools, establish new medical schools, and accelerate the rate of graduation of physicians. This deficit is filled by FMGs largely

[542] G. A. Roback, *Distribution of Physicians in the U.S.*, 1972, Department of Survey Research, Center for Health Services Research and Development, American Medical Association, v. 1, Regional, State, County, 1973, p. 8.
[543] Congressional Research Service, *Background Report on National Health Insurance*, Dec. 8, 1973.
[544] See, for example, *The New York Times*, Oct. 14, 1973, pp. 10E–11E.

from the LDCs, and accumulated evidence seems to corroborate the judgment of Dr. Thomas D. Dublin that, "with the floodgates now open for the mass migration of physicians, particularly from the lesser to the more highly developed countries of the world, a long time may elapse before this flow is stopped, or reversed. Up to 100,000 physicians may now be migrating annually. . . ." [545]

U.S. Dependency on FMGs.—As the statistical data presented in Chapter II indicated, the United States is a prime receiver of emigrating physicians: it depends upon FMGs to meet demand, and this dependency is increasing. In 1959, there were 20,575 FMGs in the United States, or 8.5 percent of the 241,036 total number of physicians; in December 1970, there were 63,391 FMGs identified in the latest AMA census. Another 10,000 or more are believed to be unregistered. The proportion of FMGs more than doubled by 1970 to almost one in five of the 334,028 listed doctors. In the 11½-year interval, the total number of M.D.s in the United States increased by 39 percent; the number of M.D.s receiving their basic medical training outside the United States more than tripled. During the 3-year period 1968–70, the proportion of newly licensed FMGs rose to more than 29 percent of the total. In 1970, the net increase in physician population was 9,102; one-third, or 3,016, were newly licensed FMGs—the figure would be 3,208 if Canadian medical graduates were included.[546]

In recent years the annual inflow of FMGs has matched and then exceeded the number of graduates from American medical schools. In 1969, 7,216 FMGs entered the country; 8,059 American medical students were graduated. In 1970, 8,166 FMGs entered; 8,367 American students were graduated. In 1971, the figures were 10,540 and 8,974 respectively. During the total period 1962–71, 75,639 FMGs entered the country; 77,867 American medical students were graduated.[547]

That FMGs contribute a great deal to American health care is evident in data presented in the studies by Stevens and Vermeulen, Margulies and Bloch, and the AMA in its 1970 report on FMGs. The benefits accrued to the United States are apparent in the statistics. In citing American dependency on FMGs for hospital staffing, Stevens and Vermeulen note that as of December 1970, 28,000 of the 63,000 FMGs were working full-time in American hospitals as interns, residents, or full-time staff. While constituting less than one-fifth of the total number of M.D.s in the country, they provide about a third of all physicians in hospital-based practice. In anesthesiology, nearly one-half of the 2,700 full-time hospital physicians, including interns and residents, are FMGs.[548] The role of FMGs in internship and residency programs during the last two decades has increased enormously. In 1950–51 FMGs represented only 10 percent of interns and 9 percent of residents in American hospitals; in 1970–71, there were 29 percent and 33 percent respectively.[549]

FMG contribution to American medical care extends beyond the hospitals. More than 20,000 were in office-based practice in 1970; more than 4,000 were in medical teaching or research; and 1,200 in adminis-

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[545] Dublin, op. cit., p. 870.
[546] Ibid., p. 871.
[547] Stevens and Vermeulen, op. cit., p. 96.
[548] Stevens and Vermeulen, op. cit., p. 1.
[549] Ibid., p. 6.

tration.[550] FMGs are also strongly represented in the field of psychiatry. The AMA/FMG study lists 1,934 FMGs as having received an American Specialty Board certification in Psychiatry and Neurology.[551] According to Dr. E. Fuller Torrey and Dr. Robert L. Taylor, officials of the National Institute of Mental Health, an estimated 34 percent or 1,370 out of 4,040 psychiatric residencies in 1970 were filled by FMGs. They also estimated that 3,100 foreign-trained, unlicensed M.D.s form the bulk of psychiatric staff at state mental hospitals, prisons, and institutions for the mentally retarded.[552]

At least quantitatively in terms of reducing the medical manpower deficit, it appears that the United States has gained much from the work of the FMGs. Margulies and Bloch give the following assessment of their general contribution to American health care: "This country has received from other countries many outstanding teachers and research scientists who have contributed notably to our society and its institutions. Other FMGs have been of great service to the communities in which they practice medicine." [553]

Savings to United States from FMGs.—In terms of cash savings, FMGs have made a considerable contribution to the United States. Attempts have been made at a rough evaluation of savings in educational costs. Such costs to the LDCs, noted above, give some insight into this matter.

Generalizing on the role of the FMG in the American health system, Stevens and Vermeulen state categorically that whatever the justification for their use, "the cold fact" remains that 63,391 of the 334,028 physicians in the United States in 1970 received their primary medical education outside the United States. "This education," they write, "represents a huge gain to this country in terms of value received for medical education." [554] These authors do not attempt to calculate overall cash savings to the American people, but specifically with regard to hospital functions, they estimate that FMGs "are contributing work worth at least $125 million a year to patients in American hospitals." [555]

Assuming that the educational cost of a M.D. in the United States is at an estimated figure of $83,000 per person, the total FMG population as of December 1970 of 63,391 represents a theoretical savings, if the equivalent number had been produced from native stock, of roughly $5,261,453,000. (See Table 32.) The estimated figure of $83,000 is not excessively high, as Henderson implies. According to an October 1973 report of AAMC, the average annual cost of undergraduate medical education is $21,350 per student, or a 4-year total of $85,400.[556]

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[550] Ibid., p. 14.
[551] AMA, *FMG Study*, 1971, p. 11.
[552] Stuart Auerbach, "Alien Psychiatrists Hit as 'Cheap Labor' in U.S.," *The Washington Post*, May 2, 1972, p. A1.
[553] Margulies and Bloch, op. cit., p. vi.
[554] Stevens and Vermeulen, op. cit., p. 19.
[555] Ibid., p. 9.
[556] Henderson, *Emigration of Highly Skilled Manpower from the Developing Countries*, 1970, p. 132. Mr. Henderson writes: "Costs of educating professionals in the United States are, of course, very much higher [than the $20,000 figure given by the House Government Operations Committee on the investment cost in education per professional in the LDCs], mounting, in the case of surgeons (the most expensive), up to $83,000 per person." Sources examined on brain drain generally do not explain the criteria for arriving at such base figures. It cannot be determined whether estimated costs include total cost of education from primary and secondary schools through college and medical school and whether they include also costs beyond strictly tuition and living expenses to the student.

The figure of $83,000 per person is not, however, too high as Mr. Henderson suggests. According to a recent report by the AAMC, the annual cost per medical student in the

(Figures on estimated savings in educational costs from incoming FMGs cited here take into account only the 4-year undergraduate training program in medical school; they do not include 4 years of premedical work a student must complete prior to entering medical school. Nor do they include costs in primary and secondary education. Accordingly, the figures given here would be much higher if such costs were included.)

Estimated savings for the total FMG inflow from the LDCs in 1971 (5,213), with similar assumptions made in tables 23 to 28 on education costs and losses is $432,679,000; and for the fiscal year 1972 (6,462), $536,346,000. Estimated savings from Latin America's 542 entering FMGs in the fiscal year 1971 is $44,986,000, and from the Far East, $327,518,000 for its entering 3,946 FMGs. India, the highest donor, contributed a saving of some $87,731,000 for its 1,057 entering FMGs, and the Philippines second with 1,040 saved the United States in educational costs an estimated $86,320,000. (See Table 32.)

In the fiscal year 1972, the estimated savings in educational costs increased. The estimate for the 6,462 entering FMGs from all LDCs amounts to $536,346,000. Of this total, Latin America contributed 523 FMGs, an estimated saving of $43,409,000. Again, the Far East ranked first among the areas of the world with 4,875 FMGs entering, thus permitting a saving in educational costs of $404,625,000. India had the greatest number of any country, accounting for an entry of 1,802 FMGs at an estimated saving in educational costs to the United States of $149,566,000. (See Table 33.)

The combined savings to the United States in educational costs of immigrant FMGs from the LDCs for the fiscal years 1971 and 1972 is considerable and emphasizes the high degree of American dependency on the LDCs. In the fiscal years 1971–72, 11,675 FMGs entered as immigrants at a total estimated savings in educational costs of $969,025,000. Latin America contributed 1,065 FMGs at a total saving to this country of $88,395,000. The greatest number came from the Far East: 8,821 at a saving of an estimated $732,143,000. India contributed more than any other country, a total of 2,859 FMGs for both years, at a savings to the United States estimated at $237,297,000. Ranking second among the highest contributors is the Philippines with 1,871 FMGs entering in both years at a savings in educational costs to this country of an estimated $155,293,000.

Gregory Henderson states that assuming the cost of training professionals in the United States is within the $20,000–$40,000 range, "during the years concerned" (presumably 1953–69), "such costs would be on the order of upwards of $2–$3 billion." For the 1968 inflow alone, he said, "they would be on the order of half a billion dollars."

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undergraduate medical educational program leading to the M.D. degree is estimated to range from a low of $16,300 to a high of $26,400. Over 4 years this would amount to $65,200 and $105,600 respectively. The average total annual cost from a selected 12 schools amounts to $21,350 per student, or a 4-year total of $85,400. The estimate, figured in 1972 dollars, is based upon a study of 12 medical schools. The components used in computing costs are, instruction, research, clinical activity, other administrative, scholarly, and professional activities. The report says that the cost of undergraduate medical education "represents only a part of the total cost of preparing a physician. A period of graduate medical education is required for the further development of the knowledge and skills acquired as a medical student to qualify the physician for the independent practice of medicine. There is also a need for continuing education to keep the practicing physician abreast of the day-to-day developments in medicine." The report goes on to express the need for support for the total cost of programs essential to continuing the educational process. (Association of American Medical Colleges, Report of the Committee on the Financing of Medical Education, *Undergraduate Medical Education: Elements—Objectives—Costs.* (AAMC, 1973), pp. 1–2.)

The education within the United States of the 28,000 medical doctors from the LDCs, he indicated, "would have cost at least U.S.$1½ billion." Henderson quotes Harold Howland, former Deputy Assistant Secretary of State, as estimating the imported scientists and engineers at nearly 100,000 and estimating also "at least $4 billion the saving to the United States in total educational costs." Mr. Henderson continues:

> The above concerns only value at the moment of entering a career in a developed country. The value which the professional migrant adds during a full career in a developed country at the salary and production levels of developed countries would be, of course, greatly larger, perhaps on the order of twenty times or more the figures for the U.S. value of the education at the time of entering the job and certainly in tens of billions of dollars for the United States and in the billions of dollars for other developed countries.[557]

Savings in Medical School Construction.—As noted earlier in the study, various sources attempt to give some idea of educational savings to the United States by estimating the equivalent number of medical schools needed to educate from native stock a given number of incoming FMGs. Dr. Kelly West said in 1966 that FMGs accounted for 18 percent of the annual additions of American manpower. In terms of cost, he said, the United States would have to build and operate about 12 new medical schools, at an operating cost of some $8 million dollars per year per medical center. "In other words," he noted, "the value of this migration may be estimated at something of the order to us of $100 million per year. . . ." [558]

The PAHO report of 1966 on brain drain from Latin America declared that every year about 300 physicians migrated to the United States from Latin America. This number, it said, is equivalent to the annual output of three large American medical schools. It would cost at least $60 million to build three teaching medical schools, and, it added, more than $15 million to operate them.[559]

In a recent article, Leslie Westoff writes, "It has no doubt been more economical in the short run to import doctors than to build the 35 or more medical schools we need, each costing $20 million and $5 million a year to maintain." [560]

Tables 32 and 33 offer some rough estimates of the number of medical schools that would have to be built in order to train from native stock the equivalent number of FMGs entering the country in the fiscal years 1971 and 1972. No attempt has been made to estimate costs of the medical schools either in construction or operation. (However, Margulies and Bloch, writing in 1969, estimate the cost of constructing one new medical school to be at least $50 million and the annual operating cost of a medical school at an average of $3.8 million.) [561]

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[557] Ibid., p. 32. Mr. Henderson adds in a footnote: "Such figures will seem more modest when it is recalled that the invention of power steering alone by a single, not very well-known (native) American inventor is credited with having added $5 billion to the U.S. economy."

[558] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills,* October 1966, p. 40. In an article published in 1969, Professor Adams quotes Dr. West as saying that there was evidence that the annual immigration of physicians exceeded 2,000. These immigrants, he added, constituted about 16 percent of the entries into the American medical profession, and noted that it would require 16 new medical schools to produce the physicians now supplied by imported manpower. (Adams, "Talent That Won't Stay Put," p. 79.)

[559] *Report on Brain Drain from Latin America,* Pan American Health Organization, 1966, p. 16. The same data were presented by Dr. Kidd in Hearings before the Senate Judiciary Committee. See *International Migration of Talent and Skills,* 1968, p. 77.

[560] Westoff, op. cit., p. 80.

[561] Margulies and Bloch, op. cit., p. 75.

However imprecise these estimates may be, they provide at least a rough order of magnitude of estimated savings to the American people. Roughly, an additional 18.2 medical schools would have to be constructed in order to accommodate in domestic manpower the equivalent of 6,462 FMGs entering the United States from the LDCs in the fiscal year 1972; 5.1 would have to be built to accommodate the equivalent number in native stock of 1,802 FMGs from India alone.

Undoubtedly, FMGs make a substantial contribution to the U.S. health system, saving the American people enormous outlays in funds that would have to be expended to eradicate the medical manpower deficit and to maintain health care at present standards. So great has this dependency upon the LDCs for medical manpower become that the authors of the CIMT study conclude: "Large parts of the hospital systems of both the United Kingdom and the United States would collapse if migration of physicians from less developed countries were suddenly to cease." [562]

[562] CIMT study, p. 696.

TABLE 32.—ESTIMATED SAVINGS TO THE UNITED STATES IN EDUCATIONAL COSTS OF IMMIGRANT FMG'S FROM LDC'S, FISCAL YEAR 1971

Area	Total number [1]	Total estimated savings [2]	Equivalent number of medical schools [3]
FMG population, December 1970	63,391	$5,261,453,000	179.0
All countries	5,748	477,084,000	16.2
All LDCs [4]	5,213	432,679,000	14.7
West Europe: Greece	52	4,316,000	.1
Latin America [5]	542	44,986,000	1.5
Asia	4,380	363,540,000	12.4
Near and Middle East	434	36,022,000	1.2
Far East	3,946	327,518,000	11.1
China	207	17,181,000	.6
India	1,057	87,731,000	3.0
Korea	999	82,917,000	2.8
Pakistan	161	13,280,000	.4
Philippines	1,040	86,320,000	2.9
Other	482	40,006,000	1.4
Africa	222	18,426,000	.6
Egypt	146	12,118,000	.4
Other	76	6,308,000	.4
All other areas	17	1,411,000	.05

[1] The source for the total number of FMG's entering the United States is the National Science Foundation's "Highlights of Aug. 20, 1973" (NSF 73-311), p. 2. The figure for the total FMG population comes from the AMA's "FMG Study for 1970."

[2] Total savings is arrived at by using the estimated figure of $83,000 per person for educational costs of a physician. Cited in Henderson, "Emigration of Highly Skilled Manpower from the Developing Countries," 1970, p. 132. Mr. Henderson cites this figure for surgeons who are, as he says, "the most expensive." However, the figure of $83,000 per person is not excessively high as Mr. Henderson suggests. According to a recent report by the AAMC, the annual cost per medical student in the undergraduate medical educational program leading to the M.D. degree is estimated to range from a low of $16,300 to a high of $26,400. Over 4 years this would amount to $65,200 and $105,600 respectively. The average total annual cost from 12 selected schools amounts to $21,350 per student, or a 4-year total of $85,400. The estimate, figured in 1972 dollars, was based upon a study of the 12 medical schools. The components used in computing costs were, instruction, research, clinical activity, other administrative, scholarly, and professional activities. The report indicated that even this figure represents only a part of the total cost of preparing a physician for independent practice. (Association of American Medical Colleges. Report of the Committee on the Financing of Medical Education, "Undergraduate Medical Education: Elements—Objectives—Costs." (AAMC, 1973), pp. 1-2.)

[3] The equivalent number of medical schools category has been arrived at by dividing 354, the average number of students per American medical school, into the total number of entering FMG's. This figure was computed in accordance with data in the 1971-72 catalog of the Association of American Medical Colleges, which indicates that there were 109 medical schools in the United States and Puerto Rico listed as accepting applications for classes (p. 67) and that the total enrollment of American citizens for 1969-70 was 37,690 (p. 63).

[4] LDCs are understood to mean the following areas and countries listed in table 1 of NSF "Highlights": Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[5] Latin America is understood to mean those areas and countries listed in table 1 of NSF "Highlights" as North and Central America (excluding Canada) and South America.

TABLE 33.—ESTIMATED SAVINGS TO THE UNITED STATES IN EDUCATIONAL COSTS OF IMMIGRANT FMG'S FROM LDC'S, FISCAL YEAR 1972

Area	Total number [1]	Total estimated savings [2]	Equivalent number of medical schools [3]
FMG population, December 1970	63,391	$5,261,453,000	179.0
All countries	7,143	592,869,000	20.0
All LDCs [4]	6,462	536,364,000	18.2
West Europe: Greece	76	6,308,334	.2
Latin America [5]	523	43,409,000	1.5
Asia:	5,558	461,314,000	15.7
Near and Middle East	683	56,689,000	1.9
Far East	4,875	404,625,000	13.8
China	274	22,742,000	.8
India	1,802	149,566,000	5.1
Korea	810	67,230,000	2.3
Pakistan	260	21,580,000	.7
Philippines	831	68,973,000	2.3
Other	898	74,534,000	2.5
Africa	259	21,497,000	.7
Egypt	115	9,545,000	.3
Other	144	11,952,000	.4
All other areas	46	3,818,000	.1

[1] The source for the total number of FMGs entering the United States is the National Science Foundation's "Highlights of Aug. 20, 1973" (NSF 73-311), p. 2. The figure for the total FMG population comes from the AMA's "FMG Study for 1970."

[2] Total savings is arrived at by using the estimated figure of $83,000 per person for educational costs of a physician. Cited in Henderson, "Emigration of Highly Skilled Manpower from the Developing Countries," 1970, p. 132. Mr. Henderson cites this figure for surgeons who are, as he says, "the most expensive." However, the figure of $83,000 per person is not excessively high as Mr. Henderson suggests. According to a recent report by the AAMC, the annual cost per medical student in the undergraduate medical educational program leading to the M.D. degree is estimated to range from a low of $16,300 to a high of $26,400. Over 4 years this would amount to $65,200 and $105,600 respectively. The average total annual cost from 12 selected schools amounts to $21,350 per student, or a 4-year total of $85,400. The estimate, figured in 1972 dollars, was based upon a study of the 12 medical schools. The components used in computing costs were, instruction, research, clinical activity, other administrative, scholarly, and professional activities. The report indicated that even this figure represents only a part of the total cost of preparing a physician for independent practice. (Association of American Medical Colleges. Report of the Committee on the Financing of Medical Education, "Undergraduate Medical Education: Elements—Objectives—Costs." (AAMC, 1973), pp. 1-2.)

[3] The equivalent number of medical schools category has been arrived at by dividing 354, the average number of students per American medical school, into the total number of entering FMGs. This figure was computed in accordance with data in the 1971-72 catalog of the Association of American Medical Colleges, which indicates that there were 109 medical schools in the United States and Puerto Rico listed as accepting applications for classes (p. 67) and that the total enrollment of American citizens for 1969-70 was 37,690 (p. 63).

[4] LDCs are understood to mean the following areas and countries listed in table 1 of NSF "Highlights": Greece, North and Central America (excluding Canada), South America, Asia, Africa, and "All other areas."

[5] Latin America is understood to mean those areas and countries listed in table 1 of NSF "Highlights" as North and Central America (excluding Canada) and South America.

UNFAVORABLE ASPECTS OF FMG INFLOW: THREAT TO AMERICAN MEDICAL STANDARDS

The United States has gained much from the inflow of FMGs, but at the risk of impairing the high standards of American health care, medical observers assert. These high standards evolved over generations that relied heavily on the quality of medical education provided through institutions accredited and approved by the AMA and the Association of American Medical Colleges (AAMC). High quality medical education has been the initial and established criterion of competence.[563] Passing the licensure examination given by the state of intended practice upon obtaining an M.D. degree represents a

[563] Margulies and Bloch, op. cit., pp. 44-45. This section draws heavily on Chapter III of this volume, entitled "Professional Qualities of Foreign Medical Graduates." In commenting on the high quality of American medical schools, Margulies and Bloch state: "Decades have passed since physicians could be licensed after only an apprenticeship training, and for over twenty years there have been no 'Class B' medical schools. All institutions must meet the high minimum standards set by the medical profession through its voluntary system." (p. 45)

"secular" affirmation of the physician's competence already certified by the profession. Certification in various specialties by the American Specialty Boards is a further stamp of approval by professional peers obtained after the candidate completes a year or two of graduate study and passes a very demanding examination.[564] Largely self-enforced by the medical profession, these criteria and procedures have succeeded in maintaining American standards among the highest in the world.

Insufficiencies Among FMGs.—FMGs coming to the United States bypass the initial and the most effective measurement of professional competence, namely, graduation from an American medical school. They also bypass the established procedures for accreditation that have evolved through practice and tradition in the medical profession. This deficiency poses the difficult problem for American medical authorities of establishing some criteria of competence. For FMGs are not a homogeneous group. They are educated in some 800 different medical schools outside the United States that vary in standards, content, plan of curriculum, teaching methods, language of instruction, and general cultural settings.[565] By historical tradition many of these schools differ in educational approach, stressing more theoretical knowledge in contrast with the American, which from the early beginning of medical practice in America has placed greater emphasis on practical and clinical training in addition to the theoretical.[566]

Some of the foreign medical schools such as those in Canada, England, Sweden, Switzerland, and other West European countries are, as Margulies and Bloch said, "representative of the best in the world." But the great bulk of FMGs in recent years have come from the LDCs where the quality of education is far inferior to that of the American, and as Margulies and Bloch observed, "generally cannot approach these high levels." [567]

Here is the root of the problem posed by the FMGs trying to practice medicine in the American environment. As Stevens and Ver-

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[564] Ibid.

[565] Stevens and Vermeulen, op. cit., pp. 25 and 75.

[566] Sources on medical brain drain have noted this particularity in approach. Dr. Daniel J. Boorstin discusses this aspect of medical practice in America. See, Daniel J. Boorstin, *The Americans: The Colonial Experience.* (N.Y.: Random House, 1958), v. I. Chapter VIII, pp. 207–240, "New World Medicine."

Margulies and Bloch summarize some of the differences in medical education abroad and in the United States. Most FMGs come from schools that require no more than two years of premedical education; the United States requires three or four years. FMG premedical education occurs at an age when American medical students are still in high school, and the FMGs' scientific studies are confined to simple instruction in physics, chemistry, and biology, with little or no mathematics. The quality of instruction in the LDCs falls below what medical students of the more advanced countries now receive in secondary school. American pre-med students usually obtain an undergraduate degree before entering medical school. Thus, they are three or four years older than their counterparts abroad "and have already acquired an understanding of the fundamentals of those subjects on which the medical sciences are based." Most foreign medical schools require five years of course work; four years are required in the United States; "but foreign internships are not always a routine period of additional education as they are in this country." Foreign medical schools "use much more didactic teaching than do medical schools in the United States, and in many countries what is taught is considerably less important than what will be demanded by students by the rigid examination system." Margulies and Bloch go on to explain the anomalies of grading, the low faculty-student ratio, poor laboratory facilities, libraries, etc., and linguistic difficulties in the learning process, especially in the LDCs. They conclude: "We must again stress the fact that there are striking exceptions to the preceding statements. On the other hand, there are few if any foreign medical schools in less developed countries that are as well endowed as the least endowed medical schools in the United States. Our schools receive greater financial support, have superior physical and scientific facilities, larger full-time faculties with smaller student bodies, and more demanding academic programs. In the United States, moreover, the medical student's hours of work are longer, vacations shorter, and clinical and laboratory experience more extensive." (pp. 47–49.)

[567] Ibid., p. 46.

meulen put it, ". . . the varying quality of education in different schools around the world is a major headache for those trying to assess the potential competence of those wishing to enter this country." [568]

ECFMG Examination: FMG Criteria of Competence.—The most important mechanism for establishing criteria of competence for FMGs is the examination given by the Educational Council for Foreign Medical Graduates (ECFMG examination). This is an examination given by a nongovernmental regulatory body created and supported by voluntary medical organizations in the United States. Representing an extension of the system of internal control that M.D.s and hospitals impose on themselves, the Council plays the vital role of establishing criteria and procedures for approval and accreditation of FMGs.[569]

The complicated procedure for accreditation of FMGs can be reduced to the following points: Any physician whose medical degree was conferred by a medical school outside the United States, Canada, or Puerto Rico is officially regarded by the American medical profession as a "foreign medical graduate." Any FMG wishing to pursue approved postgraduate training in the United States and enter practice must have ECFMG certification. ECFMG certification comes after passing its examination. In effect, the examination given by the ECFMG is the basic criterion for certification. As Stevens and Vermeulen explained:

> . . . the ECFMG certificate acts as a kind of "license" for foreign medical graduates to practice as interns and residents in U.S. hospitals, and to move from these positions into independent practice. As with other forms of license, it tests at a minimal level, hopefully screening out the patently unsafe practitioner, but not pretending to certify excellence or to act as a manpower policymaking body.[570]

The ECFMG examination tests the FMG's medical knowledge with 360 multiple-choice questions. One part of the entire examination is designed to measure knowledge of the English language. A score of 75 percent is required as a passing grade for the medical portion. Candidates must pass the English test. Stress is placed on linguistic ability because only 7.6 percent of the total FMG population come from countries where English is the primary language. Most candidates pass the English test. In September 1970, the pass rate exceeded 90 percent. However, the real problem arises in their inability to speak fluent idiomatic English, one of the more frequent criticisms of FMGs. Measurement of this ability is not the primary function of the ECFMG test. According to Stevens and Vermeulen, the task of ensuring that house staff can "effectively communicate with patients" is "the job of the employing hospital." With apparent concern they conclude: "But language remains a fundamental obstacle," as will be evident below in a critical commentary on anesthesiologists.[571]

For several years the ECFMG has chosen questions used by the National Board of Medical Examiners for testing graduates from the United States and Canada. Thus a direct comparison between results achieved by USMGs and FMGs is possible, though more difficult ques-

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[568] Stevens and Vermeulen, op. cit., pp. xiii, xiv.

[569] For an explanation of the process for accreditation, see Chapter II of Margulies and Bloch. Stevens and Vermeulen also explain the process in pp. 35–39.

[570] Stevens and Vermeulen, op. cit., p. 35.

[571] Ibid., pp. 31–32.

tions have been specifically eliminated by the ECFMG for FMGs.[572] The first examination was given in 1958.

FMG Competence: Performance on Examinations.—Specialists on medical brain drain, some of whom are M.D.s, have rendered harsh judgments on the inferior quality of FMGs. Two criteria are used: FMG experience with examinations, and performance as interns and residents.

TABLE 34.—PERCENTAGE DISTRIBUTION OF SCORES ON THE ECFMG EXAMINATION, MAR. 24, SEPT. 15, 1965, AND FEBRUARY 1969

Range of scores	Actual distribution of ECFMG candidates			Expected distribution of U.S. medical students		
	Mar. 24, 1965	Sept. 15, 1965	February 1969	Mar. 24, 1965	Sept. 15, 1965	February 1969
90 percent or higher	0.09	0.02	0	4.63	4.53	4.6
85 to 89 percent	2.94	2.62	2.1	29.34	28.77	28.9
80 to 84 percent	9.36	8.85	10.2	46.28	45.98	46.1
74 to 79 percent	29.98	30.33	25.7	18.87	19.40	19.5
70 to 73 percent	22.55	30.47	27.2	.81	.91	.9
65 to 69 percent	19.64	20.48	24.2	0	0	0
60 to 64 percent	9.86	6.54	9.0	0	0	0
Below 60 percent	5.55	.62	1.6	0	0	0

Source: This table draws from data presented in, Harold Margulies, and Lucille Stephenson Bloch, "Foreign Medical Graduates in the United States." (Cambridge, Mass.: Harvard University Press, 1969), table 8, p. 54 (for dates Mar. 24, 1965 and Sept. 15, 1965), and Rosemary Stevens, and Joan Vermeulen. "Foreign Trained Physicians and American Medicine," Washington, U.S. Department of Health, Education and Welfare, June 1972, p. 131 (Table C5 for Feb. 1969). Their data was drawn from the ECFMG, "Annual Reports."

The FMG record on qualifying examinations is not good. Stevens and Vermeulen, who evince a sympathetic concern for the FMGs, write: "A growing body of evidence indicates that as a total group, and for whatever reasons, foreign medical graduates do less well on standard tests than their American counterparts."[573] In generalizing on FMG examination performance, Margulies and Bloch called special attention to the "striking difference" between the predictable initial failure rate (2 percent) of the USMGs and the actual failures (60 percent) of the FMGs who responded to the same questions. (See Table 34.) Scores of the FMGs who did pass were, moreover, heavily concentrated around the minimal passing grade, so that, in the words of Margulies and Bloch, "an increase of the passing level to 80 percent rather than the present 75 percent could eliminate half of those who now pass."[574]

FMG performance on examinations has remained consistently poor over the decade. In 1961, 14,222 FMGs took the ECFMG examination, 37.8 percent passed; in 1963, 19,130 were examined, and 31.6 percent passed; in 1966, 18,988 were examined, and 41.2 percent passed.[575] In 1968, 19,548 took the examination, and 39.8 percent passed; in 1969, 22,598 were examined, and 36.0 passed; and in 1970, 29,950 were examined and 39.8 passed.[576]

[572] Margulies and Bloch, op cit., pp. 30, 53.
[573] Stevens and Vermeulen, op. cit., p. 41.
[574] Margulies and Bloch, op. cit., p. 53. The authors reproduced a chart from the ECFMG Annual Report of 1966 which gives the statistical information on examination scores for the FMGs and USMGs. The asymmetry in performance is striking.
[575] Ibid., p. 33.
[576] Stevens and Vermeulen, op. cit., p. 131.

The inequality in performance on examinations between FMGs and USMGs has also remained fairly consistent, to the marked disadvantage of the FMG. In the case of the ECFMG examination for February 1969, the annual report of the ECFMG compared the actual performance of FMGs on that examination with what would be expected of USMGs on the basis of the latters' performance on the same questions in National Board examinations. The theoretical score for American medical graduates dramatizes the inequality in professional competence. In the grade range between 74 to 90 or higher, the actual distribution averaged 48.0 percent for the FMGs, and the expected distribution averaged 99.1 percent for the USMGs. In other words, 99.1 percent of USMGs would have passed an examination which only 48.0 percent of FMGs had passed. The actual distribution for 73 and below, that is, failures, averaged 62 percent for the FMGs, and the expected distribution for USMGs was 0.9 percent. If the passing grade were advanced to 80, only 12.3 percent of the FMGs would have qualified, while 79.6 percent of the USMGs would have passed. In other words, the majority (25.7 percent) of FMGs passing were marginal.[577]

Parenthetically, it might be noted that the majority of ECFMG certificates are now being granted to FMGs from the LDCs. The largest single group of certificates awarded in 1970 was to graduates of schools in India (791), with the Philippines second (366). Both together accounted for more than one-fifth of the ECFMG certificates awarded in 1970. Other LDCs with relatively large numbers included Korea with 229 and Egypt with 228.[578] Further increases can be expected in view of the proportional increase in FMGs from the LDCs in the fiscal years 1971 and 1972.

Many FMGs take the ECFMG examination several times before passing. In generalizing on the ECFMG examination, Dr. Dublin noted that slightly over 66 percent of the FMGs taking the examination ultimately obtain qualifying certificates but on any single examination only 35 to 40 percent receive a passing grade. Thus, many candidates repeat the test several times. Currently, he said, 45 percent of the candidates have taken the examination and failed on one or more previous occasions.[579]

Nor is the FMG record on other examinations better. Dr. Dublin says frankly, "FMG's have difficulty passing licensure examinations." Over a period of 35 years, the average failure rate, he states, has been 39.4 percent. Variations in success occurred depending on the State. A few years ago some States did not accept FMG credentials for licensure, but, according to Dr. Dublin, this is no longer the case.[580]

Stevens and Vermeulen also state frankly that FMG "performance on specialty board examinations from pediatrics to surgery suggests a much poorer record by foreign than American graduates."[581]

Other sources indicate poor FMG performance on other examinations. Margulies and Bloch noted that since 1935 the FMG failure rates

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[577] Ibid., p. 131.
[578] Ibid., p. 33.
[579] Dublin, op. cit., p. 873.
[580] Ibid., p. 874.
[581] Stevens and Vermeulen, op. cit., p. 44.

on State Boards have been as high as 59.2 percent in 1941 and as low as 29 percent in 1961, with a 31-year average between 1935–66 of 40.2 percent. In 1966, a total of 3,691 FMGs took State Board examinations; 2,281 passed, and 1,410 or 38.2 percent failed. Performance varies according to State and affects national statistics. In 1966, four States (Illinois, Maryland, New York, and Virginia) represented 73 percent of all State Board failures by FMGs. Of the 3,691 FMGs taking the tests, 1,960 were in the above named four States; 925 of them passed, while 1,053 or 53 percent failed.[582]

Comparisons between FMGs and USMGs on performance in State Boards are revealing. According to Margulies and Bloch, the national average of failures for FMGs in 1966 was 38.2 percent; the national average for USMGs was 4.2 percent. Among eight selected States (Connecticut Illinois, Indiana, Maine, Maryland, New Jersey, New York, and Virginia) 50.1 percent of the 2,409 FMGs taking the State Boards in 1966 failed, while only 10.1 percent of USMGs failed out of a total of 602.[583] The inequality in State Boards continues, to the disadvantage of the FMGs. In 1970, 51.3 percent of FMGs failed in their state licensing examinations compared with only 9.3 percent and 1.5 percent respectively for American graduates of medical and osteopathic schools.[584]

FMG experience on the FLEX examination reveals the same pattern of poor performance. In 1968, the Federation of State Medical Boards established a new Federal Licensing Examination (FLEX) designed as a standard test for licensure in the states. FLEX draws on questions from the National Board examination (which is given in medical school) and is designed for physicians who are in house staff positions or in practice (for example, a physician leaving one State to practice in another). In theory FLEX offers a standard test of competence for both USMGs and FMGs. By the end of 1971, 29 States adopted the FLEX program. It is expected that FLEX will become a standard test for licensing for those without the National Board examination.[585] It was reported that in 1973 all but two States used the FLEX examination as their own State licensing examination[586] Apparently, a majority of physicians taking licensing examinations are now taking FLEX.[587] Studies on FMG performance indicate that between 1968 and 1972, 50 percent of the FMGs taking FLEX failed. USMG failure rate was much smaller, reportedly about 15 percent or less. In a recent study in the United States, Lowin and Cohodes conclude:

> The 50 percent failure rate for FMGs on the FLEX examination is perhaps even more disturbing than the 60 percent failure rate on the ECFMG exam, since most of those taking the FLEX have (1) passed the ECFMG and (2) have then received between one and three years of residency training in the States. These data suggest that the ECFMG exam has little validity, and that years of gradu-

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[582] Margulies and Bloch, op. cit., pp. 54–55.
[583] Ibid., p. 57.
[584] Stevens and Vermeulen, op. cit., p. 44.
[585] Stevens and Vermeulen, op. cit., pp. 39–40.
[586] Sen. Edward M. Kennedy, Remarks in the Senate, *Congressional Record,* June 5, 1974, p. S9679.
[587] Stevens and Vermeulen, op cit., p. 40.

ate training here are not sufficient to overcome the earlier handicaps of poor undergraduate medical education and cultural differences.[588]

What these data reveal is, first, that the performance of FMGs on certifying examinations is extremely poor compared with that of USMGs, and second that FMGs continue to perform less well compared with their American counterparts even after several years of American graduate training.[589]

FMG Competence: Performance as Interns and Residents.—The second criterion for judging the overall capabilities of FMGs is their performance as interns and residents. In 1967, Margulies and Bloch conducted a study of performance in these categories of service for the AAMC and the National Advisory Commission on Health Manpower. The survey was confined to FMGs serving as interns and residents in approved U.S. hospital training programs. The evaluation was based on a direct comparison between FMGs and USMGs in the same hospital service, under the same supervision, receiving the same training, and with similar patient care responsibilities. Evaluations of individual professional competence were made by members of the teaching staff responsible for internship or specialty services of the FMG and USMG. Professional competence was judged by response to 15 questions relating to such factors as ability to take a medical history, ability to perform a physical examination, knowledge of basic medical sciences, rate of learning, and capacity for independent learning.

According to Margulies and Bloch, with the exception of questions relating to personal characteristics, the 271 evaluators "rated the FMGs significantly lower in competence than their USMG counterparts. This statistically significant difference emerged on every question that measured professional skills and verified the judgment that, as a group, the FMGs have a limited capacity for independent learning, require (but do not receive) close supervision, and are predictably less suitable than are the USMGs to become members of the local medical community. FMGs achieved the same rating whether or not they were employed by hospitals that also had USMG interns and residents." [590]

The Margulies and Bloch survey did not attempt to determine whether FMGs fail to meet minimum standards of medical competence for the United States, whether they provide minimally adequate medi-

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[588] Aaron Lowin, and Donald Cohodes, *Supporting Documents Regarding Foreign Medical Graduates in the United States*, testimony before the Subcommittee on Public Health and Environment of the House of Representatives, U.S. Congress, May 21, 1974 (Interstudy, Minneapolis, Minn., 1974, p. 4–4.) Quoted in *Congressional Record*, June 5, 1974, pp. S9679–S9680. In a recent task force report on FMGs, the Association of American Medical Colleges recognized the serious problem surrounding the certification and licensure of FMGs in the United States. The task force reported:

"In reality, there is no examination available for measuring professional competence. Hence we are faced with dual standards for admission and are condoning the evolution of a dual system of graduate medical education. Currently a little over one-half of the physicans entering the American system are products of accredited United States medical schools, while the balance for the most part represents products of unaccredited educational systems. This double standard results in wide disparity in the quality of physicians admitted to deliver care in the United States. It undermines the process of quality medical education in this country and ultimately poses a threat to the quality of care delivered to the people." (Association of American Medical Colleges, *Graduates of Foreign Medical Schools in the United States*, Report to the Executive Council from the Task Force on Foreign Medical Graduates, Association of American Medical Colleges, Washington, D.C., Mar. 22, 1974, p. 6.)

[589] Stevens and Vermeulen, op. cit., p. 44.

[590] Margulies and Bloch, op. cit., pp. 49–52.

cal care in or out of hospitals in this country, and whether they are prepared for the health care of their own people. Rather, the study,

> . . . extended the accepted practice in the United States of evaluating student performance through the observations of their supervisors and mentors. It did not conclude that FMGs are professionally incompetent; it did establish the fact that they represent a level of competence significantly lower than the USMGs in the same program of graduate education.[591]

Margulies and Bloch alluded to another study on the same subject by Jacob C. Halberstam and Michael M. Dasco. Though using different terms of reference, their findings were similar. Of special interest in this study was the self-evaluation of the FMGs. The FMGs agreed with their supervisors and colleagues in rating the USMGs above themselves. None rated themselves as "much better" than the USMGs. Half of the FMGs conceded that USMGs did work of higher quality than they, and 72 percent admitted to their own inferior knowledge of basic medical sciences. Supervisors of both groups stated that the need for considerable or constant supervision occurred six times as frequently among FMGs as among USMGs.[592]

By both criteria, therefore, performance on examinations and performance as interns and residents, the FMGs do not match the higher standards set by the American medical profession. Margulies and Bloch reaffirm their negative appraisal of FMGs in a sweeping concluding statement to their chapter on professional qualities. "Considering the total lack of evidence to the contrary," they write, "we must conclude that FMGs have a lower level of professional competence than United States medical graduates initially, when they take the ECFMG examination, during their period of graduate medical education in this country, and finally at the time that they take state board examinations." [593]

FMG Competence: Some Critical Evaluations by American M.D.s.—Other M.D.s who have studied the medical brain drain problem and its impact on American health care have made similar negative judgments. Dr. Charles C. Sprague, dean of the University of Texas Southwestern Medical School, warned the House Government Operations Committee of an evolving double standard in the medical profession. He said that there were five States where more than half of all persons engaged in graduate medical education were FMGs. In some States, more than half of the newly licensed physicians in 1966 were FMGs. And he issued this word of caution: "Now, these are at a standard that I think by any criterion you would apply or virtually, I

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[591] Ibid., p. 52.

[592] Ibid., p. 52.

[593] Ibid., pp. 55, 58. Dr. Margulies reiterated the substance of this statement in a letter to the House Government Operations Committee, see hearings on *Brain Drain*, 1968, p. 91. A similar judgment is rendered in the Margulies-Bloch study: "The United States gets a physician who has been educated in a medical school which does not meet our standards, trained in hospitals here that have done little to correct his deficiencies and who finally leaves the hospital willing but still doubtfully prepared to practice medicine somewhere in this country." (p. 40)

For other judgments on the quality of FMGs, see Stevens and Vermeulen, "The Question of Competence," op. cit., pp. 41–47. They reach the following skeptical conclusion: "In summary, hard data about the actual performance and role of the foreign physician in different educational and specialty milieus are marked chiefly by their absence." They make a special plea for further research on this problem.

think, are not the equivalent of our own physicians. And it is not like we have more of a kind; we do not have. We are getting a double standard. And I think this is something we need to recognize." [594]

The Association of American Medical Colleges, in a recent task force report, reiterated the concerns of Dr. Sprague about the emergence of a double standard in American medicine. The task force declared:

> In reality, there is no examination available for measuring professional competence. Hence we are faced with dual standards for admission and are condoning the evolution of a dual system of graduate medical education. Currently a little over one-half of the physicians entering the American system are products of accredited United States medical schools, while the balance for the most part represents products of unaccredited education systems. This double standard results in wide disparity in the quality of physicians admitted to deliver care in the United States. It undermines the process of quality medical education in this country and ultimately poses a threat to the quality of care delivered to the people.[595]

That the emergence of this double standard has had an adverse effect on American health care is particularly evident in the fields of psychiatry and anesthesiology, both of which have high concentrations of FMGs. According to Dr. E. Fuller Torrey, special assistant to the Director of the National Institute of Mental Health for International Activities, and Dr. Robert L. Taylor, who is on the staff of NIMH's psychiatric training branch, an estimated 3,100 foreign trained, unlicensed physicians form the bulk of the psychiatric staff at State mental hospitals, prisons and institutions for the mentally retarded. An AMA spokesman has estimated that the number was more like 7,500. Both officials told the annual meeting of the American Psychiatric Association meeting in Dallas in May 1972 that these FMGs are a form of "cheap labor." Most American psychiatrists, they said, shun jobs in these institutions. But, they said, the FMG psychiatrists were no substitute. Many have had little or no psychiatric training in their foreign medical schools; they often have a poor command of English, if any at all, and have little understanding of American culture. "Imagine the difficulty, for instance, of a psychiatric resident from Korea," they

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[594] Hearings, House, Government Operations Committee, *Brain Drain*, 1968, p. 86.
Dr. Dublin noted that FMGs coming to the United States "bring with them an educational background considerably different and often technically inferior to that provided in medical schools here" (p. 872) and seemed to imply the possibility of a threat to the "maintenance of high standards of medical practice in this country" by attributing equivalency of medical education obtained in any medical school in the world (p. 875). Dr. Fein indicated that the primary purpose of internship and residency was education. Foreign interns and residents, "generally not as well trained," were recruited, he said, "primarily for service." And he adds: "Thus it is the very sick hospitalized patient who is often cared for by the poorly trained physician." Thus he concludes: "It is clear that American medicine cannot easily justify dual standards. Yet dual standard exists." (Fein, op. cit., pp. 86–87.) Professor Adams concludes that medical brain drain, 60 percent of which comes from the LDCs, "may have caused a deterioration in U.S. medical standards." He quotes from a study by the Adlai Stevenson Institute which implies this conclusion: "We have not faced up to the problem of our own health manpower shortage. Good medical schools have refused to lower admission standards. Supposedly this protects the quality of the profession, but in fact the shortage is filled by poorly-trained FMGs." (Adams, "Talent That Won't Stay Put," p. 79.) Professor Butter makes the same point: "The brain drain of physicians has also had a significant impact on medical care in the United States. It is commonly believed that foreign medical graduates (FMGs) are not as professionally competent as American medical graduates. Thus, the large number of FMGs in the United States (one out of every six physicians) has led to the fear that the quality of medical care in America is being seriously lowered." (Butter, op. cit., p. 18.)

[595] Association of American Medical Colleges, *Report of Task Force on FMGs*, Mar. 22, 1974, p. 6. Quoted in, Sen. Edward M. Kennedy, Remarks in the Senate, *Congressional Record*, June 5, 1974, p. S9680.

said, "trying to assess the mental problems of a drug-using American adolescent who is undergoing an existential crisis."

According to the doctors, an estimated 34 percent (1,370 out of 4,040) of all psychiatric residencies in 1970 were filled by FMGs, mostly from the LDCs—Philippines (149), India (136), Korea (107), Cuba (95), Argentina (55), Columbia (46), Iran (39), Mexico (25), Egypt (19) and Pakistan (19). "This list," they indicated, "corresponds with the frequently cited estimate that 85 percent of our imported medical manpower comes from underdeveloped countries." It was also pointed out that of the 186 residency programs that were active during 1970 for psychiatrists, 28 were completely filled by FMGs. In fact, there were more psychiatric residents in American hospitals who were graduates from the medical schools of the University of Havana (77) or from the University of Santo Tomas in Manila (74) than were graduates of any American or Canadian medical school (5).

The doctors also revealed that many of the 3,100 unlicensed FMGs at mental hospitals, prison psychiatric wards, and institutions for the mentally retarded were unable to pass their State Boards. But they were able to practice medicine under special permits allowing them to work only in State institutions. Pressures are now being brought to bear to create more loopholes for the unlicensed FMG. According to Dr. Torrey and Dr. Taylor, all but seven States have loopholes in their licensing laws that permit such temporary licensing. In New York and Ohio, 40 percent of the M.D.s in State mental hospitals are unlicensed; in West Virginia more than 90 percent are unlicensed; in Maryland, 77 percent of psychiatric residents in State mental hospitals are FMGs; in Virginia's Central State Hospital, all the psychiatric residents are FMGs.

Dr. Torrey and Dr. Taylor examined the question of competence. They noted that the majority of foreign medical schools offered "little or no psychiatric teaching to medical students." Upon graduating and arriving in the United States for a psychiatric residency, these doctors have "less knowledge of psychiatry than most American trainees at the same level."

After pointing out the difficulties of "catching up" owing to work pressure, Dr. Torrey and Dr. Taylor examined the other criterion of competence, the ECFMG examination. "Looking specifically at the pass rate for the eight foreign medical schools that contributed the greatest number of residents to American psychiatry in 1970," they said, "only two attained the worldwide average of 40 percent or higher." The two medical schools contributing the most psychiatric residents, the University of Havana and the University of Santo Tomas, had pass rates of only 20 and 13 percent respectively.

The same poor showing was made in the State Board licensure examinations. The graduates of these two schools, they said, "scored below the average pass rate of 63 percent for all foreign medical graduates," which in turn is considerably below the 91 percent for USMGs. Four FMGs, they reported, actually failed State Board examinations for the 13th time during 1970. "Between failures," the doctors pointed

out, "such individuals may remain employed in State hospitals in most States on temporary permits."

That FMGs have a negative effect on the field of American psychiatry seems fairly evident by the judgments of Dr. Torrey and Dr. Taylor. As they told the Dallas meeting of the American Psychiatric Association: "Patients who cannot afford private psychiatric care are more likely to be treated by foreign trained psychiatrists. The outcome is poorer quality psychiatric care." [596]

However, Mr. Caspar W. Weinberger, Secretary of Health, Education and Welfare, would dispute this assessment by Drs. Torrey and Taylor. In an appearance before the House Subcommittee on Public Health and Environment of the Interstate and Foreign Commerce Committee on March 1, 1973, Mr. Weinberger was questioned on the qualifications of unlicensed FMGs who work in State mental hospitals. He responded:

> . . . generally speaking and in view of the uniformity of qualification standards throughout the country, I would personally feel that no foreign doctor is going to treat patients unless he has the necessary qualifications and unless the public is fully protected by having his services. I am not aware of any States which allow untrained, unqualified people to work in their mental institutions. If there are such States, I would certainly think the States would want to move rapidly to correct it.[597]

Special problems having potentially adverse effects on American health care have arisen in the field of anesthesiology. This field has a high concentration of FMGs. In December 1970, the AMA recorded a total of 10,860 anesthesiologists. Canadian medical graduates practicing in the United States were not included among FMGs in this AMA tabulation. Of the total 10,860 anesthesiologists, 3,304 or 30.4 percent were FMGs. The tabulation was broken down to show the percentage of FMGs within the various categories of activity, i.e., office-based practice, hospital-based interns and residents, fulltime hospital staff, and teaching and research. Of the total 7,379 anesthesiologists in office-based practice, 1,697 or 23 percent were FMGs; of the 1,408 hospital-based interns and residents, 744 or 52.8 percent were FMGs; of the 1,326 serving as full-time hospital staff, 609 or 45.9 percent were FMGs; of the total 588 in teaching and research, 221 or 37.6 percent were FMGs; and, finally, of the total 159 cited as being in a category "other" than those specifically designated, 33 or 20.8 percent were FMGs.[598]

Illustrative of the type of problems that can arise in anesthesiology were revealed in Ronald Kessler's article on the Washington Hospital Center. A staff writer for *The Washington Post*, Mr. Kessler wrote a series of investigative articles on the Center in the fall of 1972, one of which dealt with "Accidents in Anesthesia." Kessler explained the function of the anesthesiologist and proceeded to record problems

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[596] The data in this section are drawn from a report in *The Washington Post* of May 2, 1972, p. A1, by Stuart Auerbach entitled, "Alien Psychiatrists Hit as 'Cheap Labor' in U.S.", and also from a more complete study by Dr. Torrey and Dr. Taylor appearing in the April 1973 issue of the *American Journal of Psychiatry* under the title, "Cheap Labor from Poor Nations." Sen. Edmund S. Muskie (D-Me.) inserted this article, along with other material, in the *Congressional Record*, Feb. 7, 1974, pp. S1468–1472, under the title, "Our Dependence on Foreign Trained Physicians: Is It Fair?"

[597] Hearings, House Interstate and Foreign Commerce Committee, *Oversight of HEW Health Programs*, 1973, p. 58.

[598] Stevens and Vermeulen, op. cit., p 153.

arising at the Center relying upon interviews with some of the physicians and surgeons for his data.[599]

Talks with a number of physicians and surgeons, according to Kessler, "reveal a widespread lack of faith in the skill of some—but not all—of the anesthesiologists who work at the center." Some of the doctors said that they would go to other hospitals in such medical Centers as Boston before allowing themselves to be put to sleep at the Center, and others said they would enter the hospital center for an operation only if a certain anesthesiologist were selected in advance. "I was very scared when my daughter came up for routine surgery (at the Center) last spring," confided Dr. Richard C. Reba, chief of the center's nuclear medicine department. Dr. Reba consented to surgery for his daughter only when the surgeon assured him he used only a certain two of the hospital's anesthesiologists. "Most of them (the anesthesiologists) don't know what they're doing," he said. Dr. P. J. Lowenthal, chief of the Center's anesthesiology department, discounted such criticism.

However, Dr. Ernest A. Gould, a trustee of the Center and former chief of the medical staff and chief of surgery until 1970, said he would only allow four of the more than 20 anesthesiologists at the Center to give him anesthesia if he had to undergo an operation. (Apparently, a high percentage if not all of the anesthesiologists are Asian FMGs.) Kessler continued to paraphrase Dr. Gould: "Even if it were an emergency, he says, he wouldn't allow two of the anesthesiologists (one of whom has recently left the hospital) to go near him, nor would he allow them in the operating room with him while he is performing surgery." Dr. Gould noted that he was similarly selective in the anesthesiologists he used, but he acknowledged that many surgeons at the Center took those assigned. He explained that breathing or heart beat is stopped by anesthesia in about 1 in every 2,500 operations at the Center and about 30 percent of these arrests result in death. He estimated about five anesthesia deaths a year at the Center. Dr. Solomon N. Albert, anesthesiologist at the Center, responded when asked about these figures: "Let him document it." When asked about the death rate, Dr. Albert said: "I don't know it offhand. It isn't so much."

One problem in anesthesiology, said Samuel Scrivener, Jr., president of the Center, who expressed concern about the state of the specialty at the Center, was, in Kessler's words, "that many anesthesiologists trained in foreign countries can't speak English well." This is particularly true of Koreans, said Dr. Gould, while some anesthesiologists from Japan speak English well. Dr. Gould noted that instant communication between anesthesiologist and surgeon are essential throughout an operation. Referring to the language problem, Dr. Gould said, "If the question requires a 'yes' or 'no' answer, they're OK,

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[599] Mr. Kessler explained the vital function of the anesthesiologist: "During an operation, the anesthesiologist generally regulates the flow of anesthetic liquid or gas entering the patient, increasing it when the surgeon wants the muscles relaxed and reducing it when the patient needs time to recover from a critical surgical maneuver. In addition, the anesthesiologist regulates the supply of oxygen to the patient and watches his bodily signs for any danger signal. A moment's delay in reacting to a problem, or a slip of the hand on the valves regulating the chemicals, can cause immediate death, brain damage, or paralysis."

but if it involves an explanation, they need help." Mr. Kessler noted the problem of lawsuits that worry the Center's officials, examined the salary structure and method of payment for services, and concluded with an acknowledgment by Dr. Albert that the problem in anesthesiology was not method of payment, but, in Kessler's words, "the lack of good anesthesiologists."[600]

Tangentially related to the matter of competence is the practice of some hospitals in appointing FMGs to hospital positions without ECFMG certification to graduate educational programs. "Repeated episodes" of such improprieties have been reported by the Council on Medical Education, to the extent that it felt compelled to issue warning to hospitals, State medical societies, and State licensure boards.[601] Such action was taken as evidence of "a significant effort" to circumvent the ECFMG. Presumably situations like this arise from the heavy demands placed upon hospital administrators and the objections of many to restrictions placed on whom they could appoint to house staff positions. As one New York hospital administrator said of the certi-

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[600] Ronald Kessler, "The Hospital Business—IV. . . . Accidents in Anesthesia," *The Washington Post*, Nov. 1, 1972, p. A1. Rep. James W. Symington (D-Mo.) raised the question of linguistic competence of FMGs and their cultural incompatability with Americans, in hearings on the oversight of HEW programs. The problem of the FMGs, he said, "must be considered in the light of the barefoot doctor of China who grows up in his community and knows how to deal with the people and in the light of the complaints of the black American community. I don't know whether you heard these complaints but they are to the effect that so often the poor go to the hospital where they are treated by men who cannot even understand their language and that they are being treated by people with absolutely no understanding of their cultural background." Mr. Weinberger replied: ". . . I see nothing inherently wrong with the utilization of foreign trained doctors if they are qualified and if they can fulfill the need in a particular area. While it may be ideal to have someone treating patients with the precise ethnic, social, and cultural background of all these patients, I don't think we are close to approaching that and I am not sure it is all that good an idea anyway." (Hearings, House, Interstate and Foreign Commerce Committee, *Oversight of HEW Health Programs*, 1973, p. 56.)

[601] Stevens and Vermeulen, op. cit., p. 34.

That the use of unlicensed FMGs is a fairly wide practice was indicated in a study published on June 20, 1974 in the New England Journal of Medicine. Undertaken at the request of the Educational Council for Foreign Medical Graduates, the study was directed by Dr. Robert J. Weiss of Harvard University with the assistance of his professional colleagues, Dr. Joel C. Kleinman, Dr. Ursula C. Brandt, Dr. Jacob J. Feldman, and Dr. Alma C. McGuinnes.

The report, which was based on a survey of 4,035 FMGs now working in the United States, stated that a growing "medical underground" of thousands of foreign-trained doctors were practicing medicine without licenses and often without supervision in many American hospitals. These uncertified doctors, most of whom either failed to pass or have not yet taken the necessary American licensure examinations are, according to the report, making crucial diagnostic and therapeutic decisions affecting the outcomes of patients' illnesses. Though many of the doctors were officially hired as laboratory technicians or assistants in various lower-level jobs categories, they often assumed responsibility, the report said, for patient care, without consulting licensed physicians. The question of legality of this practice was not examined by the authors of the report, but, as the press account said, "the findings are likely to arouse debate on whether the doctors or the hospital officials who accede to the practice as a way of coping with a doctor shortage are legally liable."

In an interview Dr. Weiss said that the "medical underground" consisted of M.D.s lacking American credentials who, though called X-ray technicians, laboratory assistants, or by some other title in their job description, actually act independently as physicians. Some perform surgery in the operating room or in the emergency ward; others give anesthesia; many practice psychiatry; some read X rays. "A few look under a microscope at biopsy specimens in pathology laboratories to distinguish between cancers and benign tumors, for example," and, as the press report stated, "determine what course the surgeon must take while the patient is anesthetized on the operating table."

Dr. Weiss said that he became interested in studying the FMG problem after other health specialists detected a gap in the AMA's listing of physicians. Doctors with partial licenses, he said, were not recorded in a systematic way and that the AMA had no way of learning the names of FMGs unless they entered formal training programs. To emphasize his point, Dr. Weiss said that when calling one noncertified doctor in North Carolina, the person answering the phone replied that the doctor was busy caring for patients in his office. AMA records cited by the Harvard research team showed at least 10,000 unlicensed physicians working in the health field in 1971. The precise number of FMGs practicing without license or examination certificates is unknown. (Lawrence K. Altman, "Many Foreign Physicians in U.S. Found Unlicensed," *The New York Times*, June 20, 1974, p. 1)

fying process of the ECFMG examination: "The ECFMG should simply publish the results and let the hospital decide whether it wants a man who got a score of, say, 50. In my opinion, it's better to have a poorly trained intern than no intern at all." [602]

A Summing Up of Views on FMG Competence.—In sum, the competence of FMGs is questioned by American doctors, some of whom are prominent figures in the medical profession. Concern has been expressed for the development of what Dr. Sprague feared might be a double standard in medicine, a situation that contains at least a potential threat to the heretofore high standards of American medicine. Whatever the reason, recent evidence shows that the confidence of the American people in the medical profession has declined sharply over the past 6 to 7 years.[603]

On the other hand, Secretary of HEW Weinberger defended the competence of FMGs and favorably assessed their impact on American health care. He told the House Subcommittee on Public Health and Environment, "I don't have any feeling that they [FMGs] should take the place of anyone else," i.e. USMGs. He contended that FMGs are not "necessarily . . . any better than anybody else but they are an available source and they are being utilized." Nor did he accept the proposition that utilizing FMGs "necessarily means that we are subjecting our people to any less good care or that we are engaged in any practice that is morally reprehensible." [604]

TERMINATING CAREER EXPECTATIONS OF AMERICAN PREMEDICAL STUDENTS

Except for occasional Congressional comment, much of the literature on medical brain drain views the problem from the perspective of the FMG. Virtually no attention has been given to its negative effects on the career expectations of qualified American premedical students. Sources generally refer to the doctor shortage and cite various problems arising from the inflow of FMGs who are expected to reduce that shortage, but they fail to consider the qualified American premedical students who in effect are denied medical careers by two interacting forces, namely, the short supply in American medical schools and the extensive inflow in FMGs to relieve the doctor shortage.

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[602] Ibid., p. 29. The director of a Paterson, N.J. hospital expressed similar views: "It's easy to sit behind a desk in Chicago and frame ideals about quality of care. But a supposedly nonqualified doctor can put on a tourniquet and give the usual drugs and plasma for shock to tide the patient over until an American trained doctor gets there. And that's better than having the patient die." (p. 30).

[603] On Dec. 9, 1973, Louis Harris published a poll that attempted to ascertain the confidence of Americans "in the people who are running" such major institutions in American life as medicine, higher education, military, media, Congress, etc. Gradations of opinion were classified as "a great deal, only some, or hardly any confidence." In the poll medicine was rated as the highest institution in which there was "a great deal of confidence," 57 percent (in 1972, it was 48 percent); the Federal Executive Branch was rated lowest with 19 percent (in 1972, it was 27 percent). But the 57 percent for medicine represents a substantial drop from the 1966 figure of 72 percent (the Federal Executive Branch had a 41 percent rating in 1966). Thus Mr. Harris concludes: "Basically, by any standard there has been a fall in respect and confidence in the people running almost every major U.S. institution compared with 1966, when we first measured it." (*The Washington Post*, Dec. 9, 1973, p. L8, and Louis Harris, Confidence and Concern: Citizens View American Government, *In* remarks of Sen. Edmund S. Muskie (D-Me.), *Congressional Record*, Dec. 3, 1973, pp. S21704–S21706.)

[604] Hearings, House Interstate and Foreign Commerce Committee, *Oversight of HEW Health Programs*, 1973, pp. 53–54.

Only the study by Dr. Fein on the doctor shortage raises, as he phrased it, "the question of the right of qualified students to pursue studies in the fields that interest them." Medicine, he noted, was one of few fields where supply was restricted at the point of entry into the educational system rather than into the profession. "Even if professional licensing arrangements are justified in order to assure quality," he observed, "it is quite another matter to prevent students from pursuing medical education if they so desire and are qualified." [605]

Admissions Crisis in American Medical Schools.—In June 1971, Senator Edward Kennedy (D-Mass.) spoke on the Senate floor of the "crisis in admissions to American medical schools," observing that it "has reached major proportions." [606] Recent data revealed that the extent of this problem has not been exaggerated. In 1970–71, 24,987 Americans applied to U.S. medical schools; to total of 148,787 applications were submitted; of this number, 11,500 were accepted.[607]

In 1971–72, 29,172 Americans filed a total of 210,943 applications for 12,361 places in American medical school freshman classes.[608] (In the fiscal year 1971, 5,748 foreign-trained physicians and surgeons entered the United States as immigrants, the overwhelming percentage from the LDCs.) In 1972–73, according to AAMC estimates, there were 37,000 individuals filing 250,000 applications; 13,570 were enrolled in medical schools.[609] (In the fiscal year 1972, 7,143 FMGs entered the United States as immigrants, a sharp increase over the fiscal year 1971, again the overwhelming percentage was from the LDCs.) AAMC estimates that in 1973–74, 40,000 American aspirants to medical school will be filing some 288,000 applications to fill 13,822 openings. AAMC also estimates that in 1974–75, there will be 43,000 individuals filing application; 322,500 applications will be filed for acceptance to fill some 14,300 openings in freshman classes in American medical schools.[610]

This anomaly of a growing number of medical school aspirants for a restricted number of openings, in an environment of a prolonged and aggravated doctor shortage, and coincidental with an increased inflow of foreign trained doctors, is becoming increasingly apparent in the medical profession and in the Congress. Dr. Robert A. Chase of Stanford University told the October 1973 meeting of the American College of Surgeons that it was "a national shame" that the United States did not have space for those students who wanted to attend medical school.[611] And the American Medical Association itself asked in a recent editorial reviewing American medical education, "Isn't there something awry when the United States must depend on the immigration of graduates of foreign medical schools for its supply of physicians, while at the same time United States schools are forced to turn away qualified applicants?" [612] What adds to this anomaly is

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[605] Fein, op. cit., p. 144.
[606] *Congressional Record*, June 18, 1971, p. S9423.
[607] Stevens and Vermeulen, op. cit., p. 165.
[608] AAMC, *Medical School Requirements, 1974–75* (Washington: 1973), p. 16.
[609] Ibid.
[610] Ibid.
[611] "Doctor Immigration Is Termed Harmful in U.S. and Abroad," *The New York Times*, Oct. 17, 1973, p. 25.
[612] Quoted in Lawrence K. Altman, "Doctors Influx Backed by A.M.A.," *The New York Times*, Oct. 23, 1973, p. 9.

the point made by JAMA, namely, that perhaps a great percentage of those turned away from American medical schools are highly qualified students from some of the best American colleges and universities. According to Stevens and Vermeulen, "paradoxically, many of these unsuccessful applicants have a much better basic premedical education than many foreign medical graduates who are imported from abroad as interns." [613]

American Medical Students Study Abroad.—As an alternative, many unsuccessful American pre-med applicants go-abroad to study at an estimated rate of 500 per year, and if they successfully complete their work, return home as FMGs, and thereupon face many of the professional problems attendant with that group. The numbers studying abroad vary. In October 1969, an estimated 2,343 Americans attended 16 medical schools in Mexico, Spain, Italy, Switzerland, and Belgium; in the same year 162 were graduated from those schools.[614] Apparently, no American students were studying in the United Kingdom where a common language would have eased the burden of study. And apparently few Americans are accepted in Canadian medical schools, although the United States imports a substantial number of Canadian M.D.s—some 362 in the fiscal year 1972 alone. Americans seemed to be accepted only in schools on the European continent and in Mexico, some of which fall far short of America's high standards. There, they face many difficulties, not the least of which is the language barrier. The attrition rate is high—only about one-fourth complete the required study.[615]

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[613] Stevens and Vermeulen, op. cit., p. 19.

The quality of education in South Asia, a major source of professional emigration to the United States, has been judged harshly by some observers. Joseph Lelyveld wrote of India: "At a generous estimate, perhaps 5 percent of the mass of Indian students in institutions of higher education are receiving decent training by recognizable world standards. . . . In most places academic standards have fallen so low that they can hardly be said to have survived." ("India's Students Demand—A Safe Job in the Establishment," *The New York Times Magazine,* May 12, 1968, p. 53. Quoted in, Brzezinski, op. cit., p. 44.) This condition is by no means limited to India. Gunnar Myrdal stated in his monumental work on Asian development: "Teaching in South Asian schools at all levels tends to discourage independent thinking and the growth of that inquisitive and experimental bent of mind that is so essential for development." (p. 1645) "The South Asian peoples are not merely being insufficiently educated; they are being miseducated on a huge scale." (p. 1649) In a "Summary of Policy Conclusions," Myrdal wrote: "It would appear more justifiable *to halt the increase in, or even to contract, enrollment in secondary and tertiary schools.* The enormous amount of miseducation at these levels is caused not only by the scarcity of properly trained teachers and generally low quality standards, but by the wrong orientation of schooling. More students should choose technical and professional schools for their advanced education; all schooling at the secondary and tertiary levels should be modernized to include more technical and scientific subjects, with greater emphasis on manual work experience." (pp. 1816–1817) (*Asian Drama: An Inquiry into the Poverty of Nations* (New York: Twentieth Century Fund, 1968), v. 3.)

Two American college educators who for many years observed the adjustment of Filipino health personnel to the American environment told the writer that what would qualify for a dentist in the Philippines would be the equivalent to an American dental assistant and that college-level science courses in the Philippines corresponded more closely to those given at the secondary level in this country. The problem of standards and deficiencies in native training became evident when immigrant Filipino nurses found difficulty in coping with science courses given at American colleges and in passing the New York State Board examinations.

[614] Ibid., p. 169. But even this alternative of study in Europe is diminishing. Open admissions policies that in the past permitted ready access of American medical students to the universities of Western Europe have been sharply restricted. Astonished to find that foreign students, more than half of them American, constituted up to 17 percent of their enrollment, medical faculties in Europe have imposed a series of quotas on foreign admissions. Beginning in the fall of 1974, for example, medical schools in France will reduce the proportion of foreign enrolled students from 15 to 5 percent. More serious for American aspirants is a new decree that French schools will consider only students who can produce evidence of acceptance in a medical school in their own country. (*Newsweek,* July 8, 1974, p. 49. The remainder of the article discusses the American role in Mexico's University of Guadalajara.)

[615] Dublin, op. cit., p. 871.

"It's a bad price to pay," said John Wilson, one of 1,046 American medical students enrolled in 1971 at the University Autonomous of Guadalajara, Mexico, in acknowledging the difficulties they faced, "but at least it's an opportunity. We were all forced down here. We're the system's rejects, the dedicated fools who want to study medicine regardless." [616]

Ironically, the largest "American" medical school is not in the United States but at Guadalajara, Mexico, which in 1974 enrolled 1,734 American students in its medical school. These students are potential USFMGs. Professors at some of the leading American medical schools have become concerned about the low quality of instruction that these young Americans receive. At least as a partial remedy they have established an unofficial program in which they devote part of their time teaching at Guadalajara. The rationale for this new program seems to spring largely from a professional desire to protect American medical standards which are affected upon the return of USFMGs. As one medical professor, a participant, said: "We have to face the reality that these students will come back to the United States to practice." [617]

Congressional and Administration Views on FMGs Versus USMGs. It is on this question of FMGs versus USMGs that the views of the administration and some Members of Congress conflict sharply. The administration sees the utilization of FMGs as an expedient for coping with the Nation's pressing medical demands. Thus, as Secretary Weinberger told the House Interstate and Foreign Commerce Sub-

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[616] John Peterson, "Our Doctors in Mexico." *National Observer* (June 14, 1971) *In Congressional Record,* June 18, 1971, p. S9423. For a general discussion of the USFMGs, see the Stevens and Vermeulen study. Lynette Goodstine, of Manchester, Conn., a second-year student at Louvain University in Belgium explained what appears to be the attitude of many young Americans studying abroad: "Anyone who comes here has to be motivated. You have to learn a new language, the school is constant hard work, and it's difficult to get back into the States to practice." (*Time,* Apr. 16, 1973, p. 54.)

[617] In an attempt to improve the level of training of the growing ranks of American medical students in Mexico, professors from U.S. medical schools are going to Mexico to give lectures and demonstrations for the American students. The professors, representing such specialized fields as cardiology, hematology, orthopedics, dermatology, among others, are collaborating with the Autonomous University of Guadalajara, a private school with 1,734 American students making it the largest "American" medical school in the world.

The first group of professors were seven cardiologists from Boston University. They returned recently. One of the group, Dr. H. Emerson Thomas Jr., came away with admiration for these potential USFMGs. "They are just eager and hungry for information," he said. "You walk into a lecture hall and immediately things quiet down—they are ready for business."

Dr. Louis W. Sullivan, a hematologist at Boston University is going to Mexico in April. The purpose of this academic medical venture is to improve the level of training of the American students. As Dr. Sullivan said, "We have to face the reality that these students will come back to the United States to practice."

More than 50 American doctors are to go to Mexico on an unofficial basis from Boston University, Western Reserve, Harvard, the New Jersey College of Medicine, Baylor, Tufts, and the Universities of Minnesota, Florida, Southern California and Massachusetts. They were invited by Dr. William D'Angels, director of medicine at Queens Medical Center in New York, who is on leave to serve as acting director for clinical sciences at Guadalajara. The professors spend their mornings doing bedside clinical instruction and the afternoons lecturing.

An assessment of Guadalajara was given by Dr. Robert J. Weiss, an expert on medical manpower at Harvard. He visited the university last summer, but he is not connected with the new program. According to the press, he "painted a grim picture of well-motivated young Americans struggling against a language barrier and chafing under a faculty that forbids long hair, beards and dissent." Dr. Weiss and others agree that the main problem is that the clinical training at Guadalajara does not meet American standards and that the students often have difficulty passing qualifying examinations in the United States. Dr. Weiss doubted that the new program could make up for these deficiencies.

This situation, the press report noted, underscores "one of the biggest problems in American medical care today: Even though there is an acute shortage of physicians, particularly in small towns, thousands of qualified Americans must go abroad to school while foreign doctors are imported to relieve the shortage." Of the 42,000 Americans applying to American medical schools last fall, only one-third were accepted. It has been estimated the half of those rejected were qualified. (Robert Reinhold, "Professors Go to Mexico to Train U.S. Students Rejected by Domestic Medical Schools," *The New York Times,* Mar. 12, 1974, p. 15.)

committee on Public Health and Environment in March 1973, "I don't think in and of itself [that] is necessarily a bad thing."

However, Rep. William R. Roy (D-Kans.), a physician, faculty member of the Kansas University Medical Center, prominent leader in the Kansas Medical Society, and member of the Institute of Medicine of the National Academy of Sciences, disputed this evaluation, saying, "May I suggest to you it is a bad thing," and for these reasons: "No. 1, we have young men and women—probably twice to three times as many—who cannot get in medical schools, who the medical schools admit are qualified; and that No. 2, we are stealing these physicians from other nations around the world who need them desperately." Dr. Roy asked: "Now will you explain to me why it is not a bad thing when we license over 12,000 foreign physicians?"

Mr. Weinberger, who professed not to have "any feeling" that FMGs "should take the place of anyone else," defended the use of FMGs on grounds that they satisfied the Nation's need for medical personnel. He insisted that this practice did not mean that "we are subjecting our people to any less good care or that we are engaged in any practice that is morally reprehensible." [618]

In the course of the hearing Secretary Weinberger revealed that he did not know how many FMGs were in the American medical community, nor was he was aware of the fact that in 1971 the United States licensed more FMGs than domestically trained physicians.[619]

Concern in the House of Representatives for the inadequacies of the Nation's health services, particularly the growing prominence of FMGs, appeared to reach a new level when on April 25, 1974, Representative Roy introduced H.R. 14357, the National Health Services Manpower Act of 1974. This legislation was designed to rectify manpower shortages in the health professions. It included proposals along the lines of those presented by Senator Kennedy on June 5, 1974 (see below p. 198) that among other things would increase the Nation's manpower resources in health services, reduce the number of postgraduate trainee positions available for FMGs and thus limit their inflow, improve the distribution of health services, and increase Federal Government support for health training programs.[620]

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[618] Hearings, House, Interstate and Foreign Commerce Committee, *Oversight of HEW Health Programs*, 1973, pp. 53–54. Rep. Tim Lee Carter (R-Ky.) also took issue with Mr. Weinberger, noting particularly the need to train American doctors. He expressed gratitude for the FMGs in his area—"there are many of them—some Chinese and Koreans and a few Cubans." But he added: "At the same time I feel that we owe it to our country to do as much as we can to assure that the students are able to go to medical school or to make it possible for them to go to school. We need as many American physicians as possible. We want to reach our quota in them I would suggest, Mr. Secretary." (p. 59.)

Representative Symington was also concerned about the future of Americans who were aspiring to be doctors but were being frustrated by the massive inflow of FMGs and by the failure of adequate medical facilities. In an exchange with Mr. Weinberger, Mr. Symington asked if he would deny that FMGs were being taken into the U.S. against the wishes of their governments and "certainly against the needs of their people?" Mr. Weinberger responded with a question: "Well, is the suggestion, Congressman, to say we will turn them back and say, 'We will not permit you to practice in this country despite your own wishes?'" But, the Congressman retorted: "I would like to see the resources of the United States which are being used one way or the other used to bring the most effective medical attention using American citizens to the service of the American people. The dollar amounts that you spend on medical training in this country will stay roughly the same but we encourage the medical schools to enroll more people, and it is more and more difficult for the Americans to compete in their own system to the point where they have lost half of the new market to foreign doctors." (p. 57.)

[619] Ibid., pp. 55 and 53.

[620] Rep. William R. Roy, "Health Services," Remarks in the House, *Congressional Record*, Apr. 25, 1974, pp. H3270–H3284. On May 9, 1974, Rep. Paul Rogers (D-Fla.), Chairman of the Public Health and Environment Subcommittee of the House Interstate and Foreign Commerce Committee, also introduced a medical manpower bill designed to increase federal support for the training of doctors and other health professionals (H.R. 14721). (*Congressional Record*, May 9, 1974, p. H3767.)

The clash of Congressional and Executive Branch views is also evident in the Senate. On June 5, 1974, Senator Jacob Javits (R–N.Y.) sharply criticized the administration's position on the use of FMGs to alleviate the doctor shortage, giving particular emphasis to the insufficient number of medical schools and inadequate Federal Government support for "desperately needed medical, dental, nursing, and other health profession schools."

I am convinced,

he said,

that where there is an actual shortage of, for example, 30,000 physicians, based on the empirical data, exclusive of the Department of Health, Education, and Welfare's unconscionable reliance upon noncitizen foreign medical graduates—FMG's—to provide medical manpower, Congress should make every appropriate effort to increase our Nation's medical schools capacity to increase enrollment and train qualified Americans to become physicians.[621]

Senator Kennedy followed with a comprehensive critique of the administration's health manpower policies by way of explaining, as he said, two "far-reaching health manpower proposals" he was introducing for Senate action in July.[622] The Senator pointed out the disparity in views on the doctor shortage, citing the familiar 50,000 figure, the Hansen study of 6 major projections during the years 1959-67

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[621] Sen. Jacob K. Javits, Remarks in the Senate, *Congressional Record,* June 5, 1974, pp. S9670–S9672. Senator Javits inserted in the record an exchange of correspondence with Secretary Weinberger. In his letter of Jan. 17, 1974, the Senator asked for statistical data and analyses upon which HEW relied for their published statements to the effect that the physician shortage will soon be eliminated. "I understand," he wrote, "that this statement is based upon the assumption that our country will continue to rely upon the utilization of FMG's . . . rather than educating and training the requisite number of qualified Americans to achieve the goal of eliminating the physician shortage without the 'brain drain' on countries which ought not to be submitted to it. I believe it would be contrary to our nation's ethics to follow such a procedure. I can find no reasonable intellectual or philosophical rationale for this nation to support the 'brain drain'—take desperately needed medical manpower from underdeveloped, impoverished nations less fortunate than ours to meet our own needs for physicians."

Not receiving a response, Senator Javits wrote a follow-up letter on Apr. 10, 1974, pointing out the urgency of this request for legislation then under consideration, and restating the essence of his inquiry. "As you know," he wrote, "I find it almost degrading for our nation to take desperately needed medical manpower from developing nations with desperate health and economic problems to meet our nation's physician shortage. Moreover, I believe that so long as foreign medical graduates are used to alleviate our medical manpower shortage, our nation will continue to be dependent on this source and that this is improper and deplorable."

On Apr. 15, 1974, Secretary Weinberger finally responded after a delay of 2 months. He noted that the current output capacity (enrollment) of health professional schools has increased significantly over the past decade (e.g. first-year places in U.S. medical schools increased by 65 percent). The rate of those entering the field, he said, is much greater than those leaving and as a result "we can expect by 1985, 50 percent more M.D.s, 40 percent more dentists, and 60 percent more registered nurses than in 1970." He defended the administration's position on the use of FMGs, arguing that it was unrealistic to assume that their influx can be entirely eliminated and indicating that physician supply projections were based on a "rather conservative assumption" regarding their inflow. The projections for 1984 indicated that the total supply of physicians will range between 495,000 and 520,000. These estimates "are based on the assumption that the net annual increase to total supply attributed to FMGs will range between 3,500 and 5,500 per year. This range represents between 50 percent and 80 percent of the number that were probably added during 1972." The Secretary explained his position on the use of FMGs, already described above; indicated administration efforts to urge the return of needed FMGs; elaborated on the "push" factors causing FMG migration; acknowledged the concern of the medical profession for possible "inferior" services provided by FMGs; and indicated an awareness of policy implications surrounding the FMG issue notably the matter of qualifying examinations.

[622] Edward M. Kennedy, Remarks in the Senate, *Congressional Record,* June 5, 1974, pp. S9677–S9704. Mr. Kennedy introduced the Health Professions Educational Assistance Act of 1974 and the Nurse Training Act of 1974. He also submitted amendments S. 3585 and S. 3586 to the Public Health Service Act relating to health professions training programs. Cosponsors of the legislation were Senators Javits, Warren G. Magnuson (D-Wash.), Jennings Randolph (D-W. Va.), Claiborne Pell (D-R.I.), William D. Hathaway (D-Me.), and Dick Clark (D-Ia.).

showing estimates ranging from a surplus of 21,700 to a deficit of 65,000 by 1975, and the HEW estimate that by 1980 physician supply would be adequate perhaps even in surplus. Mr. Kennedy rejected outright the "notion that this Nation magically has enough health professionals, though it may have enough of certain kinds of health professionals." Nor would he accept the "notion that the time has come for the Federal Government to phase out its support for these institutions and their students." Such a policy on the eve of enacting national health insurance, he declared, "is irresponsible."

A central issue under consideration, Mr. Kennedy continued, was the "Nation's growing reliance" upon FMGs "who are too frequently licensed to practice their profession when they are not adequately qualified." The effect of this inflow of foreign medical manpower has been to produce "a dual class system of health care in the Nation" through defective licensing and certification procedures. (The other points discussed were the matter of maldistribution of health manpower, the excess of medical specialists, and the insufficiency of primary care doctors.)

Mr. Kennedy presented data, appearing in this study, on such matters as the growing number of FMGs, questions of their professional qualifications, and corrective action in the entire health care field through wide-ranging Federal Government support of the Nation's health professions. "The number of FMGs entering the United States each year is growing, not leveling or tapering off," the Senator said. Some experts estimate that in the near future FMGs will constitute approximately one-third of all physicians practicing in the United States. "This is an intolerable situation which must be considered carefully," Mr. Kennedy exclaimed. To underscore the anomaly of this practice, the Senator stated that "less than half the number of individuals applying to U.S. medical schools are accepted for enrollment." In the academic year 1972–73, only 38 percent of those applying were admitted. "Increasing numbers of U.S. citizens rejected by U.S. medical schools," he declared, "are turning to foreign medical schools." An estimated 6,000 Americans were now studying medicine abroad.

(Among the corrective measures proposed by Senator Kennedy, in addition to those designed generally to remedy the Nation's health manpower problems, were:

(1. to establish national standards for licensure, thus maintaining the traditionally high standards of American medical and dental qualifications; and

(2. to limit the number of postgraduate trainee positions to 110 percent of the number of graduates from U.S. medical and osteopathic schools in any year, insuring a limited and appropriate balance of postgraduate training positions in the various medical specialty and subspecialty areas, nationwide and regionally. The net effect would be to limit to 10 percent the postgraduate positions available for FMGs, who now comprise 30 percent of the M.D.s in postgraduate training, presumably with the expectation of reducing their inflow.)

Thus, qualified American premedical students are denied the pursuit of one of the most prestigious careers American society has to offer and,

ironically, one in which society's needs are the greatest.[623] Closed out at home, they have the alternatives of moving into other career directions or going abroad to study and obtain, if successful, an inferior medical degree with uncertain prospects as a USFMG. In this environment of declining expectation for young Americans aspiring to be physicians, some Members of Congress are beginning to question publicly the premise of the administration's policy on the utilization of FMGs.

Interconnection of Science, Technology, Brain Drain, and National Policy

However difficult it may be to measure the effects of this admittedly "unmeasurable problem" of brain drain, still there are certain inescapable realities suggesting that the problem does exist and that it is large. The "internationalist" and "nationalist" models are convenient analytical devices; they provide insights that permit some grasp on these realities, but they yield no absolute answers. Nor does evaluation of demands and needs give grounds for a conclusive, incontestable judgment—what is one man's demand is another man's need. Still, they, too, can provide insights and some understanding.

That brain drain has positive and negative effects for both the LDCs and the United States there would seem to be little doubt. Certain facts are self-evident. The LDCs benefit from a returning educated elite; they share in the advancement of world knowledge in which their gifted nationals working in advanced countries can participate in creating; economic development may not necessarily be deterred, according to some observers; emigration can produce economic and political side-effects favorable to the problem-laden, pressure-filled LDCs; and as a result of a combination of all these factors, possibilities for social change and progress can be improved.

Yet these gains appear to be more than counterbalanced by serious losses in the professional manpower that could provide the nation with human resources necessary for present and future development but are now denied. Through the loss of these natural resources a nation's intellectual infrastructure can be eroded and weakened; social costs of medical brain drain can be very high, perhaps too high for the general welfare of the medically underprivileged LDC; nonreturning students can reduce the professional reserves necessary for the future; donor nations can sacrifice certain elements of national prestige, perhaps not vital but still important to the upward-striving LDC; costs to the donor LDCs from the loss of professional manpower investments can be exceedingly high, however imprecise the method for measuring them and whatever compensating effects various offsetting factors may have; loss through mismatched training, possible genetic

[623] The continuing high prestige of the medical profession is illustrated by a Gallup Poll published in December 1973. The poll confirmed a finding of surveys taken over a period of more than two decades that "medicine is the top choice among all adults as the best profession for a young man." Three persons in 10 surveyed, i.e., 28 percent, cited medicine as the most preferable career—hence the most prestigious. In 1950, medicine was first choice with 29 percent. Variations during the intervening 23 years were minor. (*The Washington Post,* Dec. 2, 1973, p. A17.)

degeneration, and the widening gap between the LDCs and advanced countries through brain drain complete the catalog of possible negative effects of brain drain on the LDCs.

The United States and other Western advanced countries gain enormously because of the inflow of professional manpower from the LDCs. The inflow of scientists and engineers, first from the advanced countries of the West and later proportionately greater from the LDCs, has contributed to enhancing American possibilities of maintaining world economic and political primacy in the last quarter of a century. The inflow of FMGs, mainly from the LDCs in recent years, enable the United States to reduce the gap in the doctor shortage and to pursue the Nation's goals of expanding health care, apparently with some success. But this success seems to have been achieved at the price of exposing the American people to what some brain drain specialists and physicians perceive to be a threat of lowering the high standards of medical care by filling the ranks of the American medical profession with FMGs of seemingly doubtful competence, and of terminating career expectations of qualified American premedical students by failing to provide sufficient medical schools to meet both the growing health demands and needs of the American people.

Thus, the effects of brain drain seem to fall into a range of possibilities that may vary by degree of relevancy and intensity, but they are nevertheless realities. Created by multiple, interacting forces within the area of science and technology, these effects intrude upon the Nation's domestic policy and make their presence known in many ways. But it is likely that their greatest impact may be in the realm of American foreign policy, for it is in this realm that science, technology, brain drain, and national policy interconnect in a way that can produce serious implications for the foreign policy goals of this Nation.

VI. Brain Drain: Present and Future Trends; Remedies

Brain drain, a lively foreign policy issue nearly a decade ago, remains today a persistent, though less visible, problem for the present and the future.

Present and Future Trends in Brain Drain to the United States

Three major trends are perceptible in brain drain: (1) The inflow of immigrant scientists and engineers declined in the fiscal year 1972; but (2) that of physicians and surgeons has increased; while (3) there is scattered, but inconclusive, evidence suggesting that there may be the beginning of a trend towards outflow of scientists and engineers from the United States.

The first two trends intersect. According to recent National Science Foundation data on professional immigration, 11,300 immigrant scientists and engineers were admitted to the United States in the fiscal year 1972, a number 14 percent below the 13,100 in the fiscal year 1971. The 7,100 immigrant physicians and surgeons admitted in the fiscal year 1972 were not only the largest influx of M.D.s over the past two decades but confirmed a steep upward trend evident in physician-surgeon inflows since 1970.[624]

BEGINNING TREND OF OUTFLOW OF SCIENTISTS AND ENGINEERS FROM UNITED STATES

Changing market conditions in manpower supply, among other factors, have arrested the heretofore unimpeded inflow of scientists and engineers of recent years into the United States and has actually created a reversal of brain drain. Professionals have been leaving this country and going to other lands. "Pull" factors have become transformed into "push" factors.

Indicators of the changing trend in brain drain became visible in the late 1960's. An appraisal in *Business Week* of October 10, 1970, began: "Suddenly, the United States is no longer a mecca for world scientists. Immigration of technically trained people has dropped sharply . . . , and many foreign nationals living here are hankering to leave. Moreover, increasing numbers of American scientists and engineers would like to live abroad." [625] Traditionally, thousands of young Canadians came every year to the United States for graduate study; they would stay on to work; but now, the report said, "comparatively few remain." In 1969, fewer than 500 Canadian scientists and engineers immigrated to the United States, about half the 1968 figure. A survey of 1,200 scientists from West Germany now in the

[624] NSF, *Highlights*, August 1973, p. 1.
[625] *Business Week* (Oct. 10, 1970). Reproduced in, *Intercultural Education* 2 (December 1970), pp. 11–12.

United States revealed that one-third wanted to return home. Many British scientists and engineers were also anxious to return. According to J. Michael Lock, scientific counselor at the British Embassy, about 300 to 400 were seeking jobs in Britain each year. Both England and West Germany instituted programs to retrieve their lost professionals.[626]

West Germany's *Der Spiegel* reported in 1970 that the brain drain process ". . . was not an irreversbile one. The scientists are returning home." Triumphant tones have been heard in a number of West German institutes: "They are all coming back now." "By no means all of them," reported *Der Spiegel.* "But hundreds are." And it concluded: "The great exodus is now moving from West to East." [627]

Unique in this exodus eastward are the many thousands of highly skilled American technicians and scientists who immigrated to Israel after the Six Day War of 1967. The figure 3,000 is given. Little noticed, this pool of technological talent, according to Peter Grose of *The New York Times*, "is quietly emerging as one of Israel's most important national assets for developing the country's long-range potential." [628]

A 1973 study by the Carnegie Commission on Higher Education confirmed earlier evidence of brain drain reversal. The inflow has been arrested, the study reported, and a reversal appeared to be underway. A recent survey found, for example, that 5 to 10 percent of the new doctors of science and engineering, most of whom were foreign students, planned to work in a foreign country. A great number of Ph. D.s have emigrated from the United States to Canada. Teachers have also been emigrating to West Germany and Australia.[629]

How the downturn and reversal of brain drain affects scientists and engineers of the LDCs cannot be determined and thus can only be a matter of conjecture. Existing "push" factors at home would continue to discourage returnees from the United States. There may be exceptions, as in the case of Argentina where improved working conditions have attracted some returnees. According to physicist Carlos Mallman, President of the Bariloche Foundation, a state-supported research center in Argentina, "We have more applications from Argentines working abroad than we can fill.[630]

Changing market conditions in U.S. manpower supply may now deter initial immigration of scientists and engineers from the LDCs. Restrictions on immigrating scientists and engineers have been tightened. They are now required to get Department of Labor certification before immigrant status is granted. Under recent revisions of regula-

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[626] "Bringing Back the Brains to Britain," *Anglo American Trade News* (January 1970), pp. 27–30.

[627] "Why the U.S. is Losing its Brains: Close-Up of a New Phenomenon, the Reverse Brain-Drain," *Der Spiegel,* translated and reproduced in, *Atlas,* Jan. 20, 1971, pp. 34–36. For a discussion of the flow of brains back to Europe and the European job market, see, Clyde H. Farnsworth, "Europe's Technicians in a Job Scramble," *The New York Times,* Mar. 13, 1973, p. 1.

[628] Peter Grose, "Israel Attracting U.S. Scientific Talent," *The New York Times,* Feb. 28, 1972, p. 2.

[629] "Carnegie Study Sees Brain Drain Shift Away from U.S.," *Science & Government Report* (Apr. 15, 1973).

[630] Dr. Mallmann continued: "Those who come here are attracted by working conditions. The income maximizers still go abroad, but it is just as well that they do." See, Lewis H. Dinguid, "Research Foundation Reverses Brain-Drain," *The Washington Post,* Apr. 12, 1973, p. K2.

tions this is not easy.[631] Accordingly, this requirement, which is related to the declining job market, would affect inflows from the LDCs. These factors, along with the existing ceiling placed on immigration from the Western Hemisphere, have no doubt affected the recent slowdown in the exodus of scientists and engineers from Latin America. (The Western Hemisphere has an annual ceiling of 120,000 immigrants; the current waiting list is about 200,000.) Similar effects can be expected in other parts of the developing world.[632]

REASON FOR BRAIN DRAIN DOWNTURN AND OUTFLOW FROM UNITED STATES

The reason for the domestic downturn and reversal in the brain drain of scientists and engineers is the changing market conditions in manpower supply. In the last few years the supply has exceeded the demand. Thus in the early 1970s the "pull" factor of an available manpower market with an abundance of professional opportunity has been transformed into a "push" factor of underemployment and unemployment.

This reversal is generally attributed to, (1) the cutback of Federal Government spending in defense and the aerospace fields; and (2) the growing surplus of an American educated elite. Termination of the war in Vietnam and conclusion of the Apollo program, both of which required vast outlays in expenditures, combined with a national mood of withdrawal from global involvement, the decompression of the Cold War, an apparently rising spirit of détente with the Soviet

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[631] The interaction between the job market and immigration regulations was revealed by a new directive announced by Immigration Commissioner Leonard F. Chapman, Jr., on Apr. 19, 1974, relating to foreign student summer employment. The Commissioner directed that henceforth foreign students seeking summer employment will have to obtain permission from the Immigration and Naturalization Service rather than from school officials. According to Chapman, the decision was intended to protect summer job opportunities for American youth, including Vietnam veterans and members of minority groups. "For several years," Chapman declared, "the Manpower Administration has advised us that unemployment among American youth is of such magnitude that summer employment of aliens is depriving young Americans of needed employment opportunities." The unemployment rate among youth exceeded the national average. Mr. Chapman emphasized, however, that foreign students, in needing employment for economic reasons due to unforeseen circumstances arising after their entry into the United States, may continue to apply to the Service for work permission at any time. Such students were not limited to summer work. Upon graduation they may also apply to the Service for approval to engage in practical training related to their course of study, Mr. Chapman said.

The State Department had been consulted on this matter and expressed the view that important foreign policy benefits were to be gained by the United States from the presence of foreign students in this country. But, Chapman said, "In balancing the labor market impact against the foreign relations aspects, I have concluded that protection of job opportunities for young Americans, including minority youth and Vietnam veterans, is the paramount consideration at this time." (Department of Justice, *Press Release,* Apr. 19, 1974, 2 p.)

For the purposes of this study it is important to note that concern for brain drain through international student programs was not the declared purpose of this new restriction but rather the tightening job market for summer employment. Yet, the effect of the new regulation could reduce the inflow of foreign students. Arthur Rodbell, executive director of the National Student Lobby, protested the INS action, disputed the assertion that foreign students were taking jobs from Americans, and claimed that there was "overwhelming evidence" that many foreign students will not be able to return to their campuses next fall if they cannot get summer jobs. Their failure to continue, he said, would cost American colleges $1.5 million in tuition. (Donald P. Baker, "U.S. Gets Tough on Jobs for Aliens," *The Washington Post,* May 19, 1974, p. B3.)

[632] Dr. Amador Muriel suggests that Filipino scientists and engineers may have to return home whatever their personal preferences: "Considering the trend in the United States and Europe today—the decrease in science expenditures and the emphasis on other aspects of life such as the environment and social problems—the reasons for leaving may no longer be sufficient to encourage emigration. Filipino physicists in training may be forced to go back to their country as jobs become harder to find in the United States." (Muriel, op. cit., p. 39.)

Union, and a shifting national emphasis on domestic economic and social concerns, to bring about an overall retrenchment in the Nation's defense, aerospace, and foreign policy commitments. As a result, funds for R. & D. were drastically reduced. Depression in the defense-aerospace professional job market, economic inflation, and sharp economies in universities with the loss of Government-sponsored programs resulted. As a consequence aerospace scientists and engineers became underemployed or unemployed, and researchers in defense-aerospace related fields at the universities found themselves to be marginal men without a program or a job. Thousands of researchers, professors, scientists, and engineers flooded a manpower market that was quickly transformed from a seller's to a buyer's market.

The second cause of the arrest and reversal of brain drain among scientists and engineers is the growing surplus of newly produced American talent. In the past 25 years, the number of institutions granting Ph.D.s, has doubled, enrollment quadrupled to more than 900,000, and the annual number of doctorates grown sevenfold to more than 30,000.[633] In the 11-year post-Sputnik period between 1959 and 1970 alone the annual growth of advanced degrees increased from 9,000 to 29,300.[634] This enormous growth of educated manpower coincided with the Nation's enlarged commitment in defense, aerospace and foreign policy. Now that retrenchment has set in, the Nation is left with a sizeable surplus of trained manpower. Cutbacks in R. & D. and defense have reduced both academic and nonacademic job opportunities. In the words of *The Economist*, "The possession of a Ph. D. is no longer a sure passport to a good job." [635]

What makes the job market particularly "bleak" for the professional (to quote a term frequently used to describe conditions in the 1970's) is the conviction that the oversupply of Ph. D.s, visible to some observers in the early 1970's, will become particularly marked late in the decade. As Chancellor Allan M. Cartter of New York University wrote:

> We have created a graduate education and research establishment in American universities that is about 30 to 50 percent larger than we shall effectively use in the 1970's and early 1980's and the growth process continues in many sectors. The readjustment to the real demands of the next 15 years is bound to be painful.[636]
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> In the coming decade, it seems likely that only about one doctorate in four will find suitable academic employment, and in the 1980s it could be less than one in ten.[637]

Thus, the United States has an overabundance of home-grown talent that, according to projections, will persist through the next decade. The effects of this development, intensified by some Federal retrenchment in defense, aerospace, and foreign policy, have produced funda-

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[633] Fred M. Hechinger, "Graduate Schools: Power of Choice to Students," *The New York Times*, Mar. 18, 1973, p. E7.
[634] "Pity the Ph. Ds," *The Economist* (Jan. 20, 1973), p. 25.
[635] Ibid.
[636] Allan M. Cartter, "Scientific Manpower for 1970–85," *Science* 172 (Apr. 9, 1971), p. 132.
[637] Ibid., p. 136.

mental changes in the professional manpower market, braking the in-bound brain drain and in some instances even reversing it.[638]

Social, political, and cultural factors have also entered into the decision of some scientists and engineers to return home from the United States. Sources revealed that returnees were going only to Europe and not to the LDCs. These motivating perceptions can be summed up briefly: dissatisfaction with American culture and the European's sense of cultural isolation in what they perceive to be a highly materialistic country; social upheaval in the Nation and unsettled conditions in the universities; what some describe as the "brutalizing" aspects of American urban life; threat of the draft when conscription was possible; improved conditions in Europe, particularly in some of the West German universities; disenchantment with the American political environment; and for American Jews, a deep sense of idealism attracting them to Israel.[639]

FMG'S, AN EXCEPTION TO THE GENERAL TREND

Although reduction and reversal of brain drain in the last 2 fiscal years occurred among scientists and engineers, no such reverse occurred among physicians and surgeons. Their numbers increased, and the future inflow seems assured for some time to come.

The "push/pull" factors operate at maximum efficiency in the case of medical brain drain. This is the reason why FMGs flow into the United States in ever-increasing numbers. In the LDCs, the prime source of medical emigrants, the "push" of oversupply and underdemand (as distinct from need), along with the other causal factors described above, provides continuing momentum for medical migration to the United States. In the United States as the prime goal of medical immigrants, the "pull" of the asserted doctor shortage is attributed to failure to build sufficient American medical schools to meet the growing demand for doctors in the Nation's expanding health services and to

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[638] In an essay on American education, *Time* made the following observations on future problems of underemployment: "The shape of the economy today argues in less theoretical terms for an open-minded attitude toward learning such skills as welding and carpentry instead of, or along with, philosophy and history. The Bureau of Labor Statistics has estimated that only 20% of the jobs in the 1970s will require education beyond high school. Yet the Carnegie Commission on Higher Education forecast last week that two-thirds of America's high school graduates will be continuing their schooling. Already, according to the commission, nearly 30% of male graduates of 4-year colleges are in blue-collar, sales and clerical jobs. There seems likely to be even more serious underemployment of talent in the future. In fact, the U.S. Department of Health, Education and Welfare projects that over the next decade an average of 2½ people will be competing for every job that actually requires a college education." ("Second Thoughts About Man—III: What the Schools Cannot Do," *Time* (Apr. 16, 1973), p. 80.)

[639] A British scientist gave as a reason: "We didn't want our children to grow up in the violent American atmosphere"; (*Business Week*, Oct. 10, 1970). A West German professor was returning because he now believed reform was possible; a zoologist returned after 7 years residence in the United States because "the working conditions are better here"; a tenured professor was going to the University of Munich because "my offer . . . was excellent in all respects including salary"; a professor of medicine returned because, "Life in America is hard"; returnees do not want "to expose their children to the brutalizing conditions of life in large American cities, and they are tired of hearing their wives complain about being isolated in the culturally destitute small towns and suburbs"; the "big complaint . . . was the growing paucity of research funds"; *Der Spiegel* concludes: "This bleak picture of the American situation is no exaggeration. The Cooperative College Registry shows dwindling job openings for scientists in the U.S. The great exodus is now moving from West to East"; (*Der Spiegel*, In. *Atlas*, January 1971, pp. 34–36.) Professor Wolff, a specialist on rocket-propulsion, said of going to Israel: "I think there is no doubt that idealism, the attraction of helping to build up the state, is the main factor that draws people here." (*The New York Times*, Feb. 28, 1972, p. 2.)

the inefficient use of health manpower already available. Whatever the causes, the quick absorption of FMGs provides the sustained magnetic force attracting medical manpower readily available in the markets of the LDCs.

Until something is done to alter this "push/pull" relationship between the sending LDCs and the receiving United States, little change can be expected in this medical inflow. As long ago as 1966, Dr. G. Halsey Hunt informed the Federation of State Medical Boards of the United States that "barring world catastrophe the foreign medical graduate will be a major fact of American hospital and medical life for many years to come." [640] And as recently as June 1972, Stevens and Vermeulen wrote:

> The influx of foreign trained physicians is primarily a market response to a shortage of physicians in the United States. While there is a continuing demand for additional physicians, most notably for hospital house staffs, economics alone would suggest a continuing flow of doctors, particularly from countries with relatively low income levels for professionals and limited openings for medical practice.[641]

What virtually assures continuous medical inflow is not just the favorable balance of "push/pull" factors but U.S. practice in encouraging—indeed facilitating—medical immigration. Stevens and Vermeulen made this point when they observed: "At present, with the new immigration laws and current Congressional attitudes both encouraging an influx of foreign trained physicians, one can expect more physicians to come intending to practice." For those continuing to come as interns and residents, they said, the new laws "facilitate their remaining here after training." [642]

CONTINUING BRAIN DRAIN FROM LDC'S

Historically, brain drain has demonstrated its durability as a natural, human phenomenon: It has been a fact of man's life, at least since the beginning of recorded history, and it is more likely to evolve into a higher form through the impact of forces released in the industrial age than to dissolve. The essential cause of brain drain is disparity in development among nations. In the present era this means disparity in economic development. It is axiomatic that investment in human resources is necessary, indeed vital, for economic development. Yet in the absence of world economic homogeneity, the movement of people between the "have-not" and "have" nations is inevitable, and it is necessary.[643] Highly skilled people naturally seek higher rewards and greater opportunities for their talents and labor. In the present era, the growing gap in development between rich and poor stimulates this flow of talent and provides the essential life-sustaining element to brain drain that makes it a continuing international problem. The conclusions reached by Gregory Henderson in his UNITAR study on brain drain from the LDCs elucidate this relationship be-

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[640] Quoted in, Nader and Zahlan, *Science and Technology in Developing Countries*, 1969, p. 458.
[641] Stevens and Vermeulen, op. cit., p. xii.
[642] Ibid., pp. xvi–xvi.
[643] Deutsch, op, cit. p. 42.

tween the pace of economic development and the durability of brain drain as a phenomenon and an issue:

> . . . there seems every likelihood that, in the long run, at least, the migration of professionals out of developing countries will grow. In the short run, reductions in American support for research and other economic adversities may reduce the movement temporarily, as it has, overall, for the United States and Canada in 1969. But experience has shown that smaller developed nations often export more of their professionals than developing nations do. As more people in developing nations are trained to have more qualifications, more will wish to and be able to migrate. Such migration will co-exist with considerable economic development. It may also co-exist with lengthening gaps between developed and developing nations. Brain drain from developing to developed nations is likely to continue its present trend of replacing gradually the older brain drain from smaller to larger developed countries.[644]

These conclusions are consistent with those of other students of brain drain. Dr. Luis Giorgi believed it "most likely" that brain drain "will continue indefinitely." Writing nearly a decade ago, he predicted that this "migratory phenomenon . . . will get worse" if means are not taken to induce professionals to remain home. Thus he reached the conclusion on prospects for brain drain that the experience of the last decade has proved to be true, namely, (1) "the migration of scientists and engineers from developing to more advanced countries will probably continue indefinitely"; and (2) "this migration will probably increase unless effective steps are taken to control and reduce it."[645]

Remedies for Brain Drain

"Effective steps" to moderate brain drain (short of total arrestment) fall naturally within the relationship between the causal "push/pull" factors. If the disharmonies creating the "push" from the sending LDCs and the "pull" from the advanced receiving nations are corrected, then the contending forces are neutralized and brain drain can no longer be a viable problem. Eliminate the causes and the effects dissolve.

Virtually every commentary and analysis on brain drain presents a set of remedies, some exceedingly detailed and programmatic, as in the works by UNITAR, Gregory Henderson, Dr. Adams, Dr. Niland, the authors of the CIMT study, the various official materials published by the State Department and the Congress; and others generalized and suggestive. There is an understandable sameness about the remedies. The problem is universal; the ingredients are fairly uniform; and while remedies may vary from case-to-case, certain principles apply generally.

DIMINISHING "PUSH" FACTORS: CLOSING DEVELOPMENT GAP

Students of brain drain tend to attribute brain drain to deficiencies within the LDCs. They concur also in the belief that the first priority for remedy is economic development. Brain drain is a symptom of un-

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[644] Henderson, op. cit., p. 149.

[645] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America*, 1965, pp. 181–182. A report on brain drain from Latin America in April 1973 said, "Despite a recent slow-down in the exodus because openings in the United States were scarcer, Latin experts foresee no general solution in the coming years." (*The Washington Post*, Apr. 12, 1973, p. K2.)

derdevelopment: it is not a cause but a component of the deeper disequalizing process that broadens and perpetuates the development gap between rich and poor. Dr. Hornig's analysis in 1968, still valid, advances the essential truth that the remedy lies in development. "The problem of migration," he told the Senate Judiciary Committee in 1968, "should be viewed not in isolation, nor as a primary problem. It should be viewed as a symptom of the basic problems of national development, and as a guide to problems that should be attacked at the source." [646]

Economic development is the principal instrumentality for modernization:

—It has the basic components that insure material success and progress in a scientific-technological age;

—It creates the means for satisfying manpower demands and needs for society;

—It enhances a developing nation's capacity to absorb surplus professional manpower, and thus break the "vicious circle" in the disequalizing process that is responsible for generating, aggravating and perpetuating the development gap between rich and poor;

—It stimulates the rational use of resources, human and material, and by necessity allows their allocation for building a scientific-technological infrastructure for improving the working environment of the scientists, technologists, and other professionals who contribute concretely to nation-building;

—It encourages the development of a national science policy that combines the community of scientists and technologists with that of the political and economic leaders and integrates their purposes into a single overall planning goal, namely, development of the nation;

—It can contribute to altering national values and traditions so that science and technology can be respected and appreciated for their real worth and accordingly assigned the prestige they deserve as vital elements in nation-building;

—It stimulates the spirit of science so necessary in this modern age;

—It can correlate the educational needs of the nation with the principles of nation-building and thus induce rationality in the development of trained human resources so that the balanced needs of a developing industrial and agricultural economy can be achieved; and

—It can create the rewards and incentives that are so necessary in attracting and retaining professional manpower.

CREATING SCIENTIFIC-TECHNOLOGICAL INFRASTRUCTURE: RELATIONSHIP TO DEVELOPMENT

Essential to the task of development, and thus of remedying brain drain from the LDCs, is building a scientific-technological infrastructure within the developing nations. Science and technology are vital instruments for development in the modern age. They generate the scientific spirit so important in transforming national habits, atti-

[646] Hearings, Senate, Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 105.

tudes, and traditions and in developing a national commitment to science and technology. Through scientific and technological institutions, the needed manpower is trained for running the machinery and organizing the productive resources of a modern industrial society. Science and technology enable a nation to utilize its material resources in creating the goods and services to meet the demands of a new era. Finally, the application of human intelligence to material resources through which economic and social progress can be achieved is made possible by science and technology. Homi Bhabha, director of Bombay's Tata Institute and the "most dynamic figure" in Indian science, stressed, perhaps overstressed the relationship between science and technology and development as seen from the LDC's perspective when he said:

> What the developed countries have and the underdeveloped lack is modern science and an economy based on modern technology. The problem of developing the underdeveloped countries is therefore the problem of establishing modern science in them and transforming their economy to one based on modern science and technology.[647]

The task of creating a scientific-technological infrastructure in the LDCs is difficult. Yet it is one in which the (American) National Academy of Sciences, in cooperation with the U.S. Agency for International Development and indigenous scientific communities, has taken an active and vigorous interest since the late 1950's. Requirements vary among the LDCs which have emerged at differing stages of national development and have moved at an uneven pace towards modernity.

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[647] E. R. Piore, "Science in the Post-Industrial Era," *Science in Human Affairs, Proceedings of the Academy of Political Science,* Columbia University, New York 38 (April 1966), p. 139.

Sources on brain drain abound in statements of this nature. One that is particularly comprehensive was made by Ward Morehouse, Director of the Center for International Programs and Comparative Studies of the State Education Department, University of the State of New York. Professor Morehouse began an article on the role of science and technology in development with these comments:

> "We cannot avoid the realization," C. P. Snow once observed, "that applied science has made it possible to remove unnecessary suffering from a billion individual lives—to remove suffering of a kind, which in our own privileged society, we have largely forgotten. . . . It does not require one additional scientific discovery, though new scientific discoveries must help us. *It depends on the spread of the scientific revolution all over the world.* There is no other way."
>
> If C. P. Snow is right, the potential importance of modern science and technology in the development process can hardly be overstated. No less a commanding figure in modern history than the late Jawaharlal Nehru of India, concerned as he was with guiding the destinies of one of the major less developed societies in the contemporary world, once observed about India: "I do not see any way out of our vicious circle of poverty except by utilizing the new sources of power science has placed at our disposal."
>
> Mr. Nehru was not alone among political leaders of the less developed countries of the world in recognizing the enormous potential of modern science and technology in achievement of their economic and social goals. Virtually every political leader of a developing country at one time or another has made similar pronouncements. The proposition that modern science and technology constitute a potential salvation for less developed societies is reflected in the allocation of resources for development throughout Asia, Africa, and Latin America where national development plans include the promotion of science and technology in a variety of forms. While there may be some who will argue that the resources allocated for this area of activity of such high potential are too limited, the fact remains that science and technology are considered to be integral parts of almost all national development programs.

(Ward Morehouse, "The Role of Science and Technology in Development: A Terra Incognita of Public Policy," *International Development Review* 1 (1970), p. 19.)

Another example of increased awareness among LDCs of the need for modernizing through technology is that of Saudi Arabia. Sheikh Ahmed Yamani, Saudi Arabia's oil minister and chief negotiator for the Arabs in the 1973–74 oil crisis, has professed goals of modernizing his country through industrialization. In its drive for modernization, Saudi Arabia has engaged many American scientists and engineers to help build the infrastructure of technology. For decades Saudi Arabian technological students, including Yamani, were trained in American universities. Saudi Arabia's long-range goals were made very clear by Yamani when he was recently asked how the West, politics aside, could get Saudi Arabia to supply world oil demand. Yamani answered: "That is very simple. Industrialize Saudi Arabia. Then we will give you as much oil as you need." ("Arabs Outline Several Methods How West Can Resupply Oil," *The Christian Science Monitor,* Dec. 11, 1973, p. 2.)

On balance it ought to be pointed out that science and technology are critical elements in development but not necessarily the only ones. Development is considerably more complex than these statements would imply.

For example, the problems facing the poorest African LDC emerging from colonialism without benefit of having available the most rudimentary forms of scientific and technical training are far different from those of some Latin American country, like Mexico which may be regarded as a developing nation but which has made great material progress and, moreover, has one of the finest and oldest universities in the Western Hemisphere, the University of Mexico.

However variable conditions in the LDCs may be, to build a scientific-technological infrastructure requires:

—Material resources and proper funding support for carrying on research;

—An educational system, soundly rooted in the sciences, that can produce trained professional manpower and provide the necessary "critical mass" for progress in science research;

—A commitment by the government and people to science and technology as a problem-solving and creative element in society;

—A network of internal and external communications within the community of world science to insure currency in scientific developments and permit indigenous science to flourish; and

—A close working interrelationship within the triad that can insure national development, namely, the scientific and technological community, the government, and the main sectors of the national economy.

Dr. Michael J. Moravcsik, Director of the Institute of Theoretical Physics at the University of Oregon, and a long-time student of scientific brain drain from the LDCs, has concentrated on this corrective aspect of brain drain, that is, the building of a scientific-technological infrastructure. Some of the salient points on this complex subject, stressed in both his published and unpublished studies, are cited here, along with commentaries from other sources.[648]

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[648] Both the published and unpublished works are cited here for the convenience of the reader. Dr. Moravcsik made his unpublished studies available to Mr. Warren R. Johnston, Associate Director of this series on "Science, Technology, and American Diplomacy."

"Technical Assistance and Fundamental Research in Underdeveloped Countries," *Minerva* 2 (Winter, 1964), pp. 198–209.

"Some Practical Suggestions for the Improvement of Science in Developing Countries," *Minerva* 4 (1966), pp. 382–390.

"The Physicist Interviewing Project," with Francis E. Dart, Department of Physics, University of Oregon, undated, 5 pp. (unpublished).

"The Physics Graduate Student in the United States: A Guide for Prospective Foreign Students," with Francis E. Dart, Department of Physics, University of Oregon, December 1969, 10 pp. (unpublished).

"Reflections on National Laboratories, *Bulletin of the Atomic Scientists*, (February 1970), pp. 11–15.

"Communication Among Scientists and Its Implications to Developing Countries." Lecture delivered at the Research and Development Management Seminar, Scientific and Technical Research Council of Turkey, in cooperation with the Technical Assistance Programme, Organization for Economic Cooperation and Development, Istanbul, May 1970, 21 pp. (unpublished).

"Basic Scientific Research in Developing Nations," based on lecture given at the Seminar on Research and Development Management, Scientific and Technical Research Council of Turkey, in cooperation with the Technical Assistance Programme of the Organization of Economic Cooperation and Development, Istanbul, May 1970, 22 pp. (unpublished).

"Education and Research in Scientifically Developing Countries," based on a lecture delivered at the Research and Development Management Seminar, Scientific and Technical Research Council of Turkey, Technical Assistance Program of the Organization for Economic Cooperation and Development, Istanbul, May 1970, 26 pp. (unpublished).

"How to Help with Modest Resources?" Lecture delivered at the meeting of the British Association, Durham, England, Sept. 7, 1970, 19 pp. (unpublished).

"A Chance to Close the Gap?" Feb. 5, 1971, 7 pp. (unpublished).

"Communication in the Worldwide Scientific Community," based on lecture given at the All-Pakistan Science Conference, University of Islamabad, Pakistan, 1973, 12 pp. (unpublished).

The reader's attention is also called to the work edited by Nader and Zahlan entitled, *Science and Technology in Developing Countries*, and referred to elsewhere in this study. While the book focuses mainly on the Middle East, much of the subject matter does have relevance to LDCs in general.

Building Trained Professional Manpower Resources.—Above all else, a sound scientific-technical infrastructure requires trained professional manpower. Professor Moravcsik cited this requirement as "one of the most important elements" in building a scientific environment:

> In science and much of technology, productivity per capita is the dominant factor in success, and to increase that, one needs highly trained, competent researchers, teachers, and technicians. Furthermore, since science and technology often progress through "breakthroughs", and these breakthroughs are due to the efforts of a very few people at the apex of scientific or technological creativity, there must be great emphasis on the quality of manpower as well as on the quantity. Second best in science and technology is often only tenth best when it is converted into its effect on the economic development of a country.[649]

Lacking an adequate supply of trained professional manpower, an infrastructure cannot take form, and development cannot be advanced. But the lack of trained scientific manpower is one of the most serious deficiencies in the LDCs. According to Professors Moravcsik and Dart, the "shortage of adequately trained manpower is one of the most important obstacles in the development of the emerging countries. In fact, many believe that as far as the development of science is concerned, it is *the* most important obstacle." [650] In most LDCs scientific manpower is "minuscule, fragmented, not always well trained, and lacks the critical mass and coherence to be effective." [651] These authors suggest that "one of the most valuable forms of help . . . that the more developed countries can offer, is assistance in training personnel." [652]

Establishing Educational Base in Science and Technology.—To establish a solid educational base is another requirement in building the infrastructure of science and technology in the LDCs. Professor Moravcsik believes that in principle indigenous scientific education at all levels is "absolutely essential in every country that contemplates any kind of scientific or technological activity." The alternative would be reliance on training abroad of all or most scientific and technical personnel. In the long run, this would be "impossible, and hence a development of indigenous education is a necessity." [653]

Indigenous education has the potential value of designing training programs that are geared to the practical needs of the LDCs and correlated with their research and development requirements. Though often flawed by an excess of educational formalism in methods of teaching to the neglect of problem-solving, indigenous education can develop "schools" of research and establish a larger scientific and technological tradition.[654]

However, until the LDCs succeed in establishing a self-contained educational system through graduate school, they are obliged to rely on the advanced countries to train their professionals. There are inherent risks in such foreign study: it is necessary to match training abroad with development needs, select students carefully to insure return, maintain contacts with them while abroad, and facilitate their employment on returning home.[655]

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[649] Moravcsik, "A Chance to Close the Gap?" p. 2.
[650] Dart and Moravcsik, "Physics Interviewing Project," p. 1.
[651] Moravcsik, "A Chance to Close the Gap?" p. 3.
[652] Dart and Moravcsik, "Physics Interviewing Project," p. 1.
[653] Moravcsik, "Education and Research in Scientifically Developing Countries," p. 1.
[654] Ibid., pp. 3–5.
[655] Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, p. 56.121.

Role of Basic Research.—Another contributing element in building a scientific infrastructure in the LDCs is emphasis on basic research, an essential basis of technological development. The LDCs are deficient in this area of scientific activity. Professor Moravcsik disagrees with those who assume that basic research is an "unjustifiable luxury" for the LDCs. "A somewhat more searching investigation," he writes, "will . . . support the contention that the underdeveloped countries must begin without delay to develop their scientific resources in the direction of fundamental research." [656] The reason for this conclusion lies in Moravcsik's belief that "the fundamental science of today is the applied science of tomorrow and because the educational process in science is a long process." [657]

Assignment of importance to indigenous basic research in the LDCs rests on the conviction that it:

—Establishes the essential base upon which is built the applied science and practical technology;

—Contributes to strengthening the scientific tradition and furthering the appreciation of science in national development;

—Provides the training ground for science administrators, those with the competence to be the decisionmakers for national science and development policy;

—Trains young professionals in the skills necessary for applied science and technological innovation;

—Increases the motivation of the country toward acceptance of technological innovation (which traditional cultures tend to resist); and

—Builds a network of communication for the diffusion of new scientific ideas; and as "one of the most sublime proving grounds for the human mind", success in basic research serves as a "source of great encouragement and high morale in the newly developing countries." [658]

Of course, as with most hypotheses concerning the development process, the value of a basic research program can be overstressed. The precise point in the development cycle at which the social yield of basic research activity is maximum would be difficult to determine. Also difficult is the determination of how much of an LDC's meagre resources to allocate to basic research. Clearly, the activity, carefully selected and stably supported, yields many values. And fortunate for this role of basic research in the infrastructure of the developing countries is that the costs, per researcher, of such research tends to be quite modest in most branches of science, as compared with costs of applied research and development.

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[656] Moravcsik, "Technical Assistance and Fundamental Research in Underdeveloped Countries," p. 198.

[657] Ibid. On another occasion Professor Moravcsik explained the urgency of developing basic research in the LDCs: "It is now my further assertion that since the establishment of basic scientific research is by nature a slow process which cannot be telescoped into short time period, even with unlimited amount of enthusiasm and money, therefore one must start *now* in order to see results thirty years from now." ("Basic Scientific Research in Developing Nations," p. 3.)

[658] Moravcsik, "Technical Assistance and Fundamental Research in Underdeveloped Countries," pp. 201–202. However, it should also be remembered that while basic research is inherently lower in cost than applied, the rewards tend to be long deferred. As Moravcsik observed, "one must start *now*" on establishing infrastructure for basic scientific research "in order to see results thirty years from now." ("Basic Scientific Research in Developing Nations," p. 3.)

Linkage Among Academia, Government, and Economic Sector.—A practical requirement for creating a scientific environment in the LDCs is the development of close ties among such a nation's academia, government, and economic sector. "Strenuous efforts" should be made, even at the most rudimentary level, states Professor Moravcsik, to strengthen the ties that bind this triad of national development. The device of the consultant, found useful in the United States, should be "vigorously explored" in the LDCs. The interaction among academia, government, and industry could be "extremely beneficial." Industry can gain from the advice of the scientists, and, as Moravcsik explains, "industrial exposure would help in bringing the academic scientist in a developed country out of his ivory tower, a tower which is much more massive and better insulated than the counterpart tower in many developing countries." [659]

What is involved here for the LDCs is the shrinking of lead-times between discoveries in basic sciences and their technological application. Professor Moravcsik explains:

> Only a country which can make a mark in a free international trade of technological products can hope to be economically viable in the long run, and to raise its per capita income to the levels achieved in the developed countries. In order to establish such a competitive industry, constant means must be found to inject into the growing industry rejuvenating and modernizing ingredients from recent scientific developments. This can be best accomplished by having people available locally who are in personal contact with such developments.[660]

Also involved is the direct participation of the scientific community with government and the economic sector in formulating national science policy and policy relating to the needs of national development. Brain drain specialists agree that scientists and technologists in the LDCs should play an active role in national planning and development.[661]

Developing the Scientific Spirit.—Another essential requirement in building an infrastructure of science and technology is the development of the scientific spirit. It is "particularly important," says Professor Moravcsik, that as a minimum "an adequate social climate" exist in which "research and development activities are at least condoned." He explains:

> There must be a general level of "scientific point of view" on the part of the whole society, a general readiness to encourage science and technology for what

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[659] Moravcsik, "Education and Research in Scientifically Developing Countries," pp. 24–25.

[660] Moravcsik, "Basic Scientific Research in Developing Nations," p. 10. However, it is to be noted that even the most highly developed countries, technologically, like the United States and the United Kingdom, have experienced considerable difficulty in effecting this "coupling" of research to application.

[661] Dr. Moravcsik made the following observations on the relationship between the scientific community of a country and the country's government:

"This relationship needs to be strengthened in many countries of the world. The participation of scientists in the national development planning process, in the joint formulation of science policy, as well as in the organization of education is of great importance. While science development must be insulated from politics as such so as to preserve its neutral and long range character, a recognition of the essential function of science in the country's development must be brought about by a joint collaboration of scientists and government officials. Science advisory bodies in the government, with a real role and an open channel of communication to the important decision makers must exist. Furthermore, more scientists must educate themselves in terms of the by now rather large amount of information that is available about science policy in general, and the building of science as part of a development process, in particular. Science libraries should have such material easily available, and vigorous discussion within the scientific community itself of such issues must precede the representation of the community before the government as a whole. Few countries, scientifically advanced or not, have done enough in this respect, so this problem is virtually a universal one." (Moravcsik, "Communication in the Worldwide Scientific Community," p. 4.)

they are, to understand and value their benefits and so give support and status to them.[662]

The LDCs need the development of the scientific spirit, for many of the problems of brain drain and thus development derive perhaps as much from an indifference to the proper role of science and technology in society as from the level of national poverty. Without prestige, status, and recognition of value to the nation, scientists and technologists are relegated to the lower orders of society (in contrast with the value system in advanced industrial countries). Morale declines, and as a consequence the LDC loses a valuable asset for development either through underutilization or brain drain.

High morale is accordingly very important to the scientific community: it provides "a motive force, a sense of purpose and faith in what one is doing, a philosophical and psychological conviction about certain values and goals." [663] But morale is "often very low" in the LDCs, and as Moravcsik explains:

> It is partly a matter of osmosis from the static quality of the society in which these scientists and engineers are embedded, and partly a feeling of hopelessness when it comes to an extrapolated comparison with the more advanced countries. But it goes deeper: as nothing succeeds as well as success, also nothing prevents success so much as lack of success.[664]

The creation of an all-pervading scientific spirit is thus essential to development in the modern technocratic age. Among the LDCs it can help transform national attitudes and values that now bar progress; it can reconstitute national cultures bringing them in line with the demands of the time. It can accomplish these goals by eroding the barriers of excessive traditionalism, by creating an appreciation of science and technology in the development process, and by instilling the habit of accepting as a normal function of life both change and the creative role of science and technology in responding to newly created needs brought on by change.

Value of Communications.—Development of a strong network of internal and external communications within the scientific community both at home and abroad is vital for developing a scientific environment in the LDCs. The developing countries face a very serious two-pronged problem: The maintenance and the supply of high-quality scientific manpower.[665] Lack of a strong communications network prevents cross-fertilization of ideas for intellectual stimulation and ultimately retards the growth of a virile scientific community. This deficiency has two negative effects: It encourages intellectual calcification among those who stay behind: It stimulates brain drain among the ambitious and the bright. In both cases, the LDC loses.

To accomplish their goal of national development, the LDCs need a strong network of communications within their scientific communities.

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[662] Moravcsik, "A Chance to Close the Gap?" p. 2.
[663] Ibid., p. 3.
[664] Ibid., p. 4.
[665] Moravcsik, "Technical Assistance and Fundamental Research in Underdeveloped Countries," p. 206.

Lack of internal communications is a serious deficiency.[666] Yet little effort and minimal funds would be required to build such a network. Devices like visiting lectureships, exchanges of professors, seminars, workshops, and conferences could serve the same useful purpose of communications within the LDCs as they do in the United States and other advanced countries of the West.[667]

Important in developing a scientific-technical infrastructure in the LDCs is the need to establish a network of communications between the LDCs and the advanced countries of the world. Moravcsik suggests various institutional devices to accomplish this end, such as, staging international scientific conferences; creating a system of visiting lectureships; arranging for exchanges of professors and research scientists; developing cooperative research projects on a university-to-university basis; creating bi-lateral ties between groups of scientists working on subjects of common interest; establishing a registry of scientists for assignments in the LDCs; and setting up a system of exchange of books, periodical literature, preprints, and other printed professional material.[668]

An international network of communications can minimize one of the most compelling "push" factors in brain drain, namely, intellectual isolation. Through this network, indigenous science in the LDCs can be nourished and strengthened by the inflow of fresh ideas, and stimulated by debate and analysis of new ideas. Possibilities can be increased for building prestige by contacts with the great teachers and universities of the advanced countries through exchanges and programs of visiting professors and by use of advanced scientific research facilities. Morale can be heightened as returning scholars, now more respected for their higher learning, impart their knowledge to interested students and even develop "schools" within their own academic realm. Visits by eminent Western scientists to these developing scientific institutions can add further to the accumuating prestige of institutions having working ties with their counterparts in the advanced countries. Thus fortified, developing indigenous science can offer an alternative to the potential brain drainee who may be lured into emigration by offers from abroad or the nonreturnee who finds greater prospects in a foreign country.[669]

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[666] Moravcsik, "Communication in the Worldwide Scientific Community," p. 3.

[667] At the All-Science Pakistan Conference in 1973, Professor Moravcsik observed: ". . . in many countries even the *internal* lines of scientific communication are weak. This is perhaps a peculiar thing to say at a meeting whose aim is exactly to bring together all the scientists in Pakistan and hence to strengthen the links of internal communication. But apart from such illustrious but rare occasions, how often does it happen that a chemist, say, from Islamabad gives a lecture to the chemistry professors and students at the University of Karachi? Or how much of an opportunity is there for somebody at the University of Hyderabad Sindh to hear in person a researcher from PINSTECH to describe his work? I hope you can prove me wrong, but from what I have seen in many other countries in the world, I would guess that the extent of such internal communication channels in Pakistan is probably slight, although it would require only a little work and rather minimal funds to develop them." (Ibid., p. 3.)

[668] Professor Moravcsik discusses these devices of communication in most of his writings, particularly in, "Communication Among Scientists and Its Implications to Developing Countries," and "How to Help With Modest Resources?"

[669] Moravcsik discusses certain aspects of the effects of connections with the advanced countries in, "Technical Assistance and Fundamental Research in Underdeveloped Countries," pp. 207–209.

Establishing "Centers of Excellence".—An important component in the network of communications is what brain drain specialists term "centers of excellence." They recommend this mechanism as a means for building and strengthening indigenous science nationally, regionally, and, as in the case of Africa and Latin America, continentally. Yet, little progress has been made.[670]

The value of establishing "centers of excellence" is readily apparent. Countries and regions in the developing areas can pool their limited funds and resources to build scientific institutions that would otherwise exceed their capabilities. Through cooperative efforts they can meet all the criteria for developing an indigenous science base. Subjects for study and research focus naturally on problems arising from the needs of the area. Scientists work under optimum conditions for professional contacts and communication and for developing research projects of common concern and interest. Regional "centers of excellence" serve as resource bases for establishing criteria and priorities in research, for identifying problems for study, and for allocating manpower where needed. These centers serve many purposes of the advanced research centers already existing in the advanced countries.[671]

The LDCs are conscious of the value of establishing "centers of excellence." Regional and continental conferences, such as those held in Latin America and Africa, have strongly recommended their establishment. The final report of the Conference on the Application and of Science and Technology to the Development of Latin America explained the purposes of such centers in a manner that has relevance to all LDCs:

> It has repeatedly been shown that centres with more than the minimum "critical mass" of teachers and research workers necessary to create a suitable working atmosphere and an adequate rate of production are needed for the training of scientists and technicians. The shortage of high-grade staff and the difficulty of obtaining a sufficient number of international technical assistance experts to meet the needs of all the countries in the region point to the desirability of concentrating efforts at regional centres or institutes, set up in different countries, as appropriate, according to speciality, which would serve as nurseries of talent for the whole of Latin America. The views expressed above with regard to the advantages of awarding fellowships and recruiting experts within the region emphasize the usefulness of such centres. In addition to strengthening existing centres, other new ones should be set up. In particular, it was deemed essential to set up an interdisciplinary regional centre to train research workers in the study of vegetation and environment, so that they may make a contribution to soil science and land use and to the rationalization of land management.[672]

A variety of existing institutions have been cited as "models" for "centers of excellence." The United Nations International Center for

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[670] Moravcsik points out that there are many developing areas of the world where scientific collaboration among themselves could improve science development significantly. But, "there are very few regions where such local international cooperation is a reality." ("How to Help With Modest Resources?" p. 17.)

[671] For a discussion of what "centers of excellence" could do for Africa, see Gardiner, op. cit., pp. 201–202.

[672] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 34.

Theoretical Physics in Trieste has been highly acclaimed for the benefits it can give to scientists and science in the LDCs.[673] The National University in Mexico has also been the subject of a case study of how a university can serve both indigenous science and the development purposes of the nation.[674] The Weizmann Institute of Science in Rehovoth, Israel has been singled out for its excellence in fundamental research.[675] A variation on models is the suggestion of Professor Abdus Salam of Pakistan, who has been promoting the idea of a "world university" built on a confederation of advanced research institutions like his own in Pakistan. The purposes of the university would be directed towards developing science in the LDCs.[676] The study by the Committee on the International Migration of Talent (CIMT) cites such models as the Indian Institute of Technology, the Di Tella Foundation in Argentina, Hacettepe University Medical School in Ankara, La Molina Agricultural University in Peru, the University of Valle in Colombia, the Korean Institute of Science and Technology, and many of the newly created universities in Africa.[677]

"Centers of excellence" may be a beginning for the development of indigenous science in the LDCs. Though their full potential is far from being realized, their existence appears vital to science and development. Again, as Professor Moravcsik observes, "The importance of the indigenous element in the establishment of scientific tradition cannot be overemphasized, and skillful external fostering and encouragement of such an element through the marshalling of the joint resources of a region are essential." [678]

However, the CIMT study cautions that the potential total effect of a new institute on development should be the center of attention, not potential effects on migration. Citing the case of the Korean Institute of Science and Technology, it noted that almost 50 Korean Ph. D.s returned from the United States to work at this Institute. But, it emphasized, "what makes the Institute worthwhile is its product—industrial development and innovation. The return of emigres is a bonus." [679] Nevertheless, however valid that conclusion may be, the role of "centers of excellence" in supplementing the repatriation efforts by LDCs trying to bring back their scientists and technologists who have been drained off to the advanced countries is not to be discounted. In many cases such efforts have proved to be most effective in retrieving

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[673] *The New York Times*, Nov. 23, 1969, p. 82. Philip Dallas, "Helping Young Nations Keep Their Physicists Home," *Management Review* (February 1968), pp. 52–53.

[674] Carl Djerassi, "Research Centers in Developing Nations," *Development Digest* 7, (April 1969), pp. 64–66.

[675] Nader, "Technical Experts in Developing Countries," *Science and Technology in Developing Countries*, p. 474.

[676] *The New York Times*, Nov. 23, 1969, p. 82.

[677] CIMT study, p. 710.

[678] Moravcsik, "How to Help With Modest Resource?" p. 17.

[679] CIMT study, p. 710.

drainees and thus ultimately strengthening the resources of scientific manpower in the LDCs.[680]

Imperatives of National Science Policy.—Achieving national development through science and technology is clearly a complicated and burdensome task for the LDCs. The requirements are demanding; the area for compromise, limited. Instructive are the imperatives of national science policy in recommendations by the 1964 Lagos Conference of African States on the Organization of Research and Training in Africa. Sponsored by UNESCO, the Conference compiled a list of imperatives that could be guiding principles applicable to all LDCs. They suggest the dimension of the tasks that lie ahead for the LDCs in their quest for national development gains through the use of science and technology:

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[680] The Indian Government supports a retrieval program called the "Scientists Pool Scheme." Over a period of 9 years it succeeded in bringing back 2,300 scientists and other professionals to India. ("Scientific Manpower in India, *Development Digest* 7 (April 1969), pp. 69–73). Dr. Kidd explained the success of Argentina's repatriation program: ". . . it is feasible, as Argentina has demonstrated, to mount a repatriation program aimed particularly at this key segment, not the ordinary, practicing physician or engineer who comes up here to make a better living; but this small, crucial group of people who can energize the universities, the research institutes, and governmental offices and activities. There, I think, although it won't solve the basic economic and cultural and governmental problems, selected and directed repatriation can, as has been demonstrated in Agentina, bring people back." (Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 137). Efforts to retrieve professionals, particularly students studying in the United States, are described by Habib Naficy *in* "Brain Drain: The Case of Iranian Non-Returnees," op. cit., p. 71 and Michael W. Suleiman, in "Repatriation of Arab Elites," op. cit., pp. 71–80. On Feb. 6, 1973, ABC Evening News (7:00 o'clock) with Howard K. Smith and Harry Reasoner broadcast a report from Peter Jennings in Jordan in which he indicated that Hasan, the younger brother of Hussein, is an intellectual; that he headed the Jordanian Academy of Sciences; and that over the years he has made a determined effort to bring modern technology to Jordan. One aspect of his program has been to reclaim lost Jordanians who came to the United States for education, received their advanced degrees and stayed on as brain drainees. Many have returned, because of Hasan's efforts, Jennings reported, and now constitute what Jennings referred to as Hasan's "brain trust" for the modern development of Jordan.

Nigeria is undertaking what appears to be a far-reaching program to retrieve some of its brain drain losses to the United States. A press report from Lagos, Nigeria in mid-February 1974 indicated than an official Nigerian delegation was touring several American cities (New York, Washington, Chicago, Miami, Atlanta, Los Angeles and San Francisco) to inform Nigerians about job opportunities back home. The delegation, led by the federal Commissioner for Economic Development and Reconstruction, Prof. Adebayo Adedeji, is the latest of Nigeria's efforts to convince students and graduates that they should return home. Nigerian officials estimate that there were probably 5,000 to 10,000 Nigerians living in the United States who intended to remain. In the past, several appeals have been made and, from time to time, small numbers returned home.. The brain drain problem is especially acute in Nigeria because, as the press account put it, of the "dire shortage of skilled Nigerians to man its booming, oil-based economy." J. O. Oche, information officer for the National Youth Service Corps, and a member of the touring delegation said: "Their physical presence in Nigeria and their assistance to their people is most necessary at this stage of our development."

The delegation was expected to meet many Nigerians holding professional positions in business, industry and education. But, as this study indicates in citing the causal factors for immigration, the Nigerians face three problems: a large number of their drainees have married American women; some are Ibos who sided with Biafra during the civil war and are not convinced by the many reports of reconciliation that they would be welcomed back in Nigeria; and others fear that their skills developed in the United States cannot be put to proper use in Nigeria.

More than any other black African nation, Nigeria, large and populous, has in recent years given a major priority to training its own professionals at home. Plans have been made to add university spaces, and predictions have been made that within a decade a system of teaching hospitals and petroleum institutes will educate all but the most specialized doctors and engineers. The proudest claim during the recent 25th anniversary celebrations of the University of Ibadan, founded in 1948, was that it had provided much of the skilled mannower now functioning in Nigerian Government and industry. The University has produced about half of Nigeria's 2,000 doctors and three-fourths of its 4,140 educators and administrators. (Thomas A. Johnson, "Nigeria Tries to Lure Graduates Home," *The New York Times*, Feb. 17, 1974, pp. 1 and 5.)

An indication of donor country efforts to retrieve emigrant professionals is shown in a mid-1970 survey by the National Science Foundation of some 8,000 alien scientists and engineers who were permanent U.S. residents in January 1969. According to the survey, "fully 37 percent . . . had been contacted by foreign employers for remigration." (NSF, *Study of Characteristics and Attitudes of Immigrant Scientists and Engineers in the U.S.*, 1973, p. vii.)

1. Realization by the African governments of the need to establish short- and long-term economic development programmes.
2. Recognition by those governments of the need to establish scientific research and industrial research programmes, both short term and long term.
3. Recognition by the governments of their responsibility for the organization of scientific research and for the encouragement of research by creating an atmosphere favourable to it.
4. Recognition by scientists of their responsibilities towards their own countries. Respect for academic freedom and the right to a free choice of methods and techniques are vitally important to the activities of research workers who, however, in choosing their subject of research, must keep in mind the needs of their respective countries.
5. Recognition of the need to establish a proper balance between fundamental and applied research. The African countries are aware of the importance of fundamental research and oriented research, knowing that their development is indispensable to progress in applied research and that they constitute the base of the pyramid of research activities.
6. Recognition of the need for scientific collaboration, at both the regional and the continental levels, in order to solve common problems.
7. Recognition of the need to establish at the highest level a body that will be responsbile for the elaboration of the national scientific policy and the coordination of research activities. The structure of such bodies will vary from country to country according to the prevailing structures and conditions in each.
8. Recognition of the need for studies and research on natural resources and the co-ordination of the activities of the bodies responsible for them.
9. Recognition of the need to train a sufficient number of research personnel as rapidly as possible, and recognition of the essential role of the universities in this regard.
10. Recognition of the need to include in all national budgets a special chapter for scientific and technical research.[651]

PERSISTING DIFFICULTIES AND DILEMMAS

Reducing the development gap by creating a scientific-technological infrastructure would appreciably diminish the "push" factors in brain drain from the LDCs. Economic development, rationally planned, energetically carried out, and successful in its designs and purposes, could create market conditions for engaging the services of any surplus professional manpower. A developing science and technology, flourishing in this environment, could also provide the instrumentalities for accelerating the pace of development and transforming traditional, static societies into dynamic modern states.

But there are persisting difficulties that reduce the scale of probable success; they derive from three sources: economic deficiencies, problems in institution-building, and inherent difficulties in the changing of attitudes of traditional societies.

Economic Deficiencies.—As shown in the next chapter on the foreign policy implications of brain drain. the development gap between the LDCs and advanced countries is widening, not diminishing. Yet success in reducing brain drain depends upon quickening the pace of economic development and reducing this gap. Ironically, the acute energy crisis in early 1974, generated by the Arab countries of the Middle East, themselves LDCs, aggravated the chronic economic situation in the LDCs throughout the world—particularly in the case of

[651] United Nations Educational, Scientific and Cultural Organization, *Outline of a Plan for Scientific Research and Training in Africa,* International Conference on the Organization of Research and Training in Africa in Relation to the Study, Conservation and Utilization of Natural Resources, Lagos, Nigeria, July 28 to Aug. 6, 1964, pp. 10–11.

India—and dimmed still further their prospects for economic progress.[682]

Problems in Institution-Building.—Furthermore, the long-term solution to brain drain, as Dr. Frankel, Prof. William C. Theisenhusen of the University of Wisconsin's Land Tenure Center, and other development specialists have concluded, must lie in institution-building in the LDCs.[683] Yet, this is a long, arduous process. Success can come only with patience, energy, and determination from both the LDCs and the assisting advanced countries, and within a continuing relationship of cooperation and interdependence. For success requires, in effect, compressing centuries of Western development into a short time-span to alter alien cultures rigid with traditionalism and the values of an earlier and unsympathetic age.[684] And as Caryl P. Haskins, educator, research scientist, and President of the Carnegie Institution, wrote: "For the developing countries, the time dimension in an already scientifically sophisticated outer world is precariously narrow, and the challenge even more formidable." [685]

Difficulty in Transforming Traditional Societies.—Added to the problem of institution-building is the far more profound problem of transforming man himself, that is, trying to induce traditional, static societies, some quite primitive, to accept societal change as a fact of life, to believe in man's power to institute change, to accept man's instrumentalities for bringing about change, and to want to participate in seeking the goals and achieving the aspirations of modern man. In brief, the problem is that of uprooting one set of traditional cultural values and replacing them with another.

This is a difficult assignment. As anthropologist B. Malinowski wrote a quarter of a century ago in a paper on native education in Africa: "To educate a primitive community out of its culture and to make it adopt integrally that of a much more highly differentiated society is a gigantic task." [686] Yet, this is what modernization means:

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[682] Indian dependency on oil and the shortfalls brought on by the Arab oil embargo affects seriously the production of fertilizer which is badly needed in agriculture. Observers now use such terms as "disaster" in discussing the turn of events in India. United States Ambassador to India Daniel P. Moynihan told the House Foreign Affairs Committee: "We expect a 25 percent shortfall in fertilizer, and that means famine." (See Lewis M. Simons, "India Staggers as Oil Scarcity Saps Economy," *The Washington Post,* Jan. 30, 1974, p. A6 and p. A8.) Similar comments have been made about the impact on the African States of the sharp increases in petroleum prices.

[683] For Theisenhusen's discussion of this problem, see, Hearings, House Government Operations Committee, *Brain Drain,* 1968, pp. 25–26.

[684] In one paragraph Jacques Barzun, philosopher and historian at Columbia University, summed up those forces that contributed to the development of science in the Western world: "The rapid conquest of the Western mind by science after the mid-nineteenth century—I mean science as the exclusive form of truth—was aided by a number of other great changes going on at the same time: the secularization of life, which had begun with the Reformation; the urbanization and mobilization of men since the industrial revolution, which was technological and not scientific; and, finally, the rise of the individual and the mass against authority—an impulse we find variously expressed in such movements as democracy, utilitarianism, positivism, statistics, and (to use a single general term) the sociological outlook.

"Science as an institution is therefore a new structure supported by several older and very solid buttresses . . ." (Jacques Barzun, "Science as a Social Institution," *Proceedings of the Academy of Political Science,* Columbia University, 28 (April 1966), pp. 123–124).

Agenda for Some Thinking," *Selected Readings on International Education,* House Committee on Education and Labor, 1966, p. 418.

[686] Quoted in, Sir Eric Ashby, "What Role for the University? Universities for Export:

[685] Haskins, op. cit., p. 239.

it means a radical transformation of society and man's outlook towards society; it means virtually a reconstitution of his whole being—cultural, psychological, social, and even religious.[687]

To quote further from Caryl Haskins: "Only in a cultural climate where the fundamental drives of curiosity and of the love of discovery for its own sake are understood and cultivated can a true science flourish." [688] Such a climate must be created in the LDCs if science and technology are to take root and flourish and development is to occur. For it is not just a matter of asking, "How can the people of technically less advanced countries learn the modern techniques?" Rather it is to ask, "Will they learn them, and how can they be induced to want to learn them?" [689]

Dilemma of Human Rights and Inequality.—These difficulties are compounded by dilemmas that seem to defy resolution. One dilemma centers on human rights; the other on inequality in human existence. The first concerns rights of the individual as opposed to rights of the state, obligations of the individual to himself as a free human being as opposed to obligations assumed as a member of a community and state. The Universal Declaration of Human Rights in article 13, paragraph 2 proclaims the principle of freedom of emigration; [690] article 23 paragraph 1 reinforces this principle by proclaiming the right to work, to "free choice of employment, to just and favourable conditions of work and to protection against unemployment." Yet article 29 lays down the principle of obligations to the community and state and recognition of certain limitations on the exercise of individual rights and freedoms, including those related to the general welfare in a demo-

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[687] Claire Nader observed that, "the education of the general population whose support, in the end, will be needed in order for modern science and its applications to root in a society is all important." After elaborating on the importance of educating the public in the value of science and technology, Professor Nader quotes an African zoologist who believed that this did not go far enough. What is instructive in his comments is the depth of the cultural changes that are needed in LDCs in order for science to flourish. He wrote:

> . . . if we wish the African to embrace more science than merely technology then we must reach the basic root of the problem, his monistic world-view, and modify it in a manner in which he can begin to regard Nature apart from himself or other beings. The rewriting and remodelling of teaching materials which have been successful in the West or in the East is not enough. We will have to begin from the beginning, with the help of African social scientists and philosophers. This should be the foundation of any new science policy for Africa.

(Nader, "Technical Experts in Developing Countries," *Science and Technology in Developing Countries*, pp. 467–468.)

For other aspects of the problem of transforming man's outlook on society, particularly in the context of building an environment of science and technology, see Gerald Sykes, "The Mental Requirements for Modern Power," *Science and Technology in Developing Countries*, pp. 553–559. In one instance he speaks of "desacralization", that is, "a removal of the sacred as an unconscious factor in one's mental processes." "New habits of desacralization," he writes, "made science possible."

[688] Haskins, op. cit., p. 244. Dr. Haskins continues: "Paradoxically, it is only when such a science becomes deeply rooted as an element of high culture that a progressively innovative technology can be maintained over long periods, fusing eventually into the close partnership with which we are familiar today. And even when attained, that partnership can never be taken for granted. The maintenance of its health and vigor requires constant attention."

[689] Ward Hunt Goodenough, *Cooperation in Change: An Anthropological Approach to Community Development* (New York: Russell Sage Foundation, 1963), pp. 36–37.

[690] "Everyone has the right to leave any country, including his own, and to return to his country." This right is an extension of the right in paragraph 1 of the same article which states: "Everyone has the right to freedom of movement and residence within the borders of each State." The Secretary General's report explains: "The first may very well be regarded as the right of personal self-determination and would involve consideration of a number of related rights of the individual, such as the right to liberty (article 3). Freedom of movement or locomotion is a constitutional element of personal liberty."

cratic society.[691] Reconciliation of the two principles creates a grave dilemma for both the individual and for the state.

At the heart of the dilemma is the fundamental question of principle: whether the state exists for the individual or the individual for the state. It is thus a question of primacy of the individual or the state. The CIMT study group supports the validity of the democratic principle asserting primacy of individual rights over those of the state.[692] The Soviet Union, at another point in the political spectrum, reverses priorities of principles: the state is the first principle of existence; thus emigration is not a right of the individual but a privilege granted by the state. (A person cannot emigrate from the Soviet Union without approval of the central government, as is currently being demonstrated in the case of Soviet Jews wishing to emigrate. The same requirement existed during Czarist times. Even within the Soviet Union movement of persons is controlled by a strictly enforced internal passport system.) The People's Republic of China, like the Soviet Union, has no brain drain problem. Guided by similarly restrictive political principles, it, too, rigidly controls the outward movement of its peoples.[693]

Yet democratically inclined states are often faced with the dilemma of enforcing their rights over those of the individual. Both India and Ceylon, for example, have taken steps to restrict emigration, apparently with mixed results.[694] The fact of the matter is that the practice of genuine democracy and the coercive act of denying the right of emigration are principles in contradiction. For this reason the LDCs

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[691] Article 29 reads:

"(1) Everyone has duties to the community in which alone the free and full development of his personality is possible.

"(2) In the exercise of his rights and freedoms, everyone shall be subject only to such limitations as are determined by law solely for the purpose of securing due recognition and respect for the rights and freedoms of others and of meeting the just requirements of morality, public order and the general welfare in a democratic society." (*United Nations Yearbook, 1948–1949*. United Nations Publication, Sales no.: 50.I.11, p. 537.) (Cited in, Report of U.N. Secretary General, *Outflow of Trained Personnel from LDCs*, Nov. 5, 1968, pp. 11–13.)

[692] The study states: "So far as control is concerned, any less developed country has the legal power to forbid its citizens to migrate if it believes that such a measure will be to the benefit of the state. This is one way to cope with whatever problems migration may generate. However, our view is that the state exists to help the individual, rather than the reverse." (The CIMT study, p. 701.)

[693] The Soviet attitude toward brain drain is evident in their refusal to permit the unrestricted emigration of Soviet Jews, many of whom are scientists and reside in Moscow, Leningrad, and other important scientific centers in the RSFSR. The following is an analysis of recent Soviet statistics on scientific manpower and the possible impact of the emigration of Soviet Jewish scientists on the Soviet economy. The Soviet attitude toward brain drain from the U.S.S.R. can be inferred by the small number of Soviet Jewish scientists who have been permitted to emigrate:

"It is not only important to look at the declining share of scientists (*nauchnyye rabotniki*) enumerated as Jews according to official Soviet statistics, but also their geographic distribution as particularly related to the alleged brain drain of the Soviet Jewish emigration. According to Statisticheskoye upravleniya goroda Moskvy, *Moskva v tsifrakh (1966–1970gg.). Kratkiy statisticheskiy sbornik (Moscow in Figures, 1966-1970. A Short Statistical Collection)*, Moscow: Statistika, 1972, p. 140, the number of Jewish scientists in Moscow city on January 1, 1971 amounted to 25,023. Dividing this number (25,023) by the total number of scientific personnel at the end of 1970 (64,392), it becomes evident that almost 40 percent (or 38.9 percent, to be more precise) resided in Moscow. If one assumes that there are perhaps another 10,000 Jewish scientists in Leningrad and another 5,000 in Novosibirsk and all other locations in the R.S.F.S.R., then in 1970 this republic would account for some 40,000 Jewish scientists, or almost two-thirds of the 64,392 enumerated. Also, according to various sources, only 1,000 persons (men, women, and children) out of the 61,000 who were allowed to emigrate from the Soviet Union through the end of 1972 previously resided in the R.S.F.S.R. Thus, very, very few of the Jewish scientists were permitted to emigrate and the impact of the emigration, i.e., the brain drain, on the Soviet economy remains minimal." (A "note" to be published in a forthcoming issue of, *Bulletin of The Association for Comparative Economic Studies*, Bloomington, Ind., 1974.)

[694] The Indian Government attempted to stop the outflow of physicians, apparently unsuccessfully, by prohibiting the further administration of the ECFMG examination on its territory in 1967. Ceylon, faced with the threat of a major outbreak of polio in 1971, was forced to take emergency measures to stop the emigration of M.D.s, including the denial of exit permits for those leaving for employment abroad. (Stevens and Vermeulen, op. cit., p. 70.)

that profess to be democracies, like India, are placed in the gravest dilemma, in attempting to prevent brain drain by coercive administrative actions.

To worsen their dilemma, the enforcing of restraints on individual movement, especially of professionals, tends to reduce the productivity of those who are compelled by choice to stay at home. As Dr. Giorgi said: ". . . coercive measures a government may adopt will be useless if the scientist and engineer is discontented at home; his usefulness will undoubtedly diminish, or disappear altogether." "Intelligence, imagination, and insight," he continued, "flourish only when the intelligence can devote himself in peace and quiet to his scientific or technological research, never when he is forced to work against his will." [695] For this pragmatic reason, the CIMT study concludes, "restrictive measures are of dubious value." [696] Still, the dilemma persists as a basic consideration for those attempting to remedy the "push" of emigrating professionals from the LDCs.

Much the same can be said for the dilemma of inequality that is inherent in human existence. What makes the solution of brain drain so extraordinarily difficult is that the essence of brain drain is inequality, especially economic inequality: it is a problem that arises out of the poverty of the poor and the dispossessed of the world; it is rooted in the lack, or uneven pace, of development of nations; and so long as inequality exists (and history is on the side of the pessimists) the emigration of talent will always take place. That is why brain drain is more an historical process than an historical event. The ideal corrective would appear to lie in raising the level of development of all nations to one of common acceptance and general satisfaction, and thus to encourage talented people to be satisfied with their lot and stay home or equalize exchange. But this is utopian; it is not possible. Nor is it possible to transform societies so radically that they can correct all the internal causes of brain drain. The division between rich and poor is expanding, not contracting, not only globally but as Robert S. McNamara, President of the World Bank pointed out, even within the LDCs themselves.[697] Thus, the dilemma of inequality in human existence persists.

Yet Dr. Kidd, drawing a parallel between the life of nations and the life of individuals, offers what seems to be at least the beginning of a resolution of this dilemma. Solutions of brain drain are not to be found in expecting to create an ideal state of affairs where all parties, that is, the countries and the individuals, will be "relaxed and happy." It is, he implies, rather to accept the inequality of nations, their lack of or unequal pace of development, and the problems issuing therefrom, as a fact of life, and to consider brain drain as a "chronic dis-

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[695] In commenting on the prevention of emigration, Dr. Giorgi observed: "The problem is not easy. States must reckon with individual freedom which, in free countries, sooner or later becomes the deciding factor in determining where a man may travel and live." (UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America,* 1965, p. 182.)

Regarding other means of coercion, Dr. Giorgi quoted approvingly from an article by Sergio Gutierrez Olivos and Jorge Riquelme Perez: ". . . we are against negative measures, e.g. taxing graduates who emigrate, or reducing the number of years for certain courses so as to make it less attractive to do the same courses abroad. These are no solution for the basic problem and can only lead to frustration and, very probably, increased emigration." (p. 185).

[696] The CIMT study, p. 702.

[697] See Robert S. McNamara. "Address to the Board of Governors of the World Bank Group," Nairobi, Kenya, Sept. 24, 1973, 31 pp.

order for which no cure exists and not as an acute disorder for which a specific remedy exists." And he offers this encouragement: As with many chronic disorders, "it is possible to take measures which permit normal development and normal life." [698]

The dilemma of inequality may, therefore, persist in the natural order of life, but mediating certain "chronic disorders," such as brain drain, may not be entirely beyond the rational management of man.

Remedies by Diminishing the "Pull" Factors in Brain Drain

Remedies for brain drain do not rest entirely upon the LDCs; the advanced countries, particularly the United States, can take some measures to diminish the "pull" factors in brain drain and lessen the burden thrust upon the LDCs.

EXPANSION OF AMERICAN MEDICAL SCHOOLS

Medical brain drain offers a promising potential area for remedial action. A decade ago when the problem was far less acute than it is today, American students of brain drain and development specialists strongly urged the United States to expand its medical school facilities, and to train a sufficient number of doctors to meet present and future manpower demands (the shortage is generally placed at about 50,000 doctors). These two actions could go far toward ending American dependency on FMGs from the LDCs.[699]

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[698] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 80.

[699] Dr. G. Halsey Hunt testified before the House Government Operations Committee: "The long-range solution of the brain drain problem in medicine will require the development of new medical schools in the United States, and the enlarging of some of the present schools, to provide a much greater output of U.S. physicians than we now have." (Hearings, House, Government Operations Committee, *Brain Drain*, 1968, p. 68.)

Dr. Charles C. Sprague told the same committee: "I do feel . . . that it should be our national purpose to ultimately meet our own needs in terms of educating an adequate number of physicians. Now, obviously, there is a transition period, but I do not feel that we should look forever to the developing countries for a continuing source of manpower in the physician field." (p. 63) In a list of recommendations for the Committee, Dr. Sprague cited the following: "7. We must assume the responsibility for training sufficient kinds and numbers of health personnel to answer the needs of our people and not rely on other nations as we are presently doing." (p. 67.)

Dr. Adams told the Committee: ". . . I think this immigration of medical doctors from abroad is a reflection of the fact that as a nation we have not produced enough medical talent. The specific policy conclusions to be drawn from that is to increase the number of American medical graduates. And that will automatically reduce the number of people 'imported' from abroad." (p. 88.)

Dr. Frankel told the Senate Judiciary Committee: "On our side, at home, we can take action to train more Americans to fill the positions now filled by foreigners. An effort to increase the number of United States medical schools, for example, would be the best long-range approach to helping other countries retain the services of their own native physicians." (Hearings, Senate, Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 21.)

Finally, the House Government Operations Committee recommended in its 23rd report on "Scientific brain drain from the developing countries": *"To reduce with greater speed the present growing dependence of the United States on foreign medical manpower—both practitioners and trainees—the committee urgently recommends further Federal and private efforts to increase the output and efficient utilization of U.S. physicians."* (Report, House, Government Operations Committee, *Scientific Brain Drain from the LDCs*, 1968, p. 13.)

Prof. Herbert Grubel made the following observation in the State Department workshop on international migration: "I would like to make a suggestion on how to solve the problem of foreign medical personnel coming to the United States, and that is that the American Medical Association release some of the grip that it has on the quantity of students who are being trained to enter the medical profession. I think that the influence that the AMA has had in this has been recognized widely." (Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, 1968, p. 143.)

The Hon. Paul H. Douglas, former U.S. Senator from Illinois, made a similar comment in the Preface of the book "Brain drain" on the need to expand medical training facilities as a remedy for medical brain drain: "The American Medical Association should cease its advocacy of excessively restrictive practices as regards entrance to the profession, thus diminishing the numbers of doctors to be imported from abroad." (Adams, *Brain Drain*, p. xiii.)

EFFICIENCY IN MEDICAL MANPOWER MANAGEMENT

Another kind of reform urged by students of U.S. medical care delivery systems is the heightened rationalization in medical manpower planning, particularly the more efficient use of paramedical personnel to relieve doctors of routine tasks that could be done by semiprofessionals specifically trained for that purpose. (An example is the training of peacetime prototypes of the medical corpsmen used so successfully in the military service during World War II, the Korean War and the Vietnam War. Apparently the doctor's assistant programs, operating in many medical facilities in the country, is structured along these lines.)[700]

With a satisfied American medical manpower market, it is reasoned, the "pull" force attracting FMGs to the United States will diminish. FMGs will then be constrained to work in their own countries and meet its needs, which are by all accounts overwhelming. Given a freely operating manpower market, surplus professionals and professional trainees will be impelled to restructure their career plans, rethink their career expectations, and accordingly move into areas where the demands and needs of their countries are the greatest and for them the most professionally satisfying and profitable.

Other remedies for medical brain drain have been suggested by various sources including the Panel on FMGs of the National Advisory Commission on Health Manpower. But these remedies appear to overlook the more fundamental supply-demand problem that governs the American marketplace for medical manpower, the main source generating the flow of immigrant FMGs; they focus rather on the more superficial, administrative features of the problem, such as, FMG qualifications and changes in visa policies requiring return on completion of training.[701] Professor Deutsch put this problem of remedies in proper balance when he wrote of the essential importance of diminishing the "pull" factors of brain drain:

> The problem . . . is not only one of preventing the "brain drain" by providing incentives for foreign students and experts to return to their home countries, but also of increasing human-resource development in the United States so as to reduce this country's need to attract talent and skills from the other nations of the world.[702]

In brief, the remedy for medical brain drain lies in human-resource development in the United States. In the case of the inflow of scientists

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[700] Dr. Hunt observed in his testimony to the House Government Operations Committee: "The long-range solution of the brain drain problem in medicine . . . will also require the development, as Dr. Sprague suggested, of methods of greater utilization of paramedical personnel to relieve the doctors of some of the things that they are now doing." (Hearings, House, Government Operations Committee, *Brain Drain*, 1968, p. 68.) Dr. Hunt referred to a recommendation by the National Advisory Commission on Health Manpower concerning FMGs which, he said, would eventually result in a considerable diminution in the number coming to the United States. But he added: "The reduction in the number of foreign medical graduates recommended by the Commission cannot realistically be expected to take place until the vacuum created by the shortage of physicians' services in U.S. hospitals has been alleviated by the production of more U.S. doctors, or by greater utilization of paramedical personnel, or both." (pp. 68–69.)

Stevens and Vermeulen discuss the use of physician associates or assistants as a means for meeting the critical need of medical care. (Stevens and Vermeulen, op. cit., pp. 77–78.)

During World War II, the writer was attached to U.S. Marine Corps Evacuation Hospital No. 1 in the Pacific and participated in the Iwo Jima campaign and the occupation of Japan. This highly mobile hospital unit was composed of some 23 officers, mostly physicians and surgeons, and 220 men, mostly U.S. Navy medical corpsmen. This personal experience, supported by the judgments of the physicians and surgeons, tends to confirm the views of those who value the services of paramedical personnel.

[701] Stevens and Vermeulen, op. cit., pp. 68–69.

[702] Deutsch, op. cit., p. 30.

and engineers from the LDCs, declining demand and increased domestic supply in the American manpower market are diminishing the "pull" of professionals from abroad. The manpower market mechanism is, therefore, shown to be a corrective for this aspect of brain drain from the LDCs. In the same way, expansion of domestically trained U.S. medical personnel and heightened efficiency of their use would enable the same market mechanisms to take effect in the field of medical care delivery in the United States.

RENEWAL OF AMERICAN COMMITMENT TO INTERNATIONAL DEVELOPMENT

At the "other end" of the brain drain, the United States can help reduce the "push" factor within the LDCs by renewing its commitment to international development.

Remedy Through Development Assistance.—One dominating theme running through the literature on brain drain is remedy through development assistance. The CIMT study makes this comprehensive judgment:

> Advanced countries should and can do more to assist the development of less developed countries, and, thereby, help to moderate the forces leading to migration. They should do more both because of long-range economic and political self-interest and out of compassion. We accept the thesis that the fate of the rich parts of the world is linked to the economic growth, political stability, and national development of the poor parts of the world.[703]

Past and present administrations, as noted in the next chapter, have reaffirmed the American commitment to development, and scholars like Dr. Perkins have urged this country to take the lead. "We must work to increase the bargaining power of the less developed countries so that the drain is not a disaster," he wrote. "And we must call forth our highest powers of statesmanship to contain our short-run domestic interests in favor of our longer-range interest in the welfare and progress of man." [704]

In 1968, Dr. Kidd made an appeal that has even greater relevance in today's climate of declining American interest in development. He told the House Government Operations Committee then studying brain drain:

> Now, it seems to me that the fundamental obligation of the United States which is real and urgent is to deal effectively with the problems of economic development and that we should put the migration question within the context of the obligations of the United States for economic development. In this connection, I certainly agree with my fellow panel members (Dr. Adams, Rev. Gibbons, Dr. Hunt, Dr. Shearer, Dr. Sprague, and Prof. Theisenhusen) that increased attention should be given in the total AID program to institution build-

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[703] CIMT study, p. 714.

[704] Perkins, op. cit., p. 619. In stressing the idea that the starting point for remedying the brain drain "must be the policies of the developing country itself," Under Secretary of State Eugene Rostow made this statement on this nation's efforts in development:

> This basic responsibility is not ours, and we cannot assume it. We can only help those who want to help themselves. We already are helping in this regard in many countries whose basic educational policies are sound. Indeed, the basic thrust of our development programs abroad is to widen the range for domestic choices available to skilled people—to encourage personal initiative, to stimulate the development of institutions, and generate the incentives in a given nation to compete with others in obtaining and retaining talented manpower.
>
> Similarly, the basis underlying our programs of educational cooperation and technical assistance is to help other nations strengthen their programs of educational development, and in so doing strengthen and enrich the world community.

(Hearings, Senate, Judiciary Committee, *International Migration of Talent and Skills*, 1968, pp. 6–7.)

ing, to sophisticated technical assistance, to measures that are importantly and directly relevant to economic development in the AID countries. And the expansion of institutions such as Icetex (Instituto Colombiano de Especializacion Tecnica en el Erterior—Colombian Institute for Student Aid and Technical Studies Abroad),[705] I think is a very high priority.

So I would say that there are things we should do with respect to migration, but in my opinion, they ought to be put firmly in the context of economic development.[706]

Development assistance in its many forms (technical assistance, student-scholar exchanges, seed money for new programs, and the like) is perhaps the most complete remedy for brain drain: it permits the intellectual and material resources, the science and technology of the advanced countries like the United States to be put into the service of regenerating the poor and dispossessed of the world; it contains the means of achieving at least some measure of equality in a world of unequal distribution of wealth and resources; it encourages the interplay and development of interdependence from which both sides have something to gain; and it offers prospects of institution building and material progress that provide an alternative for the gifted and thus encourages them to stay at home.[707]

Role of Multinational Corporations (MNCs) in Development.—Multinational corporations (MNCs) have the potential to play a creative role in development. Defined as a business enterprise conducting transnational operations in two or more countries, the MNC has the institutional resources to help the LDCs modernize, and accordingly can contribute to reducing the "push" factor of brain drain.[708] The extent of these resources is shown in the Diebold Institute report of 1973 entitled, "Business and Developing Countries." According to the report, the MNCs carry on global operations amounting to $350 billion in annual business outside their home countries. This figure is 10 percent of the total world production of goods and services. U.S. companies account for approximately 60 percent of this total. Since 1950, foreign investments of U.S. companies have increased from $12 billion to at least $90 billion. The Diebold report predicts that the trend towards expansion will accelerate. MNCs are said to be expanding at an annual rate of 10 percent, twice that of the world product; and more companies are expected to go multinational in the future.[709]

The LDCs can be expected to share in the economic benefits from this expansion of international business. Critics, however, have regarded MNCs as a mixed blessing and caution against such adverse effects of their operations as the transfer of pollution from the advanced countries to the LDCs, the exploitation of labor, especially in

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[705] The Colombian Institute for Student Aid and Technical Studies Abroad helps to prepare qualified leaders for all fields of Colombian life in universities of the world by means of loans and scholarships.

[706] Hearings, House, Government Operations Committee, *Brain Drain*, 1968. p. 42.

[707] Dr. Frankel cited a number of actions the United States could take to alleviate the brain drain, putting special emphasis on encouragement to institution building. He said: "In this list of possible measures, perhaps the most far-reaching is increased emphasis on institution building in the developing countries, and the encouragement, by one means or another, of the development of research and educational institutions which would offer opportunities for the skilled to stay at home." (Hearings, Senate, Judiciary Committee, *International Migration of Talent and Skills*, 1968, pp. 21–22.)

[708] Janet Bancroft, *The Multinational Corporation: A Background Survey*, Congressional Research Service, Library of Congress, Dec. 20, 1972, p. 1. (Foreign Affairs Division multilith, 72–244F.) Other definitions are given on pp. 1 and 2.

[709] *The Washington Post*, Sept. 4, 1973.

the mining areas of Asia, Africa, and the Americas, and the creation of social and political instability.[710]

Still, host countries of the MNCs, particularly in the LDCs, have usually welcomed the economic benefits of foreign investment. They have gained from the importation of new products and foreign capital, the transfer of modern technology, the creation of new jobs, the introduction of advanced management and organizational skills, and access to new markets.[711] Operating on a global scale and connecting the advanced nations with the LDCs, the MNCs have helped to diffuse management, production, and marketing techniques throughout the world. Nourished by the growing integration of world product and capital markets, they have contributed to the further integration of the world economy.[712]

But what is most important, the MNCs have stimulated the rapid spread of industrial technology around the world. According to Lawrence B. Krause, a Senior Fellow at the Brookings Institution, this global diffusion of technology has accelerated the movement towards expanding research and development within the multinational firms, which in turn has substantially raised the level of technology in the host countries, and in the process has set into motion a self-enforcing cycle of development. In order to utilize new technology the MNC must train workers and managers who are primarily local citizens. The effects of this training process gradually spread beyond the enterprise as the economy develops and competition in the job market from other enterprises emerges. "The aggregative effect of this spread," writes Krause, "is to reduce the technological gap among nations and thereby reduce income differentials." In brief, the effect is to strengthen the base for development.[713]

Thus, the MNCs, despite the shortcomings attributed to them by critics and the risks that they incur by operating in foreign lands, can play a potentially positive role in the nation-building process within the LDCs. That the United States perceives this possibility is evident by the various measures that have been taken to encourage investment among the LDCs, notably those measures discouraging foreign governments from expropriating U.S. property without prompt and adequate compensation.[714]

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[710] Anthony Astrachan, "Multinationals Criticized Before U.N. Panel," *The Washington Post*, Sept. 18, 1973, p. A12, and Lawrence B. Krause, "The International Economic System and The Multinational Corporation," *The Annals of the American Academy of Political and Social Science*, 403, September 1972, p. 103. Stephen Hymer of Yale University ends an article on, "The Efficiency (Contradictions) of Multinational Corporations," with this skeptical note: "The coming age of multinational corporations should represent a great step forward in the efficiency with which the world uses its economic resources, but it will create grave social and political problems and will be very uneven in exploiting and distributing the benefits of modern science and technology. In a word, the multinational corporation reveals the power of size and the danger of leaving it uncontrolled." (*American Economic Review* 60 (May 1970), p. 448.)

[711] Bancroft, op. cit., p. 3.

[712] Krause, op. cit., pp. 93, 102–103.

[713] Mr. Krause continues: "Countries obtain newest technology much faster, and it becomes more widely adopted throughout the industry." In explaining the dilemma that the technological aspect of MNCs cause for some governments, Krause notes that multinational firms may do their research at home in the advanced country, and thus "local citizens are not encouraged to become scientists or engineers, or even worse, they may emigrate to other countries after local training." A solution by insisting that MNCs undertake some research locally, he continues, "may make the situation worse, since the multinationals would then absorb the often scarce scientific talent, making it even more difficult for local firms to compete." He concludes on a note that is explicit in this study as a remedy to brain drain: "Clearly, the supply of locally available scientific talent must be increased faster than the demand for it by multinational firms in order to promote R. & D. in locally owned firms. . . ." (Ibid., pp. 98–99.)

[714] Bancroft, op. cit., p. 11.

PERSISTING DIFFICULTIES AND DILEMMAS: DECLINING INTEREST IN FOREIGN AID

The rhetoric for renewing the national commitment to international development runs counter to the reality of a declining American interest in foreign aid and the prevailing national mood of retrenchment in international commitments. Evidence presented in the next chapter on foreign policy implications of brain drain is reinforced by a recent vote in the House of Representatives (248 to 155), rejecting the Administration-sponsored bill for a new contribution to the World Bank's International Development Association (IDA) to aid the economic development of the world's poorest LDCs. The proposed contribution would have been $1.5 billion spread over a 4-year period, out of a total contribution from the wealthier advanced countries of $4.5 billion. Mr. McNamara, President of the World Bank, termed the action an "unmitigated disaster" for the world's poor. Richard L. Strout of *The Christian Science Monitor observed* that the "House vote may kill the international plan"; he added: "it was the first significant vote of the new session, and it indicated a go-it-alone, isolationist mood of Congress." [715] A major factor in the House vote was growing disillusionment with foreign aid in general, particularly as this issue came under consideration at a time of a constriction of many Federal domestic programs.[716]

A sustained attitude of withdrawal from international involvement would seriously impede efforts to diminish the "pull" factor in brain drain from the LDCs through development assistance.

Declining Interest in Brain Drain as a Foreign Policy Issue.—A second difficulty is the declining—indeed, as of early 1974, virtually nonexistent—interest in brain drain as a problem of American foreign policy. Yet it is one of those enduring, if low-profile, issues that has a great potential for mischief in this Nation's future relations with the LDCs. Medical brain drain has generated scattered concern in some quarters, such as the medical profession—which gives signs of becoming increasingly concerned about the lowering of standards and the evolution of a double-standard in American medicine—and among aspiring medical students who are closed out of a career while the deficit in medical manpower is being made up by doctors imported from the LDCs. But in the public mind, brain drain is no issue; it excites no concern. Even in current literature on development, brain drain seems no longer to be a subject of active discussion.

Popular and official indifference to the problem of brain drain derives from the fact that the United States seems not to have suffered direct injury to its interests, at least not visibly as was the case with the oil embargo during 1973–74. In the past decade the United States gained in educational savings and in filling manpower deficits by inflows of professional talent. The official view of the administration

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[715] Richard L. Strout, "Congress Smoot-Hawley, 1974," *The Christian Science Monitor*, Feb. 1, 1974, p. 8. Similar concern was expressed by Marquis Childs. See, "A Growing Mood of Isolationism on the Hill," *The Washington Post*, Jan. 29, 1974, p. A19.

[716] *The New York Times*, Jan. 24, 1974, p. 1. Another key factor in the vote, according to the *Times*, was the announcement by Rep. George H. Mahon (D-Tex.), chairman of the Appropriations Committee, that he would not support the appropriation or funds for the new contribution if it were authorized. The bill, he noted, would provide a higher level of U.S. contribution. Mr. Mahon said he would not approve any more than was currently being contributed and warned members that they would be wasting a politically unpopular vote in supporting the bill, because the money would not be forthcoming.

reflects this attitude of indifference. In 1973, Secretary of HEW Weinberger told Congress, "I don't think in and of itself" that utilizing FMGs to meet American medical manpower demands "is necessarily a bad thing." Weinberger, who did not know the number of FMGs in the United States, saw nothing "morally reprehensible" in this practice, even though he was reminded by Dr. Roy, a practicing physician and Member of Congress, that "we are stealing these physicians from other nations around the world who need them desperately." [717]

On both the popular and official level there appears to be little interest in reducing the "pull" factors that on this side have helped to prevent a solution to brain drain from the LDCs.

Dilemma in Restricting Immigration.—What adds to the difficulty of diminishing the "pull" factors is the dilemma inherent to restricting immigration, namely, the U.S. commitment to the principle of free immigration. Remedying brain drain would require selective restrictions that are incompatible with this principle.[718]

By political philosophy the United States is committed to the principle of free movement of people, an idea which, as Frankel said, has an "ancient pedigree in the history of free civilization." [719] This principle was reinforced by the Immigration Law of 1965 that did away with the discriminatory quota system. The United States does exercise the right to regulate the inflow of immigrants and thus assigns quotas for various areas of the world. But this is not discriminatory in the same sense as was the pre-1965 law. Given present medical manpower conditions, were the United States to attempt through legislation or regulation to close off selectively the flow of physicians and surgeons from India and the Philippines, for example, the major sources of medical brain drain, it would invite a renewed charge of discrimination against Asians and more important it would violate its professed democratic principle of the right of free movement of peoples.[720]

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[717] Hearings, House, Interstate and Foreign Commerce Committee, *Oversight of HEW Health Programs*, 1973, pp. 53 and 55.

[718] Brain drain specialists generally are opposed to stringent immigration regulations as a remedy. Dr. Adams declared that wealthy nations were "under no obligation to *stop* training foreign students." The world should not be denied, he said, "potential skills just because their bearers happen to have been born in the wrong place at the wrong time." Such people, Adams declared, should be permitted "to compete for rewards and opportunities on the open market." To him, freedom of movement was "essential to the expression of talent, and its curtailment to any significant degree would be a global tragedy." (Adams, "Talent That Won't Stay Put," p. 84.)

The CIMT study stated that it was "most difficult" for advanced countries to decide the effects of migration on the LDCs and "to fit general immigration policy to the presumed needs" of the LDCs. The authors of this study believed that if the LDCs perceived that migration was harming them and that this injury should be reduced by controlling the movement of people, then "it is their primary obligation to design, install, and operate the appropriate measures." The study concluded that the imposition of stringent controls by the developed countries was not a proper policy. (CIMT study, p. 718.)

Dr. Frankel indicated his belief that remedies through the immigration mechanism which imposed "restraints on the free movement of people should be approached with the greatest caution. Not only has this idea an ancient pedigree in the history of free civilization, but there is something to be said on the practical side as well for the social utility of international competition for talent." Statutory changes or administrative restrictions that would hamper the free movement of people were in Frankel's view "mistaken." The problem deserved "our best efforts," Frankel said, but he cautioned that "it is too complex and many-sided to be handled by broad codes or rules." He observed that in some aspects "no showing has been made that it is a problem at all," and he concluded that "we have too much to gain" overall—so do "our fellows in other countries"—from the process of "mutual education and exchange that goes with the free movement of people." (Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, pp. 18 and 21.)

[719] Ibid.

[720] Secretary Weinberger posed the dilemma inherent in preventing FMG inflows through restrictive immigration regulations. When pressed by Rep. Symington to deny that, "We often take these people against the wishes of their home government and certainly against the needs of their people," he responded: "Well, is the suggestion, Congressman, to say we will turn them back and say, 'We will not permit you to practice in this country despite your own wishes?'" (Hearings, House Interstate and Foreign Commerce Committee, *Oversight of HEW Health Programs*, 1973, p. 57.)

Facing this dilemma the United States appears to have only one practical recourse for remedy through immigration control, and that is the use of the Department of Labor certification requirement. In such cases the principle for denying entry would then be acceptable, namely, that of competing with American professionals and inability to absorb new immigrant professionals. This policy would be less open to charges of discrimination. Such administrative actions now account for some of the decline in the number of immigrant scientists and engineers. But as a practical matter this dilemma, though real, is essentially academic in the case of FMGs, since the United States *wants* their services and is accommodating its regulations to encourage their immigration.[721]

Paradox of Education in Nation-Building Process.—A further complication in reducing the "pull" factor is the paradox of education in the nation-building process. International educational exchange is a powerful and effective instrument in nation building; but it also creates optimum conditions for brain drain.

Specialists on brain drain and development would concur in Professor Niland's statement that "the United States has become a graduate school for much of the developing world." [722] For over a quarter of a century American education, placed at the service of the emerging LDCs, has certainly contributed much to their progress. Data presented in Chapter III give some idea of the dimension of this undertaking.

Educational exchange has thus become one of the principal and perhaps most effective instruments in building institutions vital for development. Exchange programs, as Dr. Frankel observed, "can have a profoundly constructive effect" on development. He explained: "Efforts to spread knowledge of English, arrangements for university-to-university partnerships, programs permitting attendance at international conferences—all these develop an infrastructure for international intellectual and professional life that can reduce the influence of conditions that make for a 'brain drain.'" For Dr. Frankel, the remedy for brain drain is "a continuing international circulation of brains, still larger and more far-reaching than is now going on." [723]

Despite this persuasive argument, still there can be no escaping the paradox of international educational exchange: it gives, but it also takes away. As already indicated in previous chapters, students and scholars are attracted by the allure of life in the United States. American education may have equipped them with tools for building institutions in their own lands, but it also opened up a new world in which the same tools could bring even greater personal benefits, satisfaction, and rewards. For many exchange students the attraction proved irresistible.

Paradox of Advanced Scientific-Technological Civilizations.—The nature of an advanced scientific-technological civilization, like that in the United States, produces still another paradox that further complicates the task of diminishing the "pull" factors in brain drain. The American scientific-technological civilization is driven forward by

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[721] Both Dr. Hunt and Dr. Sprague seemed to offer little hope for remedies through immigration regulation. See, Hearings, House Government Operations Committee, *Brain Drain*, 1968, pp. 64 and 69.

[722] Niland, op. cit., p. xiii.

[723] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 22.

dynamic, virtually self-perpetuating forces that by their essence accumulate power and wealth; their momentum provides an apparently built-in guarantee of success and progress.

Most LDCs have neither the base nor infrastructure, neither the material nor human resources, to create even the most elementary components of these forces. Hence the ever-widening development gap.

An absolute solution to brain drain lies essentially in what amounts to equalizing the distribution of wealth and power, and the expectation of success and progress among all nations. This effect requires either upward mobility of the LDCs or a downward depression of the advanced nations.

The paradox lies in the fact that the advanced industrial societies cannot by rational choice reverse the momentum of progress; they are driven by forces that made the scientific-technological civilization what it is. To a great extent these forces have become the determinants of a nation's destiny.

Dr. Kidd came close to revealing the essence of this paradox when he observed at the State Department Interagency Workshop, while commenting on narrowing the development gap:

> . . . We have a problem of a cultural and economic differential. I can't realistically see this country either restricting the growth of its universities, the growth of its economy, or seriously restricting the freedom of movement of people in order to resolve this problem. There are measures we can take and probably could take around the fringes, but I think generally the problem ought to be resolved in terms of reducing the differential by building the bottom rather than pushing down the top.[724]

Brain Drain: "One of the Major Challenges of Mankind"

To sum up, it appears that the major trends in brain drain to the United States have now become fairly fixed, at least for the immediate future. The LDCs are the major source; inflows of FMGs seem destined to move steadily upward, inflows of scientists and engineers to continue their downward turn; reversal of flows are apparent in some areas.

Remedies for brain drain are *possible* by diminishing both the "push" and the "pull" factors, but not likely to be pursued in the present foreign policy climate. Moreover, difficulties and dilemmas conspire to complicate and even vitiate some of the partial solutions.

In the final analysis, remedies for brain drain can be reduced to this simple question: "How can the less developed countries be put on a course that will lead to a self-reinforcing upward spiral of social and economic progress?" As the CIMT study concluded, this is "one of the major challenges to mankind, and one that will clearly require a continuing search for solutions which have thus far been found for few countries."[725]

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[724] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 136.
[725] CIMT study, p. 681.

VII. Implications of Brain Drain for American Foreign Policy

The brain drain issue has touched virtually every major institution in both the public and private sector of American life. This chapter does not describe the multidirectional character of this flow of professional manpower and its vast institutional involvement. Rather it attempts to point out some of the areas in which the brain drain issue poses problems, contradictions, or dilemmas for American diplomacy.

Areas of Institutional Involvement

Institutional involvement of the brain drain issue can be subdivided into two major categories: first, the managers or controllers of the inflow of human resources (those institutions and agencies which plan, manage, and control the inflow of professional manpower) and second, the category of those which use the manpower.

CONGRESSIONAL INVOLVEMENT IN THE BRAIN DRAIN ISSUE

Congress is the principal instrumentality for managing the inflow of manpower into the United States; it does this through its constitutional powers to legislate immigration laws. Viewed within the time frame of nearly a decade, Congressional interest in brain drain has reflected wider international concern: it gathered momentum in the mid-1960's, and crested with hearings and studies undertaken by the House Government Operations Committee and the Senate Judiciary Committee. Since then, Congressional interest has progressively diminished to the point where today it is largely limited to isolated concern for the internal aspects of the FMG inflow.

Senate and House Action in the Mid-1960's.—In October 1966, Senator Mondale, outspoken in his concern for the brain drain problem, introduced bill S. 3905 called the "International Brain Drain Act." This bill was designed to assist the LDCs and to "relieve the drain from such countries of the professional and skilled manpower which is indispensable to their progress toward stability and self-reliance." [726] The bill was referred to the Senate Foreign Relations Committee; apparently no further action was taken.

At the same time, Senator Mondale introduced an amendment to the International Education Act of 1966, authorizing the Secretary of the Department of Health, Education, and Welfare to undertake a study of the brain drain and to report to the President and Congress his findings and conclusions together with recommendations for any needed legislation to encourage the return of brain drainees. The amendment authorized appropriation of $50,000 to carry out the

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[726] Sen. Walter F. Mondale, "Program Designed to Assist Developing Countries Relating to Professional Persons and Skilled Specialists," Remarks in the Senate, *Congressional Record*, Oct. 13, 1966, pp. E26196–E26499.

study.[727] Apparently, this study was never undertaken.[728] (The Stevens and Vermeulen study on FMGs, sponsored by HEW, seemed more concerned about accommodating FMGs in this country than with encouraging their return home.)[729]

In 1967, the Senate Subcommittee on Immigration and Naturalization of the Committee on the Judiciary held extensive hearings on the "International Migration of Talent and Skills." Concurrently, the Subcommittee on Research and Technical Programs of the House Committee on Government Operations undertook an intensive study, highly commended by brain drain specialists, entitled, "The Brain Drain into the United States of Scientists, Engineers, and Physicians." In 1968, the subcommittee held extensive hearings on "The Brain Drain of Scientists, Engineers, and Physicians from the Developing Countries to the United States."[730]

Congressional Inaction on Brain Drain.—Nothing came of these congressional efforts. Concern for the issue subsequently subsided. In the summer of 1968, Professor Grubel, speaking of official Government response to what was being widely characterized as the alarming brain drain problem, expressed astonishment that "so few government policies to stop this drain have been promulgated in the less developed countries and practically none has reached the legislative stage in the developed countries."[731] In 1970, Mr. Baldwin observed, "Neither the executive nor the legislative branch of the U.S. Government has felt it necessary to do anything to reduce immigration by tightening direct controls." He added in passing that, "The one congressional subcommittee that conducted staff studies of the problem in recent years made several recommendations, not one of which aroused any interest in Congress."[732] Today, as stated above, there seems to be little or no publicly expressed congressional interest in brain drain beyond isolated references to the internal implications of the FMG inflow.[733]

Reason for Inaction: Contradiction in National Purposes.—Congressional interest in brain drain has thus been slight. Brain drain

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[727] Ibid., p. 26558. Also Public Law 89–698—Oct. 29, 1966, p. 1072 (80 Stat.) Title III.

[728] U.S. Congress, Senate, Committee on Foreign Relations, *Legislation on Foreign Relations*, 93d Cong. 1st sess., 1973, pp. 570–571.

[729] Stevens and Vermeulen, op. cit., Chapter 4.

[730] Professor Adams said of the Subcommittee study: "I think I can speak for all the panelists in stating this consensus, whatever their views of the executive branch or the State Department: I think all of them would applaud heartily the fine staff report that this committee put out on the brain drain in the first session of this Congress which to my knowledge is the greatest contribution made to an understanding of the problem to date." (Hearings, House Government Operations Committee, *Brain Drain*, 1968, p. 81.) Both the Senate and House publications on brain drain have been frequently cited in brain drain literature.

[731] Grubel, Reduction of the Brain Drain: Problems and Policies." p. 541.

[732] Baldwin, op. cit., pp. 369–370.

[733] In an address given before the American Immigration and Citizenship Conference on Nov. 2, 1973 entitled, "New Goals of U.S. Immigration Policy," Rep. Joshua Eilberg (D-Pa.), Chairman of the House Judiciary Committee's Subcommittee on Immigration, Citizenship, and International Law, discussed current concerns of Congress. Brain drain was not mentioned. Indeed, interest in Congress and in the Administration on the entire matter of immigration seems at a low ebb. In referring to needed revisions in Titles II and III of the Immigration and Nationality Act of 1965, Mr. Eilberg observed: "The most serious obstacle facing us in this task is no longer the prejudice responsible for the perpetuation of the national origins quota system for four decades, but apathy. The present Administration has shown very little interest in the subject of immigration, and the Senate appears virtually unaware of its existence. House-passed immigration legislation died at the end of the 92nd Congress, and no Senate action has been taken to date during this Congress on any immigration legislation passed by the House, with the exception of private bills." (Joshua Eilberg, "New Goals of U.S. Immigration Policy," *In* Extension of Remarks of Peter W. Rodino, Jr., *Congressional Record*, Nov. 27, 1973, pp. E7522–E7523.)

had never been a great national issue—not even a national issue—perhaps because the United States gained and other countries suffered the losses. But a more decisive reason is that the issue itself is set in the context of a paradox: the Nation is committed to the principle of liberalized immigration policies and to the principle of international education exchange; both would conflict with any administrative policies that could be designed to reverse the flow of emigrating professionals.

The Nation maintains a commitment to liberalized and more equitable immigration laws. This commitment was spelled out in the revised immigration law of 1965 which eliminated the discriminatory national origins quota system and which has since been refined through liberalizing immigration regulations. However, the United States does exercise its right to establish priorities for admission, for example, of scarce professionals, and to limit immigration, but without resorting to discriminatory devices based on nationality. For example, an annual ceiling of 120,000 was placed on immigration from the Western Hemisphere with no preference system or previous-country limit.

The Nation also maintains a commitment to the principle of international educational exchange.[734] This commitment, which is rooted in the Nation's history, was given new life in the Fulbright Amendments to the Surplus Property Act of 1944; it was expanded in the U.S. Information and Education Exchange Act of 1948; and it was subsequently refined by administrative regulations and such laws as the Mutual Educational and Cultural Exchange Act of 1961, which were intended to accommodate the exchange and inflow of students and visiting scholars. With the adverse effects of brain drain in mind, amendments were made to legislation on educational exchange programs to encourage the return of students and scholars.

National commitments in immigration and education exchange and the laws and regulations they generated work at cross-purposes with efforts to correct, much less reverse, brain drain, for they stimulate the inflow of professionals by providing convenient legal and administrative mechanisms that encourage exchange and accommodate professionals seeking entry. Gregory Henderson summed up the paradox in these words:

> This change [revising the immigration quota system] sounds most reasonable. Yet it will greatly increase the already painful draining away to ourselves of the very skills needed by the emerging nations in order to better themselves. For prominent among the nations whose quotas have until now been insufficient are those very lesser developed nations we have sought to aid. Addedly painful has been the fact that this drainage has, up to the present, been serious but has been effected under the . . . [beneficent] name of "international exchange."[735]

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[734] For a study of the overseas activities of nongovernmental American scientists and technical personnal in major programs of the Federal Government, see U.S. Congress, House Committee on Foreign Affairs, *U.S. Scientists Abroad; An Examination of Major Programs for Nongovernmental Scientific Exchange.* Prepared for the Subcommittee on National Security Policy and Scientific Developments by Genevieve J. Knezo, Analyst in Science and Technology, Science Policy Research Division, Congressional Research Service, Library of Congress. (As part of an extended study of the interactions of science and technology with United States foreign policy), 1974, 163 pp. (Committee print)

[735] Henderson, "Foreign Students: Exchange or Immigration, p. 348. Stevens and Vermeulen have written convincingly of the paradox inherent in creating programs "nominally for educational exchange, whose purposes were vague, and which had become a prime vehicle for the importation of physicians to the United States." (See Stevens and Vermeulen, op. cit., p. 64, and Chapter 3 for a discussion of international exchange and immigration.)

ASPECTS OF EXECUTIVE BRANCH INVOLVEMENT

In the Executive Branch the brain drain problem touches many departments and agencies. The division between the managers or controllers and the users is clearly visible. The Department of Defense, the National Aeronautics and Space Administration, and the Department of Health, Education and Welfare probably rank among the leading users of foreign scientists, engineers, and doctors, particularly in their research and development activities. (And as noted above, state institutions concerned with mental health depend heavily upon FMGs for staffing. Other state and local government operated facilities concerned with health care such as municipal hospitals also draw upon FMGs for staff.)

Controllers Within Executive Branch: Justice, State, HEW, Labor.—The principal controlling agencies are the Departments of Justice, State, HEW, and Labor. They are the primary agencies charged with enforcing the immigration law. Hence, they have had to live with the brain drain problem since it emerged in the early 1960's.

The major enforcement responsibilities under the immigration law and implementing procedures are assigned to the Attorney General.[736] The Attorney General discharges these responsibilities through the Immigration and Naturalization Service, a bureau of the Department of Justice. The second enforcement authority is the Secretary of State, acting through the Department of State's Visa Office and Consuls stationed abroad. These officials determine the admissibility of aliens seeking entry and issue visas to those found eligible. Theirs is a preliminary determination; the immigration officer at port of entry in the United States has veto authority. The Public Health Service of the Department of Health, Education, and Welfare is responsible for the physical and mental examination of entering immigrants. Finally, the Department of Labor, acting through its Bureau of Employment Security, must certify that American workers are unable to perform the tasks of those aliens entering to work, except certain relatives of American citizens or of lawful resident aliens, and that their entry will not adversely affect wages and working conditions in the United States. Because of the doctor shortage, FMGs receive virtually blanket certification. All that the Department of Labor requires of an FMG seeking a preferential immigration visa is that he present an ECFMG certificate or other proof of eligibility for appointment to the staff of a hospital in the United States.[737]

Major Role Played by State Department.—The major burden of responding to critics of the brain drain problem has fallen upon the Department of State which is responsible for those subordinate agencies and operating programs which have proved to be conduits for brain drain. Loss of talent is clearly evident in programs relating to the international exchange of students and scholars, and to a lesser

[736] This section draws upon, Charles Gordon and Harry N. Rosenfield, *Immigration Law and Procedure,* (New York: Banks, 1970), v. 1, pp. 1-33-36.
[737] Dublin, op. cit., p. 875.

extent in the case of the Agency for International Development's technical assistance programs.[738]

In the mid-1960's Dr. Charles Frankel, Assistant Secretary of State for Educational and Cultural Affairs, in his capacity as chairman of the Interagency Council on International Educational and Cultural Affairs, was the principal spokesman for the administration on brain drain matters. Formed in 1964 to improve coordination of Government educational and cultural programs which were international in purpose and impact, the Interagency Council was composed of representatives from AID, the Defense Department, Peace Corps, HEW, Bureau of the Budget, and the Smithsonian Institution, in liaison with the Federal Council on Science and Technology. Other agencies worked with the Interagency Council when problems arose relating to their interest.[739]

The Interagency Council made a significant contribution to the literature on brain drain with the publication of its proceedings of a workshop and conference on "The International Migration of Talent and Skills," held in October 1966. The present study has drawn heavily upon the work of this conference.

Declining Interest in Executive Branch Since Late 1960's.—Interest in the State Department seemed to wane after 1968 with the diminishing interest in the brain drain problem in Congress and apparently elsewhere in the Western world. Reduction of immigration by tightening direct controls was not considered to be imperative. Perhaps, Mr. Baldwin best expressed the view of the Johnson Administration on brain drain when he summarized the official position set forth by Dr. Frankel:

> In sum, Frankel objected to all the major specific changes that had been proposed [in regard to immigration legislation] and came forward with no new ones of his own. The main "causes" of emigration from developing countries, he felt, lay in the "push" factors found in those countries, and the most important thing the United States could do to help was to continue and to expand its foreign assistance for the institution-building, particularly the building of research and educational institutions capable of attracting and holding professional people. As for the special problem of medical doctors, Mr. Frankel acknowledged that the United States should indeed expand its own training programs.[740]

The present administration has shown little interest in immigration as a whole, much less in the specific problem of brain drain. If the judgment of Rep. Joshua Eilberg, Chairman of the House

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[738] Staff study, House Government Operations Committee, *Brain Drain Into the United States of Scientists, Engineers, and Physicians*, 1967, p. 15. The State Department has tended to minimize the extent of brain drain through Government-sponsored programs. For a discussion of AID's assistance programs in scientific fields, see U.S. Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research and Development, *The participation of Federal Agencies in International Scientific Programs*, Report, 90th Cong., 1st sess., 1967, pp. 40–42. (Committee print). The report noted that in fiscal year 1964, 965 foreign educators were trained in the United States under AID auspices and 299 American professional experts were working abroad. $109 million was committed in the field of education in fiscal year 1966. (p. 41.)

[739] Dr. Frankel discusses the organization and functions of the Interagency Council in, Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 13.

[740] Baldwin, op. cit., pp. 369–370.

Judiciary Committee's Subcommittee on Immigration, Citizenship, and International Law, is correct, namely, that the attitude toward immigration is one of apathy, then it seems that official concern for brain drain has reached its nadir.[741] Certainly the comments by Secretary Weinberger noted in the preceding chapters reveal a certain insensitivity to the brain drain issue in the administration.

An indicator of current State Department interest in the brain drain problem is the address by Alan A. Reich, Deputy Assistant Secretary for Educational and Cultural Affairs, to the 70th Annual Convention on Medical Education of the AMA in Chicago on February 1, 1974. In the address, entitled, "International Understanding and Foreign Medical Graduates," Mr. Reich discussed the problem of FMGs within the larger context of what the State Department calls "meaningful people-to-people interchange," that is, international exchange and communications as an instrument of American diplomacy. Mr. Reich cited three major problems relating to FMGs and the possible impact on international understanding: (1) The "so-called 'brain drain' or loss of much-needed medical manpower in other countries to the United States"; (2) the failure of exchange visitor physicians to return home after training in this country; and (3) "our failure to provide many foreign medical graduates in the United States with proper orientation, exposure to the American way of life, and meaningful cross-cultural experiences with Americans."

Loss of medical manpower, Reich declared, stemmed from the failure of many countries of origin to provide adequate incentives to retain their doctors or to have them return home after training abroad. As for the United States, he said, "We do not seek to entice medical manpower from other countries or to deprive them of this much-needed human resource." Justification for admission of FMGs to the United States as immigrants is based on the principle of freedom of movement and the failure of the donor countries to control the outflow or rectify the conditions that create it. As Mr. Reich said: ". . . with the receiving country not opposing the entry of doctors and their own countries not providing adequate encouragement for them to practice at home, it is difficult to reduce the number of foreign physicians taking up attractive positions in the United States and other developed nations." This problem, Reich stated, "creates embarrassment" for the U.S. Government, and he acknowledged that this Government was "cooperating with other concerned governments in an attempt to alleviate the problem."

In discussing problems arising from the exchange visitor programs, Mr. Reich emphasized that this program was not designed to fill staffing needs of U.S. institutions, nor was it intended to be used "as a springboard for immigration to the United States." Rather it was designed to improve and strengthen U.S. diplomacy by promoting better mutual understanding and two-way communication between Americans and other peoples of the world. Reich implied that the purposes of the program had been misused. The "fallout" rate for M.D.s from the exchange visitor program, he noted, over the 4-year

[741] Eilberg, "New Goals of U.S. Immigration Policy," p. E7523.

period 1967–70 had been 11 percent, as compared with only 3 percent of all exchange visitors. "We consider the 11% rate high but not alarming," he said. However, the foreign residence requirement was relaxed in April 1970, and the "fallout rate," especially among physicians, "increased dramatically." In 1972, he said, the United States put into effect a "skills list," specifying skills critical to each country. He hoped that cooperative efforts between the United States and other nations in adhering to the "skills list" requirements would result in a reduction in the number of adjustment cases. In the future, he said, most FMGs would be subject to the 2-year foreign residence requirement upon completing their training programs.

Finally, Mr. Reich discussed the problem of accommodating the FMG to the American environment, citing particularly the lack of hospitality and appreciation of Americans for their presence. Reich suggested a 10-point program for rectifying this problem of accommodation and concluded with a statement on the obligations of Americans to the FMGs, particularly the fact that "they all are important to us in helping to build the human foundations of the structure of peace." [742]

It is significant for the purposes of this study to note that nothing was said in this speech about the obligations of American institutions to cope with the doctor shortage through the use of American manpower, and about the rights of American premedical students to a reasonable expectation of fulfilling career goals. Nor was there any reference to remedies for the medical brain drain problem at the source where lay the greatest potentiality for difficulties in U.S. foreign relations. Rather the stress was on administrative measures for control, and on the obligations of Americans to accommodate the FMG to the American social environment.

EDUCATIONAL INSTITUTIONS, ASSOCIATIONS, AND THE PRIVATE SECTOR

Educational institutions and professional associations such as the AMA and the AHA (American Hospital Association) are heavy users of foreign professional manpower flowing into this country. Also among the heavy users are the many scientifically and technologically oriented research and development enterprises in the Nation's private sector.

Data presented in the preceding sections of this study suggest that in varying degrees the brain drain problem has directly and indirectly involved these nongovernmental sectors of American life. In certain areas the involvement is deeper than in others. The medical profession is becoming increasingly dependent upon FMGs to take up the growing slack in its own production of doctors and to meet the demands of the Nation's expanding health care. With the cutback in defense and space related research and development, the demand for scientists and engineers has dropped. The decline is reflected in the most recent NSF data on the inflows of scientists and engineers in the fiscal year 1972. But international student exchange continues on an expanding scale,

[742] Alan A. Reich, "International Understanding and Foreign Medical Graduates," *In* Remarks of Robert McClory, *Congressional Record*, Mar. 12, 1974, pp. E1339–E1341.

with the result that the Nation's colleges and universities will no doubt continue to play a primary role in the education of foreign students. And if past experience can be any reliable guide, international student exchange will continue to be a serious source of brain drain.[743]

BRAIN DRAIN PHENOMENON: A HIDDEN FOREIGN POLICY PROBLEM

Thus the brain drain phenomenon has touched many parts of American Government and society. Involvement has depended upon the particular relationship of the controllers and the users with the incoming professionals. Awareness of foreign policy problems arising from brain drain has not gone much beyond this triangular relationship.

In this sense, brain drain is a hidden problem for American foreign policy. And though expressed concern may have diminished in the past decade, the problem persists, along with the conditions that produced it, while the consequences appear to be worsening because the problem is no longer between the United States and the developed industrial nations of the West. Rather it is between the United States and the emerging LDCs. An unequal relationship has evolved. The gap between rich and poor has been widening, not closing. The poor continue to subsidize the rich with expensively produced professional manpower.

Brain Drain in the Matrix of American Foreign Policy

Brain drain and development converge in the matrix of American foreign policy to form a complex of opposites. Brain drain, one of many essential elements in the international development process, is a low visibility problem that comes and goes with the rise and fall of complaints by donor nations and concern by the receiving nations. Yet it is a durable problem that relates directly to development, and accordingly poses the essential question of the American stance towards the developing countries. For brain drain and development are principles in contradiction: one cannot have it both ways—an LDC cannot develop without an educated elite.

The contradiction is compounded by the inability of the United States, despite its current mood of withdrawal, to escape involvement with the LDCs. The LDCs have the greatest concentration of the world's population and natural resources; they are a resource-base and market for the advanced industrial states; they are the international trouble spots, real and potential, in a delicately balanced world political system.

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[743] International student exchange is about to get a substantial thrust forward in a cooperative effort to be undertaken by Georgetown University in conjunction with the West German Government. Under the proposed plan Georgetown is prepared to bring about 500 German students to the United States next summer and spread them among 25 colleges and universities from coast to coast for a year's trial run. If the idea proves workable, it is possible that as many as 30,000 young Germans may be studying in America annually. The idea is based on the law of supply and demand. American enrollments have been declining; the current openings are estimated to number some 300,000. Competition for available openings in West German universities is so intense that almost 50,000 qualified applicants are turned away yearly. The Germans reason that the cost of education abroad would be considerably less than building equivalent educational facilities in Germany. For the Americans, the plan enables its colleges and universities to use their facilities to maximum efficiency. Unmentioned in the press coverage is the vulnerability of the West Germans to brain drain. (John M. Goshko, "German University Plan May Involve Georgetown," *The Washington Post*, Sept. 16, 1973, p. A1.)

AMERICAN ATTITUDE TOWARD THE LDC'S

The principal indicator of concern by the United States for the LDCs is its attitude towards foreign aid and international development. The depth and durability of this commitment is apparent by the fact that between the fiscal years 1946 and 1972 the United States expended over $173 billion in foreign aid.[744]

The Executive Branch on Development Policy.—All administrations have reaffirmed this commitment to foreign aid and international development. The present administration has been no less emphatic in reaffirming this important foreign policy principle. In his report to Congress in February 1972, President Nixon said that the goals of the administration for 1972 would be to

> . . . Work toward an improved foreign assistance program which will merit increased domestic support and will enable us to adequately contribute, along with other industrialized nations, to an international assistance effort which will ensure that the development progress made in the 1950's and 1960's can continue in this decade.[745]

A year later the President told Congress:

> There has been a growing tendency to question our commitment to help developing nations. Attracted to rapid solutions and under-estimating the time and effort needed to stimulate development, Americans are frustrated by the slow pace of visible progress. But, our future economic and political needs will be far better served by actively cooperating with the developing countries for our mutual benefit than by neglecting their needs. We must pursue a realistic policy of development assistance and find better ways of dealing with the trade and monetary interests of developing nations.[746]

Secretary of State William P. Rogers reiterated the administration's commitment. In his 1972 foreign policy report to the Congress, the Secretary declared:

> It is now clear that present efforts to help the less developed world cannot reduce the gap between rich and poor nations. But we must seek at least to help them achieve a more equitable sharing in the progress occurring in the developing world, giving special attention to the poorest countries. Working from the base that was built over the last decade, a greater effort must be made to solve the problems arising from extreme poverty, overpopulation, poor health conditions, and limited education opportunities which affect most directly the lives of the majority of the developing world's population.[747]

That the administration has appreciated the connection between science and technology, development, and foreign policy is evident in the remarks by Secretary Rogers on January 26, 1971, to the 12th meeting of the panel on science and technology of the House Committee on Science and Astronautics. "The United States Government is very conscious of the opportunities for economic development that

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[744] Agency for International Development, Statistics and Reports Division, Office of Financial Management, *U.S. Overseas Loans and Grants and Assistance from International Organizations: Obligations and Loan Authorizations, July 1, 1945–June 30, 1972*, Washington, May 1973, p. 6. (Hereafter cited as, AID, *U.S. Overseas Loans and Grants*, 1973.)

[745] U.S. President, Richard M. Nixon, *U.S. Foreign Policy for the 1970's: The Emerging Structure of Peace*, A report to the Congress, Feb. 9, 1972, p. 78. (Hereafter cited as, *President Nixon's Foreign Policy Report to Congress of 1972*.

[746] U.S. President, Richard M. Nixon, *United States Foreign Policy for the 1970's: Shaping a Durable Peace*, Report to the Congress, 93d Cong., 1st sess., 1973, p. 141. (House Doc. No. 93–96.) (Hereafter cited as, *President Nixon's Foreign Policy Report to Congress of 1973*.)

[747] U.S. Department of State, *United States Foreign Policy 1972: A Report of the Secretary of State (William P. Rogers)*, 1973, p. 42. (Department of State Publication 8699, General Foreign Policy Series 274). (Hereafter cited as, *Secretary of State Roger's Foreign Policy Report to Congress of 1972*, 1973.)

technology is providing," he said, and added: "We accept the obligation to do all we can to help the poorer countries meet their development needs through more effective use of technology." [748]

The Congress on Development Policy.—The Congress, like the Executive Branch, has for many years consistently reaffirmed its commitment to the principle of assistance to the disadvantaged in the world. The Foreign Assistance Act of 1961 as amended contains the most comprehensive statement of policy by the Congress on the matter of foreign aid. Section 102, Part I, of the Act states: [749]

> The Congress declares that the freedom, security, and prosperity of the United States are best sustained in a community of free, secure, and prospering nations. In particular, the Congress recognizes the threat to world peace posed by aggression and subversion wherever they occur, and that ignorance, want, and despair breed the extremism and violence which lead to aggression and subversion. The Congress declares therefore that it is not only expressive of our sense of freedom, justice, and compassion but also important to our national security that the United States, through private as well as public efforts, assist the people of less developed countries in their efforts to acquire the knowledge and resources essential for development and to build the economic, political, and social institutions which will meet their aspirations for a better life, with freedom, and in peace.

The Congress further declared that to achieve the objectives of this Act, programs authorized by the Act should be carried out in accordance with seven principles. The first and fourth principles have a direct bearing on the use of trained manpower, institution-building, and self-help by the LDCs, all of which are central to the relationship between brain drain and development:

> First, development is primarily the responsibility of the people of the less developed countries themselves. Assistance from the United States shall be used in support of, rather than substitution for, the self-help efforts that are essential to successful development programs, and shall be concentrated in those countries that take positive steps to help themselves. Maximum effort shall be made, in the administration of this Act, to stimulate the involvement of the people in the development process through the encouragement of democratic participation in private and local governmental activities and institution-building appropriate to the requirements of the recipient nations.
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> Fourth, the first objects of assistance shall be to support the efforts of less developed countries to meet the fundamental needs of their peoples for sufficient

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[748] U.S. Department of State, Secretary of State William P. Rogers, "U.S. Foreign Policy in a Technological Age," Address to the 12th meeting of the Panel on Science and Technology of the House Committee on Science and Astronautics, *Department of State Press Release No. 20,* Jan. 26, 1971, p. 6. On the following day, Jan. 27, 1971, Dr. E. E. David, Jr., Science Advisor to the President, told the panel: "Another facet of the problem involves the developing nations. We in the developed world have an obligation to encourage and aid their peaceful development. Secretary Rogers yesterday mentioned the President's proposal to create an International Development Institute as a future focus for our bilateral technical assistance efforts. This promising proposal will lay a new foundation for effective technical cooperation between the United States and developing countries. It will provide a unique instrument for bringing the best of U.S. scientific and technological talent to bear and in a way which will strengthen, not supplant indigenous institutions in those countries. It is very clear here that we have much to learn about how to make such efforts truly effective. . . . Basically I believe the key lies in creating competences within the developing societies relevant to their own needs." (E. E. David, Jr., "Remarks at Luncheon Meeting of House Science & Astronautics Committee," Panel on Science and Technology, and National Capital Section of American Institute of Aeronautics and Astronautics held at the Rayburn House Office Building, Washington, D.C., Jan. 27, 1971, p. 7.)

[749] U.S. Congress, Senate and House, Committee on Foreign Relations and Committee on Foreign Affairs, *Legislation on Foreign Relations With Explanatory Notes,* 93d Cong., 1st sess., 1973, pp. 1–3. (Joint Committee print.)

food, good health, home ownership and decent housing, and the opportunity to gain the basic knowledge and skills required to make their own way forward to a brighter future. In supporting these objectives, particular emphasis shall be placed on utilization of resources for food production and voluntary family planning.

Development Policy in Practice.—During the 27-year period 1946–72 the United States made substantial outlays in expenditures to assist both developed and developing countries. The total authorization for this period amounted to $173.5 billion. Of this total, $52.5 billion went to developed countries and $121.1 billion to the LDCs. Within the LDCs the total for official development assistance came to $69.3 billion.[750] During the fiscal years 1962–65, the United States obligated and authorized a total of $17.8 billion in total economic programs for the LDCs. During the fiscal years 1966–72, the figure ranged between $4.04 billion in 1969 to $5.05 billion in 1966. For the entire period of the Foreign Assistance Act, 1962–72, the total obligation and loan authorization for the LDCs in economic programs came to $50.3 billion. The grand total obligated and authorized for loans and grants in economic programs during the entire 27-year period amounted to $80.1 billion.[751]

U.S. obligations and loan authorizations to particular developing countries indicate in specific ways the American commitment to development. Data on a selected list of LDCs showing the total obligations and loan authorizations for economic programs during the fiscal years 1971 and 1972 and the decade 1962–72 have been compiled in Table 35 from the 1973 AID report on American foreign assistance programs. A total of $647.3 million and $1,169.9 million were obligated and authorized for Latin America during the fiscal years 1971 and 1972 respectively. Among Asian countries, India ranks highest with an obligation and loan authorization of $456.9 million for the fiscal year 1971 and $428.5 for the fiscal year 1972.[752]

TABLE 35.—U.S. OBLIGATIONS AND LOAN AUTHORIZATIONS TO LDCS FOR FISCAL YEARS 1971 AND 1972

[In millions of dollars]

Area	Fiscal year 1971	Fiscal year 1972	Total, FAA period, 1962–72
West Europe: Greece	14.1	13.5	251.8
Latin America	647.3	1,169.9	12,283.1
Asia:			
China	69.5	187.9	676.6
India	456.9	428.5	6,539.2
Korea	223.1	298.6	2,487.0
Pakistan	120.5	170.4	2,907.2
Philippines	124.7	111.8	582.6
Africa: Egypt		104.6	695.0

Source: Agency for International Development, Statistics and Reports Division, Office of Financial Management, "U.S. Overseas Loans and Grants and Assistance From International Organizations: Obligations and Loan Authorizations, July 1, 1945–June 30, 1972," Washington, May 1973. The data are drawn from this publication.

[750] AID, *U.S. Overseas Loans and Grants*, 1973, p. 4.
[751] Ibid. p. 9.
[752] Ibid., p. 33 and p. 16.

BRAIN DRAIN AS A FORCE UNDERMINING DEVELOPMENT POLICY: JUDGMENTS OF THE PAST

Nearly three decades of policy and practice affirm a positive American stance towards the LDCs. The Nation's commitment to development has become a significant component of U.S. foreign policy in the post-World War II era. But brain drain and development policy are interacting opposites: one tends to cancel out the other, or as *The Christian Science Monitor* explained the contradiction: "With one hand the United States is giving [foreign] countries millions to develop themselves. And with the other it is casually taking away the seed corn of future leaders in natural science, health, and technical knowledge. These are even more precious to the country than food or machinery." [753]

As will be seen below, the criticism that brain drain undermines foreign aid is a common thread running through much of the literature on this subject. Judgments of the past may vary on certain aspects of brain drain, but they seem to concur on this central, all-abiding theme. Costs and losses to the LDCs have been documented in this study. These data are further corroborated by the evaluations of those who have studied the brain drain problem, particularly its implications for foreign policy.

Views of the House Government Operations Committee, 1968.—In its detailed study of the problem in 1968 the House Government Operations Committee pointed out the anomaly of the brain drain's undercutting foreign aid to the LDCs. Taking the estimated cost per person of at least $20,000 in education and training, as suggested by Dr. Kidd, the Committee staff calculated that 4,390 scientists, engineers, and physicians emigrating from the LDCs in the fiscal year 1966 represented a contribution of some $88 million to the United States. Of this amount, the 13 countries which had been the major targets of U.S. aid programs contributed more than $50 million to the United States in the form of 2,563 scientific professionals. According to the Committee's staff study, the estimated "reverse foreign aid" more than offset the $40,285,000 spent in American aid funds to give technical training to about 16,000 persons from the LDCs, of whom perhaps 25 to 30 percent were scientists, engineers, and similar specialists.[754]

The Committee reemphasized this anomaly in its final report to the Congress which stated:

> On the one hand, Federal programs in research and development, initiated and expanded in pursuit of important national objectives, have greatly increased demand for domestic scientific manpower in the United States. They may also be providing incentives for immigration of scarce scientific talent from the poorer countries of the world.
>
> On the other hand, the long-sustained U.S. foreign aid program has devoted substantial sums and given high priority to the education and training of professional manpower in the developing countries as an essential ingredient of development. To the extent that these countries suffer an emigration drain of

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[753] *The Christian Science Monitor,* Jan. 31, 1969, quoted *in* Walter Adams, "Talent That Won't Stay Put," p. 60.

[754] Staff study, House Government Operations Committee, *Brain Drain into the United States of Scientists, Engineers and Physicians,* 1967, p. 7.

the very skills and talents they are attempting to increase, an important part of the foreign aid program is undermined.[755]

Under section 5 of the report entitled, "Major recipients of U.S. foreign aid in recent years account for a large share of scientific immigration from the developing countries," the Committee explained in detail its findings that demonstrated the heavy burden borne by 11 major recipients of aid, namely, India, Korea, Turkey, China, Brazil, Pakistan, Philippines, Iran, Chile, Israel, and Colombia, and how the drain of professional manpower had tended to offset this aid. In 1967, these 11 LDCs supplied two-thirds or 5,189 of the 7,913 scientists, engineers and physicians entering the United States.[756]

Criticisms by Senator Mondale.—Senator Walter F. Mondale, a long-time critic of brain drain from the LDCs to the United States, rested his case largely on the contradiction between brain drain and foreign aid. In a Senate speech on August 31, 1966, the Senator acknowledged the "many brain drains" that have occurred in the course of history, but emphasized that the problem as it now related to the LDCs was "particularly urgent." He expressed his concern that brain drain from the developing countries "compromises our commitment to development assistance, by depriving new nations of high-level manpower indispensable to their progress. It runs counter to the education and training programs which are so vital to our foreign aid." Student leakage contravened efforts by AID to train leadership cadres in the LDCs such that "the brain drain among students more than cancels out one important phase of our foreign assistance programs." [757]

Qualifying Views of the Department of State; Contrasting View of AID.—The State Department has assumed a defensive posture on the foreign policy implications of the brain drain issue. Spokesmen like Dr. Frankel acknowledge the gravity and complexity of the problem, but in terms of official action they tend to disclaim responsibility on the ground that brain drain is essentially a problem for the LDCs to resolve, since programs sponsored by the U.S. Government (e.g., AID training programs) are controlled and consequently student leakage is minimal. (Students of brain drain have disputed this claim.) However, the Department of State qualified this view in an ambiguous statement, seemingly implying that student leakage through nonsponsored channels might adversely affect development.

A "background note" prepared for the occasion of the Interagency Council's workshop and conference on "International Migration of Talent and Skills" alluded to the increase in flows of professional manpower that produced the problem of brain drain. Causes were complex, it said, but the net effect for the sending country was the same, namely, their exchangees, students or trained professionals, have become emigrants. "Such losses," the note continued,

. . . tend to be particularly difficult for less developed countries to sustain; they seek to conserve and develop their resources, especially their stock of educated and skilled manpower. The United States Government is often actively

[755] Report, House Government Operations Committee, *Scientific Brain Drain from the LDSs*, 1968, pp. 1–2.
[756] Ibid., pp. 14–15.
[757] Sen. Walter F. Mondale, "The Brain Drain from Developing Countries," Remarks in the Senate, *Congressional Record*, Aug. 31, 1966, p. 21477.

cooperating with them in these developmental efforts through its assistance programs. Thus, in a sense, the United States is helping to create or expand the human resources needed by these countries for their social and economic development and it may, at the same time, be attracting or absorbing a significant share of the members of this scarce group.

Inquiries by the Interagency Council had revealed that U.S. Government-sponsored programs of exchange and those sponsored by nongovernment organizations in the United States under the Exchange Visitor Program "do not appear to be contributing directly to these types of immigration, in significant numbers or proportions." The greatest number of nonreturnees were free-lancers or those coming under other auspices. The note concluded, again at most suggesting an awareness of the problem in its relation to development: "This fact does not lessen the national interest in learning more about the sources, trends, and consequences of these patterns, given their obvious and important implications for public policy in the fields of international education and foreign aid." [758]

Less equivocal were the comments by Dr. William C. Gibbons, Director of Congressional Liaison in AID. In a letter to Senator Mondale, of September 23, 1966, endorsing the substance of the Senator's speech of August 31 on brain drain and the LDCs, Dr. Gibbons said: "We are very pleased that you have added your voice so forcefully to those others who have been calling attention to the complex problem of the emigration of talent, especially from developing countries." AID, and particularly the Office of International Training, was "acutely aware" of this problem, he said. "There are countries from which at least as many talented or skilled people may be 'drained off' by the process you describe as we are training in the United States and in the other country." AID-sponsored participants tend to return in very high proportions, Dr. Gibbons went on, but he added: "even for these . . . we lack figures on how many later emigrate to the United States or some other developed nation after they have fulfilled that commitment or satisfied the legal requirement to wait for two years before re-entering the United States." After a point-by-point commentary on the Senator's speech, Dr. Gibbons concluded: "We intend to give your remarks wide circulation and the most thoughtful study. They touch upon not only the brain drain problem but the whole subject of foreign students in this country and the problem and opportunity they present, even though the vast majority are not government-sponsored." [759]

This letter is significant not only its spirit of concern for the welfare of the LDCs but also in its official expression of awareness of brain drain as a force contravening the purposes of foreign assistance to the developing countries.

From the Perspective of Academia.—Students and concerned scholars of development in academia quickly perceived the contradiction between brain drain and development: they protested and urged corrective action. In a seminal article in *Foreign Affairs* of July 1966, Dr. James A. Perkins, President of Cornell University, cited brain

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[758] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 2.

[759] William C. Gibbons to Sen. Walter F. Mondale, Department of State, Agency for International Development, Washington, D.C., Sept. 23, 1966. Inserted in *Congressional Record*, Oct. 13, 1966, p. 26503 (by Senator Mondale).

drain as a case study in which foreign and domestic policies of the United States sharply conflicted; unless the conflict was understood and resolved by governmental leaders, domestic pressures could "completely undermine and even nullify" our Nation's foreign programs. Dr. Perkins perceived the conflict as being specifically "between the objectives of our foreign assistance programs and the requirements of our expanding economy—between our efforts to train people in the less developed countries and our drain of foreign specialists to fill important jobs here in the United States." Pointing out the positive effects and accomplishments of the Nation's foreign assistance and exchange programs in bringing enlightenment and development to the LDCs, he addressed the disturbing, negative side effects of brain drain:

> It is at just this point, however, that our foreign and domestic policies come into conflict. For one of the gravest problems facing the underdeveloped world is the fact that all too many of its best-trained men and women leave home and never return to the departments of agriculture or the schools or the hospitals. If we accept the fact that those who climb the ladder of change are a minority at best, that the climb was difficult, and that the presence of these people determines whether or not a foreign assistance program will succeed, then we must understand that it is far more critical for the less developed world to lose them than it is for the more developed world to gain them. Yet it is just this loss we not only countenance but encourage. While with one hand we give laboratory equipment, train teachers, send our own teachers, build buildings—all on the very simple propositions that the modernization of the underdeveloped world is in our immediate and demonstrated self-interest and that the critical component of a modernizing society is its modernizing men—with the other hand we take away not only the raw materials but the very people who have been so carefully trained to develop them.

Dr. Perkins concluded:

> Here is the cruel fact of life: we are in competition with the results of our own assistance policies. While we support the idea of foreign development, our domestic needs may be quietly making hash of our best efforts abroad. In that case, foreign aid might simply be a misnomer for domestic assistance with overseas implications.[760]

Gregory Henderson, a research associate at Harvard University, former Foreign Service Officer, and author of authoritative studies on brain drain, predicted in 1966 what has come to pass in the early 1970's, namely, that the inflow of professionals from the LDCs would increase as political instability in these areas worsened. Thus, the contradiction deepens rather than attenuates as the United States gives aid with one hand and absorbs professional human resources with the other. With the benefit of firsthand knowledge in the field, along with expertise derived from research into the subject, Henderson made this sharp judgment:

> As revolutions and coups overthrow more of Africa's new regimes and those of other countries, more students will wish to remain in the United States. Our intention to help emerging nations will be increasingly compromised. Our Government's left hand is heedless of its right. We give aid to China, Korea, India, and Iran with the one and take their best-trained men away with the other. Our universities do no better than the Government. Students of development decry our failures to help emerging nations successfully; their colleagues sign on foreign technical assistants; the foreign student adviser bewails the nonreturn of training to the lands it should help. There are few universities, great

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[760] Perkins, op. cit., pp. 608, 616, and 618.

or small, that do not share in this pattern. Many other institutions and individuals have become caught up in it. A recent poll among international developers conducted by Paul Hoffman estimates that 10 percent or less of the potential human resources of emerging nations being utilized.[761]

Other scholars and international authorities have made similarly harsh judgments. Dr. George Seltzer, professor of economics at the University of Minnesota, stated categorically that brain drain was "perverting specific international programs for aid and technical assistance." [762] Dr. John C. Shearer, Director of the Manpower Research and Training Center at Oklahoma State University, presented data to the House Government Operations Committee that, he said, "dramatize the heavy loss of highly trained talent for underdeveloped countries." This brain drain, he said, "significantly offsets U.S. efforts to encourage the development of high-level human resources as the essential stimulators and implementors of economic and social development of poor countries." [763] Philip H. Coombs, Director, International Institute for Education Planning, UNESCO/Paris, stated that in some instances "the good that donor nations are doing with one hand is being canceled by the other, consciously or not." It was "counter-productive to be hiring away some of their best people for use in the donor country," while at the same time devoting millions of dollars and man-hours of aid effort in helping the LDCs to "train their specialized manpower and to build their own educational institutions." [764]

FMGs as "Reverse Foreign Aid".—Medical brain drain to the United States has been portrayed both as a countervailing force to foreign assistance and as "reverse foreign aid." In an oft-quoted assessment, Dr. Kelly West equated the inflow of FMGs with comparative costs in building and operating new medical schools. The value of this migration, he once said, "may be estimated at something of the order to us of $100 million per year, which exceeds somewhat the total value of our foreign aid in the medical field." [765] The Pan American Health Organization (PAHO) study estimated that the value of the estimated 300 FMGs coming to the United States from Latin America annually was "roughly equal to that of all U.S. medical assistance to Latin America." [766] Stevens and Vermeulen described the United States as "the recipient of substantial 'reverse foreign aid,' " because it "is reaping the rewards of investments made by other countries in the education of physicians" while "those countries are

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[761] *Selected Readings on International Education,* House Committee on Education and Labor, 1966, pp. 249–250. Drawing from his experience in Korea, Mr. Henderson gave this example of brain drain undermining foreign aid:

"I vividly remember the first electrical engineers we in the U.S. embassy in Korea considered for study in the United States in 1949. One ended up at Westinghouse, another at General Electric; a third, whom we did not send, is now a Columbia professor. They have since been joined here by several dozen more. Our aid program has to make up for them. Americans with no better engineering training than these Korean graduates, but speaking no Korean, devoid of either knowledge of or interest in Korea or its culture, are sent to advise USAID's electrical projects in Korea. They receive high salaries, live behind barbed wire, subsist on artificial PX and commissary support, and last all of 2 or 3 years. The same could be said of the programs in many other countries. Congress complains of the costs but contributes to them by passing such bills as H.R. 7700 and Public Law 37–885 of October 24, 1962, allowing thousands of such trained foreigners to remain permanently here. If we could figure the value of what we and our Congress thus remove from development, it would run into hundreds of millions of dollars."

[762] Seltzer, op. cit., p. 56.

[763] Hearings, House Government Operations Committee, *Brain Drain,* 1968, p. 22.

[764] Coombs, op. cit., p. 62.

[765] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills,* October 1966, p. 40.

[766] *Report on Brain Drain from Latin America,* Pan American Health Organization, 1966, p. 16.

suffering a long-term loss of physician services." [767] Dr. Dublin rendered a similar judgment. He observed that despite the commitment of many affluent nations to share their resources and technical knowledge with the LDCs, the "flow of medical manpower is predominantly from the lesser developed countries to the wealthier ones. This is a reverse form of foreign aid." [768]

Experience During the Fiscal Years 1971 and 1972.—That brain drain continues to work against the declared purposes of foreign aid is evident by selected data presented in Table 36 showing the experience of some LDCs during the fiscal years 1971 and 1972. In the case of India, the United States extended $456.9 million in obligations and loan authorizations for the fiscal year 1971; yet it cost India an estimated $105.7 million in educational expenditures to train the professionals emigrating to the United States; at the same time the United States saved an estimated $241.1 million in educational costs to itself. In the fiscal year 1972, the United States extended $428.5 million; the estimated cost to India for educating its emigrating professions was $107.4 million; the estimated educational savings to the United States was $279.0 million.

In the case of the Philippines, American aid authorizations amounted to $124.7 million in the fiscal year 1971. But the estimated educational cost of $51.4 million to the Philippines for its emigrating professions amounted to nearly one-half the amount of aid authorized. The estimated educational savings to the United States was $141.8, substantially more than the aid extended. Roughly the same proportions are apparent in 1972, when the United States extended $111.8 million in obligations and loan authorizations; the estimated educational cost to the Philippines for its emigrating professionals amounted to $47.4 million; the estimated saving in educational costs to the United States was some $124.8 million.

TABLE 36.—U.S. ECONOMIC AID TO SELECTED LDC'S; EDUCATIONAL COSTS TO SENDING NATIONS AND SAVINGS TO UNITED STATES OF IMMIGRANT SCIENTISTS, ENGINEERS, PHYSICIANS AND SURGEONS, ENTERING UNITED STATES AS IMMIGRANTS, FISCAL YEARS 1971 AND 1972

[In millions of dollars]

Area	Fiscal year 1971			Fiscal year 1972		
	U.S. economic aid [1]	Estimated educational costs to sending LDC	Estimated educational savings to United States	U.S. economic aid	Estimated educational costs to sending LDC	Estimated educational savings to United States
West Europe: Greece	14.1	4.3	10.3	13.5	3.8	10.4
Latin America	647.3	27.6	89.6	1,169.9	25.6	70.8
Asia:						
China	69.5	22.1	49.7	187.9	18.7	46.7
India	456.9	105.7	241.1	428.5	107.4	279.0
Korea	223.1	29.0	99.2	298.6	27.1	87.0
Pakistan	120.5	15.8	36.1	170.4	15.0	39.4
Philippines	124.7	51.4	141.8	111.8	47.4	124.8
Africa: Egypt		10.7	26.2	104.6	7.1	18.2

[1] The term "U.S. economic aid" is intended to mean U.S. obligations and loan authorizations as indicated in AID's report for 1973.

Source: The data in this table are drawn from the above tables 25, 29, and 35.

[767] Stevens and Vermeulen, op. cit., p. xi.
[768] Dublin, op. cit., p. 874.

In the case of other selected LDCs, the disproportion may not be so striking. But the overall impression given by the data in Table 36 is that losses through brain drain of professionals from the LDCs does tend to undercut the purposes of foreign aid and development programs. And the costs to the LDCs are compounded by the annual outflow of professionals and by the loss of their services to development over subsequent years of their productive lives. Moreover, the savings to the United States in educational costs constitute, as so many students of brain drain have observed, a "reverse form of foreign aid" from the LDCs to the United States. The judgments of the past are, therefore, affirmed by the experience of the last 2 fiscal years.

DECLINING INTEREST IN FOREIGN AID AND DEVELOPMENT

The interaction between brain drain and U.S. foreign policy has been quickened by the declining interest in foreign aid and international development, and continuing brain drain from the LDCs, notably in the medical and health professions. This interaction further weakens the commitment to international development and broadens the economic gap between the developed and developing countries of the world. Thus the Nation now faces a situation in which foreign aid is downgraded, brain drain from the LDCs ignored, and the growing breach between rich and poor disregarded. (A countervailing force in the decline in interest in Government-sponsored foreign aid and international development is the expansion of American-based privately organized multinational corporations, discussed above in Chapter VI.)[769]

Foreign policy observers, Government officials, and former and present policymakers, have publicly recorded their dismay at the declining interest in the Nation's commitment to development. In 1971, Caryl P. Haskins, then president of the Carnegie Institution of Washington, observed that the United States had made its lowest contribution to foreign aid since 1963: Less than half of 1 percent of GNP, the lowest of any member nation of the Organization for Economic Cooperation and Development.[770] President Nixon termed 1971 "a year of crisis for foreign assistance" in his 1972 foreign policy message to Congress, and proceeded to record declining congressional concern.[771] In his 1973 message the President expressed similar doubts about the Nation's support for foreign aid.[772] Before the House Foreign Affairs Subcommittee on National Security Policy and Scientific Developments in June 1972, Dean Rusk, former Secretary of State, reminded his listeners that during the Korean War the United States had maintained its foreign aid programs with 3.5 percent of the Nation's GNP. "Today," he said, "it is very difficult . . . to get one-half of 1 percent for foreign aid." And he added: "I agree with you foreign aid is in trouble. . . ."[773] Robert S. McNamara, President of the World Bank, noted that the

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[769] See p. 229.

[770] Caryl P. Haskins, "Science and Policy for a New Decade," *Foreign Affairs* 49, (January 1971), p. 248.

[771] *President Nixon's Foreign Policy Message to Congress of 1972*, pp. 73–76.

[772] *President Nixon's Foreign Policy Report to Congress of 1973*, p. 141.

[773] U.S. Congress, House, Committee on Foreign Affairs, *National Security Policy and the Changing World Power Alignment*, Hearing-Symposium before the Subcommittee on National Security Policy and Scientific Developments, 92d Cong., 2d sess., 1972, p. 3[illegible] (H[illegible] after [illegible] a [illegible]earing Symp[illegible]um, H[illegible] Foreign Affairs Committee, *Nat[illegible] Se[illegible]an[illegible] Cha[illegible]ng W[illegible] Power [illegible]lignme[illegible] 1972.)

rich nations of the world were devoting to foreign assistance only half of the 0.7 percent of their GNP that the United Nations had proposed as a proper allocation. The United States in particular was "laggard": the percentage of its GNP allocated to foreign aid was expected to shrink to 0.24 by 1975.[774] In June 1973, Robert R. Bowie of the Harvard University Center for International Affairs pointed out that the LDCs have become the "forgotten men" of U.S. foreign policy. He noted that U.S. foreign assistance had dropped to a low of three-tenths of 1 percent of its GNP, ranking 12th among the rich nations on this scale.[775]

Foreign policy specialists attribute this declining interest in international development to disillusionment growing out of the frustrations of the Vietnam War, to the mood of withdrawal gripping the Nation in the aftermath of Vietnam, in reaction to two decades of what many believe to be overcommitment in foreign affairs, to the balance of payments crises, doubts as to the efficacy of foreign aid, increasing domestic economic problems, and finally to the weakening of the Cold War spirit which had previously provided a substantial motivation for foreign aid.

This declining interest in development coincides with the continuing brain drain, now almost entirely from the LDCs. Inflows of scientists and engineers are decreasing, but the decline in this area is offset by a marked increase in the medical inflow. The downtrend in development and the sustained brain drain both contradict the principle of development, defeat the declared national purposes of assistance to the LDCs, and—many observers contend—contribute to potentially dangerous political consequences for the future.

QUESTION OF COMMITMENT TO LDC'S; AMERICAN RESPONSIBILITY AND NATIONAL INTEREST

The interaction between brain drain and development in U.S. foreign policy, as well as the contradiction now evident between policy intentions and actual performance in foreign assistance, raise a basic question about the Nation's commitment to the LDCs. For in the long run, and in some cases the short, the developing countries suffer adversely from the drain-off of professional manpower, and this loss of an educated elite in turn impairs the development that United States proposes to advance.

Students of brain drain state that the United States has assumed a responsibility toward the LDCs in accepting their professionals.[776] Perhaps the greatest responsibility this Nation assumes, they would argue, is to insure their return home after training so that they can carry on the tasks of nation-building. At this juncture responsibility becomes a national interest for the United States. As Dr. Frankel told the Senate Judiciary Committee in 1968:

> ... the "brain drain" is an important problem because it raises, in the most dramatic form, the question of the kind of world in which the United States wants

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[774] Harry B. Ellis, "Foreign Aid Fails to Filter to Poor," *The Christian Science Monitor*, Dec. 15, 1972, p. 10.

[775] Robert R. Bowie, "Forgotten Men of U.S. Foreign Policy," *The Christian Science Monitor*, June 27, 1973, p. 14.

[776] For example, Stevens and Vermeulen spoke of "the formidable international responsibilities imposed on the United States by the annual appearance of 10,000 physicians from countries with a vast range of languages and cultures, many of which have totally inadequate health services." (p. 76)

to live a generation, or even a half generation from now. Over the long run we cannot stand the burden of a world in which most people and most countries will have inadequate intellectual resources and leadership of their own, and will have to lean on us and one or two other giants for their own well-being. This is why the brain drain is an important matter, and why it behooves us to seek affirmative measures to alleviate it.[777]

Widening Gap Between Advanced and Developing Countries.—But a more profound national interest is involved than just the burden of dependency: it is the potential consequences for the United States of a continued widening gap between the advanced and developing countries. An underlying assumption of arguments by brain drain critics is that failure to halt the migration of professionals from the LDCs can only widen this gap. Development specialists warn that despite decades of development assistance the gap between rich and poor, rather than narrowing, has indeed been widening. Therein lies the potential danger, they say, for future U.S. foreign policy, and the vital connection between brain drain and foreign policy.

The argument is posed in general rather than specific terms. It goes something like this: as the development gap widens, tensions increase between the rich and poor nations—the "global cities" versus the "global ghettoes"; the rich become richer, the poor poorer; social and economic progress among the LDCs become arrested; frustration, anxiety, and despair set in as hopes and expectations diminish; bitterness and resentment are directed towards the rich and often against competing neighbors among the poor; global instability results; the United States, as the world's richest nation, cannot avoid being enmeshed in the international troubles that flow from these economic conditions. Among development specialists it is virtually a self-evident truth that growing impoverishment of the Third World has potentially adverse consequences for American diplomacy.[778] Secretary of State Henry Kissinger said as much when he told the special session of the United Nations General Assembly meeting in April 1974 on the matter of raw materials and development:

On behalf of President Nixon, I pledge the United States to a major effort in support of development. My country dedicates itself to this enterprise *because our children—yours and ours—must not live in a world of brutal inequality, because peace cannot be maintained unless all share in its benefits*, and because

[777] Hearings, Senate Judiciary Committee, *International Migration of Talent and Skills*, 1968, p. 22. Dr. Frankel has also defined the problem in moral terms. In an address to the State Department-sponsored conference on the imigration of talents and skills, he said: "First of all," it [brain drain] has been defined differently because our moral standards have changed. We no longer think that the manpower of the rest of the world is a resource for the enrichment of the already rich societies. We regard this as a problem, not just an opportunity. We take it as a sign of our defect and not a sign of the manifest opportunities we open up to people elsewhere in the world." (Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 78.)

[778] The potentially explosive nature of the LDCs was demonstrated by David Wood in a study entitled, "Conflict in the Twentieth Century." He noted that the majority of conflicts during the post-1945 years to 1967 had taken place in Africa, the Middle East, and Asia—the so-called Third World. He cited a list of 80 conflicts. A large number of them followed on or had been associated with the breakup of colonial empires and the subsequent emergence of new states which are often small, poor, and insecure. All but eight of these 80 conflicts involved Third World participants on both sides. (*Adelphi Papers*, June 1968, p. 19. Cited in, Brzezinski, op. cit., p. 7.) Since 1967, major wars have erupted in Nigeria, between India and Pakistan, and in October 1973 between the Arabs and Israelis. The United States has been involved directly in many of these upheavals within the less developed areas of the world, most notably Southeast Asia (Vietnam, Cambodia, and Laos) and the Middle East, where even today it finds itself deeply entangled.

America has never believed that the values of justice, well-being, and human dignity could be realized by one nation alone.[779]

That the rich are getting richer and the poor poorer is not an unproven hypothesis but rather a commonplace. The cartoon by LePelley in *The Christian Science Monitor* of October 4, 1973, entitled "Quo Vadis?" graphically portrays the essence of the problem. Western progress, depicted as a fleet of fast-flying jet planes, leaves behind the "Less Developed Countries," depicted as a bedraggled, emaciated, barefoot figure in tattered robes. The vast distance in space between the two, the speed of the jets and the immobility of the figure, suggests a mood of hopelessness for the LDC who, as the symbolic figure, is left behind and plaintively asks with out-stretched arms. "Where are you going?" What is shown graphically by LePelley is demonstrated statistically in Figure 9 and Table 37 on the development gap.

Literature on development and brain drain stress this disparity between the developing and the advanced countries as a matter of fact. In 1966, Gregory Henderson told the State Department-sponsored conference on the migration of talents and skills:

> . . . Setting aside the migration of talent from Britain, Germany, etc., and concentrating on that from the far more defenseless developing countries, no value with which the "brain drain" is concerned exceeds the developmental.
>
> The facts need little rehearsal. Secretary-General U Thant, Mr. Paul Hoffman, the chiefs of many governments including our own, have given persuasive, shocking evidence of the growing gap between rich and poor in the world. Half the world has per capita income of $100 or under where we have $3,000. Five percent of the world's nations have 95% of its science, the rest have as good as no science at all. Some 30,000 people die in the poor nations every day of preventable causes. There seems no end to the statistics of development gap horror.[780]

TABLE 37.—THE DEVELOPMENT GAP

Indicator	Developing countries	Developed countries	United States
Per capita GNP	$230	$3,085	$4,756
Population (millions, mid-1971)	1,850	664	207
Population growth rate (percent)	2.6	1.1	1.1
Literacy (percent)	40	97	98
Protein consumption (grams per person per day)	54	97	
Calorie consumption (per day)	2,180	3,030	3,300
Life expectancy (years)	52	71	70
Infant mortality (death per thousand live births)	110	21	
People per physician	3,400	700	620
Per capita power consumption (annual kilowatt-hours output per person)	220	5,140	8,000

Source: Based on U.S. Agency for International Development, "Development and Humanitarian Assistance, Fiscal Year 1973 Program Presentation to the Congress," p. B–1; and U.S. Agency for International Development, "Selected Economic Data for the Less Developed Countries," June 1972, p. 8. (Reproduced from Robert E. Hunter, project director, "The United States and the Developing World: Agenda for Action," 1973 (Washington: D.C., Overseas Development Council, 1973), p. 123.

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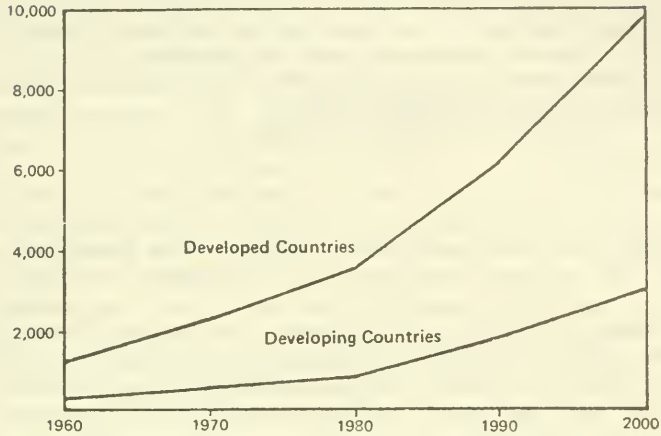
[779] U.S. Department of State, Bureau of Public Affairs, Office of Media Services, *Challenges of Interdependence.* Address by Secretary of State Henry A. Kissinger before the Sixth Special Session of the United Nations General Assembly. Washington, Apr. 15, 1974, p. 3. (Italics added.)

For a discussion of the interrelationship between the widening development gap and prospects for international peace and stability, see Brzezinski's, *Between Two Ages: America's Role in the Technetronic Era,* Chapter 3 entitled, "Global Ghettos." Brzezinski warns that the Third World confronts "the specter of insatiable aspirations." With the spread of education and communications, "passive resignation may give way to active explosions of undirected anger." (pp. 35–36) He predicts that "feelings of intensive resentment will most likely grow as the gap widens." Less developed areas containing the majority of the world's population and experiencing at best only partially effective progress will by the year 2000 "in all likelihood be the centers of volatile political activity, resentment, tension, and extremism." (p. 50.)

[780] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills,* October 1966, pp. 120–121.

Figure 9

Gross National Product for
Developed and Developing Countries, 1960-2000
(in billions of U.S. dollars, 1971)



Source: Figures for 1960 through 1980 are based on Bureau of Intelligence and Research, Department of State, The World's Product at the Turn of the Decade: Recessional, September 12, 1972. Projections for 1990 and 2000 were arrived at by computing annual growth at 5 percent for developed countries and 6 percent for developing countries. Reproduced from, Robert E. Hunter, Project Director, The United States and the Developing World: Agenda for Action, 1973 (Washington, D.C.: Overseas Development Council, 1973), p. 124.

In 1970, Mr. McNamara gave this appraisal of present and future disparity in economic development to the Columbia University Conference on International Economic Development:

> The gap between the per capita incomes of the rich nations and the poor nations is widening rather than narrowing, both relatively and absolutely. At the extremes that gap is already more than $3,000. Present projections indicate it may well widen to $9,000 by the end of the century. In the year 2000, per capita income in the United States is expected to be approximately $10,000; in Brazil, $500; and in India, $200.[781]

On December 23, 1973, James P. Sterba of *The New York Times* gave this end-of-the-year view of development in an article entitled,

[781] Robert S. McNamara, "The True Dimension of the Task," *International Development Review* (1970), p. 6.

"There are more poor in the world than ever: The United States now contributes less, others more, but to no avail":

> The aid people tried for a quarter of a century. They spent billions of dollars. They accomplished some remarkable feats. But they failed over-all.
>
> As 1973 ends, the world looks like this: There are 3.8 billion people on earth, give or take 200 million because the computations are often vague. Of the total, about 30 percent, those who live in North America, Europe, the Soviet Union and Japan, are rich. They earn generally more than $3,000 a year, or $8.21 a day. They consume 92 percent of the world's energy (the United States alone takes a third) and most of the other mineral wealth.
>
> The other 70 percent of the world's population, those who have to get by on . . . 65 cents a day, divide the remaining 8 percent of the world's energy and its leftover minerals.[782]

The economic consequences of the 1973–74 energy crisis has widened still further the gap between rich and poor. Caught up in a crossfire of rising prices for energy and growing food shortages, many LDCs are experiencing a deepening economic crisis. Predictions have already been made by responsible American officials of a possible famine in the offing in India. In March 1974, the Overseas Development Council forecast the possibility of some 30 poor nations with 900 million people facing economic collapse unless assistance was forthcoming. The nations cited are in tropical Africa, Southeast Asia, and Latin America and include Chile, India, Bangladesh, Uruguay, and possibly the Philippines. According to James P. Grant of ODC, the poorest nations need an additional $3 billion annually to cover increased prices for food, fertilizer, and fuel. India may be one of the hardest hit nations as the result of the energy crisis and food shortages.[783] In the United Nations, Secretary General Kurt Waldheim called for immediate assistance for countries threatened by economic disaster. "The fate of millions of people," he told the opening special session of the General Assembly on April 24, "may well depend, within the next few months on what this special session does, or does not do." [784]

These appraisals, and others of a similarly pessimistic nature, suggest that the world's future, at least in the next three decades, seems bleak: the gap in need and plenty can be expected to continue widening; prospects for escape seem not to be very promising. A scenario, constructed on Gunnar Myrdal's 1958 theory of "circular causation" that sketches out a continuing downward spiral in development among the LDCs and a corresponding widening gap with the advanced coun-

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[782] *The New York Times,* Dec. 23, 1973, p. E3.

[783] *The Christian Science Monitor,* Mar. 6, 1974, p. 3B. For the American response at this special U.N. session, see the address by Secretary of State Kissinger entitled, "Challenges of Interdependence," (op. cit.). For a summary and analysis of the session, see, Barbara Ward's commentary published in *The Economist* (May 18, 1974), pp. 65–73. Miss Ward observed that when the session closed on May 2, "it left behind the feeling that possibly something new had taken place." Secretary of State Kissinger, she wrote, called the session part of an "unprecedented agenda of global consultations in 1974" which implied "a collective decision to elevate our concern for man's elementary well-being to the highest level." Mr. Ivor Richard, Britain's chief representative at the United Nations, put it rather more simply: "Things will never be the same again." (p. 65.)

[784] *The New York Times,* Apr. 25, 1974, p. 10.

tries unless development aid breaks the cycle, has thus become a reality in the 1970's.[785] One immediate effect of this phenomenon is that it creates a dynamic interaction which appears to make the brain drain virtually inevitable. The argument, placed in the context of development economics, goes like this. The widening gap in incomes of the LDCs and advanced countries is reflected in the corresponding gap in salary levels of skilled occupations. As shown above in the discussion of economic causes of brain drain, this gap in income and salary exerts a general economic pull, attracting the best brains from the former to the latter, and thus, in the words of Prof. Hla Myint, "set up a dynamic cumulatively disequalising process or a 'vicious circle' which aggravates the economic gap between the two types of country."[786] The development gap perpetuates brain drain; brain drain prevents the establishing of a scientific-technological base; without this base development is impaired; the gap continues to widen—and so the cycle continues.

Thus brain drain can be a critical link in the development process, and this process is surely impaired by the outflow of the professional elite from the LDCs. The report of the House Government Operations Committee on brain drain came directly to the point when it said:

> The root of the concern is the inadequacy of trained manpower in the developing countries despite pressing needs for a great variety of skills, talents, and capacities for taking the initiative which development requires. The loss by these countries of scientists and other professionals to the United States reduces trained manpower where it is scarcest and most needed and augments it where it is most abundant. This can only widen the technological and economic gap between the richest country in the world and the poorest ones.[787]

EFFECTS OF DEVELOPMENT GAP ON FOREIGN POLICY: CONFRONTATION BETWEEN RICH AND POOR

The development gap between the rich and poor countries constitutes a potential threat to U.S. national security. This threat arises from

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[785] The theory of "circular causation" is discussed in Gunnar Myrdal's *Rich Lands and Poor* (New York: Harper, 1958). It is summarized in, Robert Ellsworth Elder, *The Policy Machine: The Department of State and American Foreign Policy* (Syracuse: Syracuse University Press, 1960), p. 42. This theory holds that an underdeveloped area has low standards of living which result in a poorly educated and relatively unhealthy work force, as well as little working capital for investment. Because of the character of the labor force, production is low, and producing units already in a country may eventually move to a more favorable location. This process further lowers the living standard, the level of education and health, and results in even less investment capital. Myrdal calls this the "backwash effect."

On the other hand, a country with a relatively high standard of living can maintain or improve its educated and healthy labor force, increasing production, bringing additional funds for investment, and causing additional producing units to enter the area. Myrdal calls this the "spread effect."

Thus, in the first case, conditions become progressively poorer; and in the second, they become richer. According to Professor Elder, Myrdal would be likely to advocate an economic development policy for the United States toward the LDCs which would enable them to turn the corner from regression to progress, from the "backwash effect" to the "spread effect." He concludes: "A policy without sufficient impact to accomplish this goal could never really be successful in making it possible for an underdeveloped country to 'go it alone.'"

Lafi Ibrahim Jaafari seemed to express the essence of this theory of "circular causation" in concrete terms in his survey of Palestinian and Jordanian Arab professionals and students who are residing in the United States. Jaafari concluded: "In overall perspective, the respondents tended to bear out the statement that the 'brain drain' is not only a cause but an effect of sociological, economic and governmental underdevelopment within the Middle East." (Jaafari, op. cit., p. 125.)

[786] Myint, op. cit., p. 236.

[787] Report, House, Government Operations Committee, *Scientific Brain Drain from the LDCs*, 1968, p. 1. The *Ditchley Park Conference Report* said that the loss of professional manpower from the LDCs "would imply that it was a factor enlarging still more the gap between rich and poor, whereas to strive to narrow that gap is an acknowledged aim of the United States, Britain and indeed all responsible nations." (p. 5.) President Perkins approvingly quotes John C. Shearer: "The movement of high-level human resources may, to a great extent, account for the persistent and ever widening gaps between the rich and poor areas." (op. cit., p. 618.)

two sources: (1) the increased likelihood of confrontation between rich and poor caused by political, economic, and social differences; and (2) world competition for vital mineral resources, the main sources of which are largely located in the LDCs.

Instability: Source of Conflict and Tension.—President Nixon expressed an oft-repeated truth voiced by foreign policy specialists and students of development when he said in his 1973 foreign policy report to the Congress: ". . . an increased pace of development is essential. Unless substantial progress occurs—through efforts by developed and developing nations alike—the stability of many countries and regions can be jeopardized as essential needs of people go unsatisfied." [788] In the mid-1960's, Dr. Kidd had warned: "If the gap does not narrow over the long run, the prospect of reduction of world tensions is dim." [789] In an appearance before House Foreign Affairs Subcommittee on the occasion of a review of national security policy, Mr. Robert R. Nathan, a consultant economist and development specialist, warned of the consequences for American security if the aggravated ills of the LDCs were not attended to. Alluding to the outbursts of racial violence in the United States against historic injustices long ignored, he went on to observe that Americans had learned that "great and growing gaps between the haves and have-nots are not conducive to happy and secure relationships among individuals or communities or groups within our own society." The Nation had responded belatedly, he said, to that "relative insecurity." He then warned:

> . . . if gaps persist and increase, as they tend to grow in absolute terms between the advanced nations such as the United States and the less developed nations, we will have a very distressing element of insecurity and there may come a time when American embassies and consulates and American ships and airplanes and American tourists may not be secure in any of the nations in the less developed world where there is terrible privation.[790]

In a lecture not many months later Mr. Charles W. Yost, a veteran American diplomat and foreign policy analyst for *The Christian Science Monitor*, deplored what he saw as a tendency in the Nixon Administration to downgrade the LDCs and the North-South problems and to become excessively preoccupied with relations between East and West. Ignoring the LDCs, he warned, would allow animosities to build up and situations to emerge that could lead to tensions and wars bound to involve the United States. Yost expressed concern over the disproportion in priorities and the dismal prospects for the future if present policy of ignoring the LDCs continued.[791]

Algerian Conference of Nonaligned LDCs.—That these warnings had substance and that the feelings against the advanced countries do, indeed, run deep in the LDCs is evident by the proceedings of the Fourth Conference of Non-Aligned Nations meeting in Algiers during September 1973. Delegates from 76 LDCs, representing the "overwhelming majority of mankind," as Algerian President Houari Boumedienne said, conferred for 5 days. The proclaimed "Spirit of Algiers" was in reality a spirit of confrontation. President Boumedienne made this clear when in an opening speech he outlined a plan

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[788] *President Nixon's Foreign Policy Report to Congress*, 1973, p. 141.
[789] UNESCO, *Final Report of the Conference on the Application of Science and Technology to the Development of Latin America*, 1965, p. 184.
[790] Hearing-Symposium, House Foreign Affairs Committee, *National Security Policy and the Changing World Power Alignment*, 1972, p. 202.
[791] Lecture in Washington, D.C., Jan. 25, 1973.

for a new world order in which the rich of the earth would no longer be able to dictate their wishes to the poor. The tone of hostility toward the advanced industrial nations that permeated the conference was shown by such slogans as, "Joint Action Against Multinational Corporations," "Economic Liberation," "Non-Alignment, a Commitment to Just Causes," "Down with Racism and Apartheid," "Down with Imperialist Monopolies," and "Down with Foreign Military Bases." The transcendent grievance was, however, the widening gap in development between the LDCs and the advanced industrial states. As the Reuter correspondent reported from Algiers, "the main binding link between the participants was the feeling that they were being left behind in the prosperity race led by the big industrialized countries." [792]

Brain Drain: Source of Grievances and Complaints.—Press coverage at Algiers did not mention brain drain as a deterrent to development. But it has been a subject of complaint in the past, and among LDCs most seriously affected, like India, brain drain remains a sore and lively issue in relations with the United States.

As long ago as 1966, Assistant Secretary of State Frankel called brain drain "an issue which is one of the steady, trying, troublesome diplomatic issues confronted by your government. Many other countries raise the problem of brain drain with us steadily." [793]

In the United Nations, delegates from the LDCs accused the West of transferring its exploitative urges from physical to human resources. On one occasion the representative from Dahomey called it an "odious bleeding" of Africa, a continuation of the slave trade. The General Assembly, where the presence of the LDCs is most forcefully felt, passed a resolution acknowledging the seriousness of the problem and expressing grave concern.[794]

In 1966, the Iranian Minister in charge of Cultural Affairs at Iran's Embassy in Washington complained to American foreign student advisors about the drain-off of Iranian students (some 60 percent) studying in the United States. "Our government," he wrote, "is now thoroughly alarmed at the very high casualty rate of these skilled young people and is pressing us to take effective counter-measures." [795]

So concerned has the Indian Government become about the loss of its doctors that it has taken administrative action to discourage emigration. For example, the United States has been prohibited from allowing prospective Indian FMGs to take the ECFMG examination at its embassy and consulates in India.

In recent years, the State Department has become more sensitive to the complaints of the LDCs, and apparently complaints have continued to be registered. Stevens and Vermeulen observed that with the present foreign policy attitudes of "low profile" in foreign affairs, coupled with the "pricking of the myth of omnicompetence," foreign governments, heretofore inclined to acquiesce quietly and without protest, have become "less likely to accept in silence" the loss of some of their best professionals.[796] They pointed out that one of the underlying

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[792] A 76-Nation Summit, *The Christian Science Monitor* (editorial), Sept. 11, 1973, p. 18.
[793] Department of State, *Proceedings of Workshop on the International Migration of Talent and Skills*, October 1966, p. 79.
[794] Eren, op. cit., p. 10.
[795] Quoted in, Said, op. cit., p. 7.
[796] Stevens and Vermeulen, op. cit., pp. xii–xiii.

pressures for change in American policy towards FMGs comes from "a growing clamor by foreign governments and international private groups (including groups in the Philippines, India, Thailand, and Korea) over the loss of physicians to the United States."[797] As recently as September 1973, Leslie Aldridge Westoff reported that a sign that brain drain was becoming "increasingly serious is the pressure put on our State Department by about 80 countries which have asked that we send students skilled in essential fields back home when their programs are over, and not encourage them to study sophisticated subjects, such as psychiatry, for which there is not yet a need where they come from."[798] Finally, Deputy Assistant Secretary for Educational and Cultural Affairs Alan Reich acknowledged publicly in February 1974 that "at times this problem creates embarrassment for the United States Government."[799]

Political Reality: Confrontation Between Rich and Poor.—Thus, confrontation between rich and poor is a reality in relations between the advanced industrial countries and the LDCs. The ingredients are present for heightening rather than reducing prospects for even more serious confrontations. Success of the oil embargo in the wake of the October 1973 Arab-Israeli war that spawned a worldwide energy crisis with far-reaching implications seemed to be a storm signal to the great industrial powers of a newly gained negotiating strength for the LDCs in an evolving world of interdependence.

WORLD COMPETITION FOR VITAL MINERAL RESOURCES IN SHORT SUPPLY

A related threat to American national security issuing from the development gap is the world competition for vital mineral resources in short supply. The main sources of these minerals are largely located in the LDCs.[800]

World Mineral Resources in the LDCs.—LDC predominance in possessing the world's minerals is a fact of nature that the industrial nations are rapidly becoming aware of, and movements toward developing cartel-relationships among the LDCs indicate the political pur-

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[797] Ibid, p. 89.

[798] Westoff, op. cit., pp. 79–80.

[799] *Congressional Record*, Mar. 12, 1974, p. E1340.

[800] The energy crisis of 1973–1974 made Americans conscious of the uncertain supply of many resources, materials, and commodities vital to national needs. This concern was reflected in the Congress. On Feb. 19, 1974, Senate Majority leader Mike Mansfield (D-Mont.) and Senate Minority leader Hugh Scott (R-Pa.) corresponded with the President on this matter. They suggested the creation of a Legislative-Executive Branch mechanism in conjunction with representatives of industry, labor, and other areas of national life "for the purpose of thinking through our national needs, not only as they confront us, today, but as they are likely to be five, ten or more years hence and how they are best to be met." The President reacted favorably to the suggestion and proposed a meeting with leaders of the Executive Branch. On Apr. 9, 1974, the Senate Democratic Policy Committee adopted a resolution incorporating the ideas set forth in this exchange of correspondence. (Mike Mansfield, "A Proposal for a New Approach on Economic Foresight," Remarks in the Senate, *Congressional Record,* Apr. 11, 1974, pp. S5744–S5745.)

That there is an urgency to study and future planning in the materials field was indicated by Dr. Franklin P. Huddle, Senior Specialist in the Science Policy Research Division of the Congressional Research Service, in a study prepared in 1972 for the House Committee on Science and Astronautics. Dr. Huddle wrote: "The question is not whether the United States *could* pursue a policy of self-sufficiency in materials without total economic collapse. It could. But not without painful readjustments, severe inflation, and an inestimable erosion of individual freedom of choice and standards of living. In the past, such sacrifices have been observed in nations only under the powerful motivation of war for survival." (U.S. Congress, House, Committee on Science and Astronautics, *Industrial Materials: Technological Problems & Issues for Congress,* A study prepared for the Subcommittee on Science, Research, and Development by Dr. Franklin P. Huddle, Science Policy Research Division, Congressional Research Service, Library of Congress, 92d Cong., 2d sess., 1973, p. 14. Committee print.)

poses they have in mind. John K. Cooley, Middle East correspondent for *The Christian Science Monitor*, reporting on the Algiers conference of the non-aligned LDCs, wrote that the delegates represented countries that "contain over half the world's oil and two-thirds of most of its other vital resources." [801] The 1973 report of the U.S. National Commission on Materials Policy stated: "The less developed regions of the world have held the principal sources of materials imported by industrial countries." [802]

According to C. Fred Bergsten, senior fellow at Brookings Institution, four countries control more than 80 percent of the exportable supply of world copper; two countries account for more than 70 percent of world tin exports, and four countries raise the total close to 95 percent; four countries produce more than 50 percent of the world supply of natural rubber; four possess over one-half the supply of bauxite (the inclusion of Australia raises the total above 90 percent); a few countries are coming to dominate each of the regional markets for timber, said to be a truly vanishing resource. "A wide range of Third World countries thus have sizeable potential for strategic market power," concludes Mr. Bergsten.[803] Secretary of State William P. Rogers recorded in his 1972 foreign policy report to Congress that the "known reserves" of many minerals are located in the LDCs. Peru, Chile, Zambia, and Zaire, he said, supply most of the world's exportable copper. Malaysia, Bolivia, and Thailand account for 70 percent of the tin in international trade.[804] The Materials Policy report produced a table showing the significance of mineral exports in 1968. Export of minerals from the LDCs accounted for 46.1 percent of total exports; the proportion in the case of the more developed countries was only 15.7 percent. In Latin America alone mineral exports accounted for 39.1 percent of total exports; in Africa, for 48.6 percent; and in Asia, for 15.5 percent.[805]

Growing U.S. Dependency on Mineral Imports.—In the last 60 years the direction and dimensions of the import/export of materials by the United States has changed "dramatically"—in the words of the Materials Policy report.[806] "While both imports and exports of materials increased," the report said, "imports expanded more rapidly to the point where the United States imports 15 percent of minerals consumed and 8 percent of forest products consumed." [807] In 1973, the United States had a deficit of some $7 billion. Elburt F. Osborn, until last year director of the Bureau of Mines, warned shortly before leaving office that if present trends in mineral uses continue, the U.S. deficit could approach a rate of $100 billion a year.[808] In the meantime, he predicted "cutthroat competition on a global scale." [809] According to Secretary Rogers, United States imports of energy fuels and minerals

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[801] John K. Cooley, "Nonaligned Nations Aim for 'New World Order'" *The Christian Science Monitor*, Sept. 8, 1973, p. 3.

[802] National Commission on Materials Policy, *Material Needs and the Environment Today and Tomorrow, Final report*, 1973, pp. 9–11. (Hereafter cited as, National Commission on Materials Policy, *Final Report*, 1973.)

[803] C. Fred Bergsten, "The Threat from the Third World," *Foreign Policy* 11, (Summer 1973) pp. 107–108.

[804] *Secretary of State Roger's Foreign Policy Report to Congress of 1972*, 1973, p. 43.

[805] National Commission on Materials Policy, *Final Report*, 1973, pp. 9–13.

[806] Ibid. pp. 9–11.

[807] Ibid.

[808] Carroll Kilpatrick, "Arab Example Worries Officials: Crisis in Minerals Is Feared," *The Washington Post*, Jan. 14, 1974, p. A1.

[809] Ibid.

are expected to increase from $8 billion in 1970 to more than $31 billion by 1985.[810]

U.S. dependence on foreign imports of materials, many of which are from the LDCs, is impressive. Table 38 gives the percentage of U.S. mineral requirements imported during 1972 and the source countries, while Table 39 shows the changing import requirements of the United States in the mineral and materials field.

TABLE 38.—PERCENTAGE OF U.S. MINERAL REQUIREMENTS IMPORTED DURING 1972

Source: "The International Scope of the Materials System," Figure 2.32. The United States imported varying amounts of metal, nonmetallic, and fuel minerals from more than 40 countries or areas of the world in 1972. No major nation of the world is completely self-sufficient in all the minerals required to sustain an industrialized economy. Source: U.S. Department of Interior, Bureau of Mines, 1973. (Reproduced from: National Commission on Materials Policy, "Materials Needs and the Environment Today and Tomorrow: Final Report," 1973, p. 2.25.)

[810] *Secretary of State Rogers, Foreign Policy Report to Congress of 1972*, 1973, p. 43.

TABLE 39.—CHANGING IMPORT REQUIREMENTS OF THE UNITED STATES

[Net imports as percent of domestic use]

	Net[1] imports (percent)		
	1950	1960	1970
Ferrous metals:			
Iron ore	5	25	30
Chromium	100	94	100
Cobalt	92	75	96
Columbium	100	100	100
Manganese	77	92	94
Nickel	99	88	91
Tungsten	80	40	(2)
Vanadium	(3)	41	1
Nonferrous metals:			
Aluminum (bauxite)	71	77	86
Beryllium	89	96	w
Copper	35	9	8
Lead	59	59	40
Nonferrous metals—Continued			
Magnesium	0	1	0
Mercury	92	36	38
Platinum	91	95	98
Tin	100	100	100
Titanium	32	30	47
Zinc	37	54	60
Other basic materials:			
Petroleum	8	17	22
Natural gas	0	1	3
Uranium		47	0
Timber products[4]	11	11	8
Natural rubber	100	100	100

[1] Net imports include semirefined forms (e.g. ferromanganese).
[2] Stockpile transactions distort proportions.
[3] Withheld for disclosure reasons.
[4] Net imports in 1972 are up 50 percent from 1970.

Source: Interim report (April 1972) National Commission on Materials Policy and Minerals Yearbook, Bureau of Mines (Reproduced from: National Commission on Materials Policy, "Materials Needs and the Environment Today and Tomorrow Final Report," 1973 p. 2.23.)

Dependence on this scale for foreign supplies of minerals illustrates U.S. vulnerability to pressures from the source countries. This vulnerability is increased by the fact that 15 of the 26 companies from the advanced industrial countries involved in the foreign extraction and production of oil, copper, aluminum, and nickel have their headquarters in the United States.[811] Nationalization, or threat of nationalization, is always the ultimate recourse in a changing bargaining relationship, and for the United States the cost could be considerable. U.S. corporations have invested some $30 billion in LDCs and these investments are growing at about 10 percent a year.[812] "Confiscation of its investments in the Third World," Mr. Bergsten states, "could thus create major costs for the United States." Much of this investment, he went on, is in raw materials; so "Third World action could affect the United States doubly (as it already has in oil) by both raising our costs and reducing our earnings."[813] Thus depedency inevitably creates vulnerability.

Potentialities for Conflict.—The potentialities for conflict between the United States and the LDCs seem to issue from three sources:

(1) The inherent U.S. dependency on foreign supply. ("For the United States," the Minerals Policy report said, "self-sufficiency is technically possible at times, but economically unfeasible and diplomatically unacceptable at others.")

(2) The fact that the United States has the highest per capita demand for materials, while the rate of demand is increasing more rapidly in the rest of the world so that mineral specialists now speak of a "global minerals shortage"; and

(3) The growing awareness among the LDCs that they possess unique marketable resources will tend to lessen their fears of exploitation and encourage a practical bargaining attitude.[814]

[811] National Commission on Materials Policy, *Final Report* 1973, pp. 9–11.
[812] *Secretary of State Roger's Foreign Policy Report to Congress of 1972*, 1973, p. 43.
[813] Bergsten, op. cit., p. 112.
[814] National Commission on Materials Policy, *Final Report*, 1973, p. 4B–13, and *The Washington Post*, Jan. 14, 1974, p. A1.

The combination of these three factors has created a situation in the minerals field akin to the 1973–74 crisis in oil. The LDCs have powerful bargaining leverage, as the Arabs have already demonstrated. Applied in the minerals field this leverage could have far-reaching adverse economic and political consequences for the industrial nations. The oil situation, Bergsten wrote, is the "prototype": "Oil may be merely the start." [815]

"We are not in a minerals crisis at the moment," said Dr. John D. Morgan, Jr., Acting Director of the Bureau of Mines, "but we must take cautionary action to avoid being in one a short distance down the road." What worries U.S. officials is that a cartel of nations having control over the bulk of supplies of a given mineral will, indeed, follow the Arab example, and, as one press report put it, "try to blackmail the rest of the world." [816]

It goes without saying, therefore, that the politics and economics of a "global minerals shortage" can create grave new problems between the United States and the LDCs, for as Secretary Rogers said, the United States has a "clear interest in facilitating the flow of resources to the developing world." [817] Thus the impending minerals shortage is pregnant with possibilities for conflict between the LDCs and the advanced industrial countries. Mr. Bergsten, sharply criticizing the administration and Congress for failing to take greater interest in the LDCs, urged establishing a policy framework that would depress conflict, and offered this estimate of the consequences of pursuing a policy of confrontation with the developing countries:

> . . . it is no longer clear that the United States would emerge "the winner" in confrontation with the Third World. Even if it was economically irrational for other countries to trigger such confrontations, however, this by no means rules them out. Individual LDC governments might be forced into such a posture by internal political imperatives even if the outcome were unfavorable to their "true" national interest. But the main point is that the United States would suffer significant costs even if, in some sense, it "won" a confrontation—by substituting high-cost shale oil for lower-cost Persian Gulf crude, or South Carolina cotton goods for Korean synthetics. In the long run, there will be no winners. Since the policy framework of U.S. relations with the Third World is likely to go far in determining whether such events occur, or even threat to occur, U.S. interests would be greatly served by creating a framework in which they will not occur.[818]

Call for Policy Reappraisal.—Development specialists seem agreed on a policy of interdependence as a means for reducing the development gap and for achieving the Nation's best interests. The inequities and injustices issuing from the development gap, along with one of its causes, brain drain, have long provoked the LDCs. But it has also pricked the conscience of Americans and inspired demands among political leaders and foreign policy specialists for reappraisals of policy and corrective action. Underlying the expressions of moral indignation and recommended responses are assumptions that "national security interest" and "self-interest" could be achieved by recognizing and acting on the principle of the interdependence of nations. Professor Robert R. Bowie of Harvard has warned that the waning of con-

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[815] Bergsten, op. cit., p. 110.
[816] *The Washington Post*, Jan. 14, 1974, p. A1.
[817] *Secretary of State Roger's Foreign Policy Report to Congress of 1972*, 1973, p. 43.
[818] Bergsten, op. cit., p. 116. In this same article, Mr. Bergsten wrote: "The United States is the least responsive to Third World needs of any industrialized country at this time. U.S. help is small in quantity, and getting smaller. Its quality is declining. It often runs directly counter to the central objectives of the LDCs just outlined. It lags far behind the policies of Europe and Japan. The Administration and Congress must share in the indictment." (Bergsten, op. cit. p. 104.)

cern for the LDCs is "extremely shortsighted." It is not feasible, he said, "to develop a peaceful order for an interdependent world while ignoring one-half of it." "The urgent necessity," he continued, "is to reappraise U.S. interests in the developing nations and its relations with them." [819]

A similar urgency was evident in the Overseas Development Council's study, "The United States and the Developing World: Agenda for Action," published in 1973. In an introduction the Rev. Theodore M. Hesburgh, C.S.C., President of Notre Dame, emphasized the imperatives of self-interest that were to be achieved in a world of growing interdependence of nations. Stressing the moral approach that permeates the entire study, and the value of interdependence, Father Hesburgh wrote:

> . . . the United States has a new and broader self-interest that can be secured only if it is merged with growing regard for a global interest. This global interest must also include a greater concern for social justice among nations and peoples. There are practical reasons for this, based on the desire of rich countries to secure more cooperation from the poor in meeting common problems. But there is also our membership in one human family. We now have greater awareness of the problems facing people everywhere, especially people who are poor; and there is increasing opportunity for people rich and poor to do something about these problems.[820]

Nearly a decade ago Senator Mondale in a speech on the floor of the Senate made much the same appeal for a reappraisal of policy, but with one significant difference: he correlated the problem of development directly with brain drain.[821] The United States may gain in the short run, he said, but the brain drain to the United States "threatens one of the paramount longrun objectives of American foreign policy—progress in underdeveloped lands." Quoting from the Montreal speech of Secretary of Defense McNamara that world security and U.S. security depended upon development of the LDCs, the Senator stated that, "Since the brain drain threatens development, it is ultimately a threat to the security of our own land." He was "troubled" by the one-way flow of brains from the poorest nations of the world to the richest, some having the finest educational institutions. He was also concerned that this country was "following a continuing policy of draining professional manpower from countries whose rapid development is strongly in our national interest." Laying out a program for corrective action, the Senator went on to urge the importance of balance. He emphasized the valuable contribution of immigrants from all continents to the Nation's life. But he warned that "if we would build a world where our children can live in peace and freedom, development of poor nations must likewise receive high priority in our national policies." The Senator concluded with a prediction of what he hoped could be avoided: "The gap between rich and poor will continue to widen, and hopes for lasting peace will vanish for our century."

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[819] *The Christian Science Monitor*, June 27, 1973, p. 14.

[820] Robert E. Hunter, project director, *The United States and the Developing World: Agenda for Action*, 1973, Washington, D.C., Overseas Development Council, February 1973, pp. 2–3. Harry B. Ellis summarizes some of the main points in the study. See, "Rich Nations Warned Poor Must Catch Up," *The Christian Science Monitor*, Feb. 22, 1973, p. 11. Mr. Ellis concludes: "Much of this has been said before. What is new is the stress on self-interest on the part of the United States, caught up in a world of growing interdependence."

[821] Sen. Walter F. Mondale, "The Brain Drain from Developing Countries," Remarks in the Senate, *Congressional Record*, Aug. 31, 1966, pp. 21477–21480.

DEVELOPMENT GAP, BRAIN DRAIN AND INTERDEPENDENCE: INTERACTING FORCES WITHIN A NATIONAL MOOD OF WITHDRAWAL

Eight years later the development gap has in fact widened; and brain drain, though now a foreign policy of low visibility, constitutes an even greater threat to the educated elite of the LDCs and accordingly to progress towards their development. Added to these factors are the indifference and apathy which characterize the Nation's response to development problems that specialists insist can be managed only within the framework of an actively pursued policy of interdependence.

As Secretary Kissinger told the special session of the United Nations General Assembly meeting in April 1974 on problems of raw materials and development, "We in this Assembly must come to grips with the fact of our interdependence. . . . economics, technology, and the sweep of human values impose a recognition of our interdependence and of the necessity of our collaboration." [822]

But the prevailing national mood of withdrawal from what many students of American foreign policy have perceived to be excessive global commitments is incompatible with the requirements of a vigorously pursued policy of interdependence.[823] To a great extent this

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[822] Kissinger, "Challenges of Interdependence," p. 2.

[823] The direction of U.S. foreign policy at least in the immediate future will be determined largely by the attitudes of the American people. Surveys of American public opinion made in the winter and spring of 1974 reinforce the belief that their attitudes are changing increasingly from internationalist to isolationist. It is said that isolationism in this country has more than doubled in the last two years and that during the same period internationalist views among Americans have dropped 15 percent to a post-1945 low. "There has been a pronounced tendency to turn inward," the survey said, because of what was termed the "shattering" effect of the American experience in Vietnam on beliefs in "U.S. predominance in power" and, more important, because of preoccupation with increasing domestic problems.

The surveys were planned, financed, and analyzed by Potomac Associates, Inc., and the polling was done by the Gallup organization. One of the surveys relates to testing internationalist attitudes, the other to testing "hopes and fears" of Americans. The internationalist survey was to be published in June 1974 in a book entitled, "A Nation Observed: Perspectives on America's World Role," edited by Donald R. Lesh; the other survey was to be published in the fall as the second in a series of books called, "State of the Nation," edited by William Watts and Lloyd A. Free.

The poll on international views revealed that "total isolationists" increased from 9 percent of a sample polled in 1972 to 21 percent interviewed in 1974. "Total internationalists" declined from 56 percent in 1972 to 41 percent in 1974. An essay based on the international poll revealed among other things that 42 percent of Americans, against 43 percent who disagree, feel that it is no longer important for the United States to be No. 1, that is, "the world's most powerful nation." Most Americans see U.S. power declining as other nations improve their power positions; most said they would be satisfied with "essential equivalence" with the Soviet Union. More than half of those surveyed (excluding those expressing no opinion) believed that too much was being spent on defense; 15 percent advocated an increase in military expenditures. And a majority of Americans would disapprove of the United States going to the defense of Japan; only 48 percent would approve the use of military force to help Western Europe.

A chart of internationalist-isolationist trends showed a steady decline in internationalist feelings—65 percent in 1964, 59 percent in 1968, 56 percent in 1972, and then the sharp drop to 41 percent in 1974. On the other hand, isolationism held constant from 8 percent in 1964 to 9 percent in 1968 and again 9 percent in 1972 before rising to 21 percent in 1974.

The last question in the survey was presented as a proposition: "We shouldn't think so much in international terms but concentrate more on our own national problems and building up our strength and prosperity here at home." The survey showed that 77 percent agreed with this statement, as against 14 percent who disagreed, and 9 percent who offered no opinion. The 77 percent in agreement contrasted with 55 percent in 1964, 60 percent in 1968, and 73 percent in 1972.

This growing isolationist spirit was reflected throughout the entire population but was most advanced in rural areas and small communities, the Midwest and West, and among the young. A striking decline in internationalism occurred among people under 30 years of age—71 percent in 1964 to 42 percent in 1974, a decrease of 29 percent. Mr. Free, a polling specialist and editor of one of the books to be published, concludes his analysis of findings with this warning: "The only prediction that I feel can be made with some confidence is that the greatest complications in international relations over the next decade are likely to stem from violations of expectations; of what our allies, friends, competitors, and former adversaries expect of the United States, and what Americans expect of themselves and the world as a whole." (Leslie H. Gelb, "Polls Find U.S. Isolationism on Rise, Hope at Ebb," *The New York Times*, June 16, 1974, p. 3.)

mood, along with other forces noted above, accounts for the declining U.S. interest in international development. Nevertheless, it is possible that a new balance in the foreign policy posture of the Nation may be struck as it recovers from the frustrations of Vietnam and fears of economic instability, and succeeds in resolving some of its more pressing internal problems so long left unattended and others that now seem to threaten its prestige and integrity in the eyes of the world. As the requirements of interdependence press in upon the Nation's security interests, a rational policy choice may compel reengagement on the broader scene of international development. Meanwhile, as this study points out, the Nation is not without recourse in providing at least some remedies for the brain drain. By taking remedial action a contribution, however modest, could be made to aid progress toward development in the most seriously affected LDCs while at the same time advancing the economic and military security of the United States.

VIII. Brain Drain: A Force in History, Science, Technology, and Diplomacy

A subject so universal, so wide-ranging in its implications, and so multifaceted, as brain drain defies simple summation. Three transcending themes deserve special emphasis for the purposes of this study. They are:

(1) That brain drain is an historical phenomenon with a past, a present, and a future;

(2) That brain drain, as a problem, has special relevance for the modern scientific-technological age; and

(3) That the brain drain problem, lying as it does at the juncture of science, technology, and American diplomacy, reveals and is symptomatic of a deeper and far more serious problem: that of this Nation's relations with the LDCs and its foreign policy stance respecting the larger issue of international development as related to U.S. economic health and national security.

Brain Drain as an Historical Phenomenon

Migration is a natural phenomenon in the history of mankind, and brain drain is one of its unique manifestations. An integral part of historical development, brain drain is a process, not an event. It has a past, a present, and a future; the direction of its flow depends upon historical forces that determine the rise and fall of nations, and the ebb and flow of their wealth and power. Scientists and scholars, doctors, and other intellectuals going to Athens, Rome, and Alexandria in the Ancient World; to Bagdad, Bologna, London, and Paris in the Middle Ages; to France, England, and Germany in the 19th and early 20th centuries; and to the United States in the 20th—were drawn along a magnetic course whose center of attraction was power, wealth, and civilization.

A widely accepted principle provided a rational basis for this talent migration throughout history: the principle of self-determination. Without the exercise of this human right there could not have been mobility in the past, nor could there be in the present and future. Motivated by powerful economic, social, intellectual, and political forces, talent migrates to seek its greatest reward.

Now, as throughout history, state policies contribute to this flow of talent from nation to nation. The value placed on the acquisition of science and knowledge determines the intensity in applying these policies. Science policy is thus a durable phenomenon in the history of mankind, as indeed is the perception among nation-states of the interrelationship among science, diplomacy, and the acquisition of political power. A persisting awareness of the value of technology and its handmaiden, science, as instrumentalities of progress, politics, and power continues into the contemporary era.

Relevance of Brain Drain as a Problem of the Contemporary Era

The relevance of brain drain as a problem of unique dimensions in the modern era derives from a combination of intellectual, economic, social, political, and diplomatic factors that are themselves rooted in the reality of contemporary scientific-technological civilization. Science, technology, and economics catalyze the normal forces producing brain drain; they quicken the process; they complicate the solution.

Yet science and technology do not function in a vacuum; they evolve in a world environment that has shown marked changes over the past three decades. Unique political and economic conditions created by these changes have encouraged brain drain to flourish as a contemporary international phenomenon. The political aspects of the brain drain problem are rooted in the processes of decolonization that have produced a "Third World" of independent states in Asia and Africa. The economic aspects derive from the nature of an evolving and increasingly globalizing industrial revolution with parallel developments in the world of science and technology. This revolution has created an expanding world economy, stimulated the universalization of knowledge, and generated competing needs and demands, priorities and goals, between the advanced industrial societies and the emerging LDCs. The former seek expanding markets and resources, human and material, for sustaining and enlarging their industrial systems; the latter seek development and modernization of their undeveloped and developing economies so that they can assume positions of some worth in the society of nations. Both are motivated by the imperatives of want; their competitive energies are directed toward the acquisition of trained professional manpower, a common need for a common purpose—development and growth.

But the advanced industrial countries possess most of the advantages in this competition for human resources; the LDCs have few. Structural maladjustments and inner disequilibria in the country of emigration or immigration, or both, activate "push/pull" forces that inevitably produce brain drain flows from the less developed to the advanced nations. And it is the LDCs which suffer most from dislocations that set into operation these brain drain forces. Added incentives are often created by state policies that reorder immigration priorities to stress quality over quantity, and that grant other allurements at the disposal of the wealthy to induce immigration. The LDCs cannot compete; the odds are against them. Hence for this drain-off of trained manpower it seems an inescapable conclusion that the most advanced societies bear "universal culpability." The United States, long the mecca of world immigration, has been one of the prime beneficiaries; and though, after nearly a quarter century of massive inflows of professionals, the number of immigrant scientists and engineers declined somewhat from 1972 on, the inflow of foreign physicians and surgeons continues on a steady upward trend. What aggravates the situation for the LDCs is that for nearly a decade the losses of professional immigrants to the United States have been shifting increasingly from the advanced to the emerging countries; in recent years flows of professionals have been almost entirely from the latter.

In the long view of human experience, the brain drain problem can thus be seen as an historical reality, perhaps an historical inevitabil-

ity—but one of unique proportions in the contemporary era. Forces of progress and poverty are in contention; professional trained manpower is the object of struggle. Causes of this problem lie deep in the nature of scientific-technological civilization and in the nature of newly developing and aspiring societies in the Third World. Effects are virtually predetermined by forces turned loose in the struggle for international development: the gap between rich and poor widens dangerously and the potentialities for tension and conflict between advanced and developing societies magnifies. And though the United States may be the gainer in the drain-off of professional manpower from the LDCs, the gains may prove to be more apparent than real as the potential power of the LDCs is brought to bear on the international scene. For while the effects of the brain drain problem intrude on the Nation's domestic policy and make their presence known in many ways, it is in the realm of foreign policy where science, technology, brain drain, and national policy interconnect in a way that can produce serious implications for the foreign policy goals of this Nation. These implications include economic dislocations, denial of overseas markets, tensions with the "Third World," the withholding of needed raw materials, and eventually a global compartmentalization of a "Spaceship" that needs to unite to survive.

Brain Drain at the Juncture of Science, Technology, and American Diplomacy

Brain drain is a symptom of underdevelopment; solutions lie largely in the realm of international development; the most essential mechanism is nation-building through science and technology. As a foreign policy problem, therefore, brain drain raises the basic question of this Nation's stance towards international development.

Brain drain is essentially a foreign policy problem of low visibility; but even so, it is a testing ground for the vitality of a policy of much larger significance, namely, the Nation's commitment to development. Solutions for brain drain may be the primary responsibility of the LDCs, particularly the task of institution-building and establishing an infrastructure of science and technology as the basis for modernization, but solutions can neither be devised nor development goals achieved without assistance from the advanced countries like the United States. Success in diminishing the "push" factors in brain drain and in resolving the dilemma of development by transforming needs into demands would seem to rest upon acceptance of the principle of interdependence as a contemporary fact of life in international affairs.

That the United States has an interest in international development on humanitarian grounds goes without saying; it is a long-established tradition in this Nation's diplomatic history. But development specialists, among others, urge a more hard-headed appraisal of the national interest, one that requires, out of national interest, rejuvenation and reaffirmation of the Nation's commitment to development. The case is made, in short, from the position of political realism. It would seem beyond dispute that the LDCs, long the cockpit of international tension and conflict in which the United States has not been able to stand aside uninvolved, hold the potentialities for even deeper and more dangerous involvement. War in South and Southeast Asia, recurring crises

in the Middle East, famine and tribal strife in Africa, are only recent illustrations of the problems that have been shaking the foundations of this volatile, troubled Third World. Economic development, it is argued, offers perhaps the best prospects for peace and stability. Thus the increasingly compelling requirements of political interdependence bind all nations, advanced and underdeveloped, in a common search for peace through economic development.

American dependence on mineral resources largely under the control of the LDCs, as development specialists are quick to indicate, points to a new vulnerability for the United States. Awareness of this problem comes at the height of the current energy crisis and suggests what may be a scenario for things to come with growing cartelization of world mineral resources and growing consciousness of increased leverage among the LDCs to be used against the advanced industrial nations. Reasons of self-interest appear to warrant a reappraisal of the Nation's posture towards the LDCs and the affirmation of a policy of interdependence.

Counterforces hinder solutions to brain drain through economic development. A mood of withdrawal from extended—possibly overextended—foreign policy commitments seems to have enveloped the Nation in the post-Vietnam era. Reinforced by other powerful forces, termed isolationist by some observers, this mood has had the effect of restricting foreign policy initiatives and inducing a cautious attitude among lawmakers toward reaffirming traditional but far-reaching foreign policy commitments. Apathy and indifference toward economic development (and also immigration) is reflected in the attitude and posture of the administration; and thus far in the 1970's the Congress, preoccupied with other pressing matters such as the energy and constitutional crises, has seemed unaware that a problem exists.

Persisting difficulties, dilemmas, and paradoxes, make unlikely a long-term, much less a short-term, "solution" of brain drain. The LDCs must cope with severe economic deficiencies, now worsened by the petroleum pricing policies of the Mid-East—yet to do so is the first requirement of development. They are faced with seemingly insoluble problems in institution-building and in modernizing their traditional societies. They cannot avoid the perplexing dilemma posed by adherence to democratic principles of human rights, while taking measures to check emigration; nor can they avoid the dilemma inherent in the natural inequalities of opportunity among peoples and nation-states.

On its part the United States is thrust into the position of coping with declining interest among the American people in international development and with what the present study has found to be a virtually nonexistent present concern for brain drain as a foreign policy issue. It is faced with the dilemma posed by restricting immigration selectively, while seeking the right balance of adherence to the democratic principle of free movement of people. It seems to have no other course than to come to terms with the paradox presented by potential loss through brain drain in educating the untrained in the nation-building process, and also with the further paradox inherent in the "permanent draw" of the disadvantaged to an advanced scientific-technological civilization.

In the face of many perplexing ambiguities and conflicting trends, perhaps the most that can be expected at the present juncture in U.S. foreign policy is that brain drain and the larger problem of international development be placed on the agenda of matters to be attended to when the Nation has recovered its balance, slowed its retreat from international involvement, and is prepared to resume a larger, and some would say a more creative, role in world affairs. This course, requiring a vision of the future and a reassessment of this Nation's place in it, would seem to be unavoidable, one dictated by self-interest, not a matter of moral conscience or mere national preference. For in the judgment of students of development and brain drain, one of the major challenges to mankind remains the challenge of finding ways to put the LDCs on a course leading to a self-reinforcing upward spiral of social and economic progress. The ultimate goal of this endeavor would be a world in balance, with economic and social opportunity within the grasp of all inhabitants and a sense of hope in all nations.

Chapter 14—Science and Technology in the Department of State: Bringing Technical Content Into Diplomatic Policy and Operations

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CHAPTER 14—SCIENCE AND TECHNOLOGY IN THE DEPARTMENT OF STATE: BRINGING TECHNICAL CONTENT INTO DIPLOMATIC POLICY AND OPERATIONS

I. Introduction

This is the concluding substantive study in the series on "Science, Technology, and American Diplomacy." It identifies and examines those elements of the Department of State where science and technology interact with diplomacy. The purpose of the study is to discover legislative opportunities to strengthen the Department's resources (a) to carry out those of its diplomatic functions that have a substantial technical content, and (b) to extend the reach of its policy planning in diplomatic trends and concerns that are gravely influenced by the rush of technological change.

The Congress appreciates fully the magnitude of the discontinuity that science and technology have injected into the stream of history, beginning in 1945 with the first atomic bomb and later confirmed with thermonuclear-tipped ballistic missiles launched from silos or submarines. These developments have made general war with its nuclear implications seem an exercise in suicidal folly, thereby undermining the military power base of diplomacy and enormously complicating the practice of that obscure art.

In his 1957 study, *Nuclear Weapons and Foreign Policy*, Henry Kissinger remarked that "President Dwight D. Eisenhower [had] summed up the dilemma posed by the new weapons technology in the phrase 'there is no alternative to peace.' " Kissinger went on to remark that "if recourse to force has in fact become impossible, diplomacy too may lose its efficacy," giving as his explanation the point that "The motive force behind international settlements has always been a combination of the belief in the advantages of harmony and the fear of the consequences of proving obdurate." [1]

Science, Technology, and the Growth of Interdependence

Science and technology have wrought many other changes in the relations among States:

—Instant communication and visual reports at great distances;
—Unlimited recording and rapid manipulation of data;
—Photographic surveys of the total area of the Earth;
—Man-made nuclear energy;
—Global weather prediction;
—Cheap synthetic substitutes for many cash crops;
—Chemicals and drugs with global social and environmental impacts; and
—Massive and rapid air transportation.

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[1] Henry A. Kissinger, *Nuclear Weapons and Foreign Policy* (New York: Harper and Brothers for the Council on Foreign Relations, 1957), pp. 3-4. A concurring opinion comes from the discipline of psychology:

> If coercion has passed the limits of utility as a means for adjusting differences among states, means must be found to limit the use of force and, simultaneously, to substitute other ways of exercising influence. The discovery that action depends on perception has provided a necessary modifying factor: an approach can be made to limiting the use of force by altering the perceptual basis for coercive acts; meanwhile, systems adjustments can come about through influences on perception of the actors by other means besides the threat or use of force—for example, by persuasion.

Vivian J. Rohrl-Wedge and Bryant Wedge, "The Role of Perception In International Politics," *International Studies Newsletter*, Preliminary Issue A (Fall 1973), p. 40. (Vivian Rohrl-Wedge is a psychologist and Bryant Wedge is a physician.)

Note: This chapter was prepared in 1975 by Franklin P. Huddle.

No nation has been more extensively altered technologically in culture or economics than has the United States, as measured by:

—The substitution of machine power for manual power in homes and work places;

—The move from field, forest, and mine to offices and service occupations;

—Personal transportation, communications networks, and computer services; and

—Consumption of fossil fuels and industrial materials.

By these means also, the United States has increased the dependence on supplies of industrial and energy materials from foreign sources, while other nations have increased their dependence on the United States in the need for food, educational facilities, technical assistance, and economic stability. As a consequence of technology, the United States has led the world in bringing about a global structure of international interdependence. The multinational corporation is a commercial manifestation of this development; and the worldwide acceptance of the products of U.S. science and invention is a technical manifestation of the same.

In his nationally televised "State of the World" address before a joint session of Congress on April 10, 1975, President Gerald R. Ford identified technology as presenting "a vast new agenda of issues in an interdependent world." He called on technology to close the food-population gap, urged cooperation among nations in developing the world's ocean resources, spoke of the need to create new world institutions and practices in trade, finance, and raw materials, and declared that among the areas for U.S. leadership was the harnessing of technology to the service of mankind while protecting the environment. It is "our goal in this new era," he said, to reconcile the "interests and the aspirations of the developed and developing nations . . . in a manner that is both realistic and humane."

Goals of Technological Diplomacy

The conduct of diplomacy involves a balancing of competition and cooperation, of competing national aspirations and shared international concerns. To the extent that the balance tilts toward international cooperation the prospect is one of peace; a tilt in the other direction leads to the prospect of tension and conflict. This is, of course, an oversimplification; competition in trade, athletics, and scientific achievement implies an extensive degree of cooperation among competitors. One aim of diplomacy would seem to be to confine competition to these kinds of competitive-cooperative endeavor, while resolving diplomatically the issues arising out of such competition.

In calibrating kinds of human endeavor as to their relative propensity for generating conflict, a distinction can be made between science and technology. Science, the pursuit of knowledge, is almost inherently international. Technology, on the other hand, is more closely bound to national power and interest. In the words of a prominent technologist:

> World leadership and technological leadership are inseparable. A third-rate technological nation is a third-rate power, politically, economically, and socially. . . . If we lose our national resolve to keep our position on the pinnacle of technology, the historical role of the United States can only go downhill.[2]

[2] U.S. Congress, Senate, Committee on Aeronautical and Space Sciences, *Hearings* to inquire into the state of the aerospace industry, its importance in achieving the goals set forth in the National Aeronautics and Space Act of 1958, and the relevance of those goals to our nation's future, 93d Cong., 1st sess., September 26 and 27, 1973, pp. 202–203. Statement by Dr. Wernher von Braun, vice-president, engineering and development, Fairchild Industries, Inc.

This view, expressed by a man long active in the space program and in private industry, is echoed in the academic community:

> Since the end of World War II, the world economy has undergone a major transformation. . . . The effects of the contemporary technological revolution upon economic and commercial activities have been of primary importance. [And later on, in the same article.] To a degree perhaps unparalleled in the past, economic and technological considerations will shape the ways in which political interests and conflicts seek their expression and work themselves out. In a world where nuclear weaponry has inhibited the use of military power and where social and economic demands play an inordinate role in the political life, the choice, success, or failure of a nation's technological strategy will influence in large measure its place in the international pecking order and its capacity to solve its domestic problems.[3]

Statement of the Problem of Technical Diplomacy

The main hypothesis of the present study is that science and technology are in fact important and perhaps separable ingredients of diplomacy, and that they warrant explicit organizational provision in the Department of State and in the conduct of U.S. diplomacy. The problem, then, is to characterize the elements of U.S. foreign policy and the elements of both science and technology that interact most strongly with it, and to examine legislative or organizational options to strengthen the performance of the Department of State in the design and conduct of U.S. diplomacy. This main proposition suggests a number of apparent requirements. For example:

—The need to organize the Department of State most effectively to exploit selectively the unique strength of the United States in both its science and its technology;

—The need for the Department of State to anticipate the need for, and to initiate, action—especially future-oriented action—in these fields, rather than responding to foreign pressures;

—The need to understand the processes by which technological innovations, and their wide use, produce changes in the diplomatic environment;

—The need to increase the technical sophistication of the practitioners of diplomacy at all levels and in most—if not all—organizational units;

—The need to translate the generalized and normative goals of American foreign policy into operational goals to which American technological superiority can effectively contribute;

—The need to establish a closer functional relationship between the specific and concrete goals of foreign policy and domestic programs of science and technology and to enlist the communities of science and technology in support of these foreign policy goals; and lastly,

—The need for a close relationship in diplomatic policy planning involving the White House, the Executive Office of the President, the Department of State, and Government agencies having international technical missions.

The role of the Department of State in the formulation and implementation of foreign policy is a central variable: strong Presidents take up diplomacy as a personal task, while leaving the chores and less interesting initiatives to the Department; conversely, some strong

[3] Robert Gilpin, "Technological Strategies and National Purpose," *Science*, July 31, 1970, pp. 441, 448. The author is professor of politics and international affairs, and faculty associate, Center of International Studies, Princeton University.

Secretaries of State may occupy a commanding position in the formulation of diplomatic policy, while sparing less attention for the mundane administrative chores of running a department; either way, the interest of a strong diplomatic leader in science and technology as ingredients of diplomacy may or may not be strong.

Institutional Effects of Technological Change

World leadership of the United States, political and technological, during and after World War II, brought with it a vast increase in international involvement of many Federal departments and agencies. During the 19th century, the brunt of foreign contacts was borne by the Department of State, and the burden was not onerous. However, today most major Federal departments and agencies have an "international" division, bureau, or office. Most of the attention of these units is addressed to matters of international science or technology.

In view of the fact that technology brought about most of these institutional changes, it is not surprising that the bulk of the foreign contacts of U.S. agencies have a technological content. In its role as coordinator of these foreign contacts, the Department of State is mainly concerned with their political consequences. Yet political and technical causes and consequences tend to be intertwined, and there is inescapably a technical element in the political and diplomatic coordination of foreign technical contacts.

Changed Role of the Department of State

At the same time, technology has brought about a marked alteration in the structure and mission of the Department of State. Traditional isolationism in the 19th century left the Department with little to do: negotiating commercial treaties, facilitating foreign travel of U.S. nationals, and resolving a few maritime disputes. ". . . A Chief Clerk with seven subordinates served John Quincy Adams; and the staff of the Department of State numbered less than a hundred as late as the turn of the century."

> [Continues this author] There was a true continuity in the Department of State's business. For the most part, it handled a steady flow of two-way communications concerning the commercial and other private problems in which American citizens traveling or conducting business abroad became involved; and it noted and filed the endless flow of dispatches forwarded by those on foreign service, describing the state of things in the parts of the world to which they were assigned.
>
> Down to the First World War [and even to 1939], the great acts of foreign policy—the issues which get into the books on diplomatic history—were so few and far between that they were handled personally by the Secretary of State, usually in intimate consultation with the President; or they were directly handled by the President himself.[4]

Even in its traditional roles, the Department of State has enormously increased the volume of its business. As new nations emerge, there is the requirement that American interests be represented there by a formal mission and frequently by consular offices as well. The flood of incoming correspondence from these offices needs to be processed by geographic and functional bureaus in Washington. The proliferating agencies of the United Nations require both representation and attention. A long list of new contacts abroad, many of them

[4] W. W. Rostow, *The United States in the World Arena: An Essay in Recent History* (New York: Harper & Row, 1960), pp. 20-30.

technological in mission or concern, have also been added to this business. For a few random samples:

Foreign aid
Multinational corporations
Military deployments (in extent and purposes)
Intelligence
Treaty organizations
Bilateral science and technology agreements
Peace Corps
Exchange students
Foreign offices of U.S. agencies
USIS offices
Research offices of U.S. agencies abroad
Astronomical and weather observatories
Foreign procurement offices
Space and communications stations
Agricultural inspection stations
Oceanic research vessels

Scope and Limitations of the Study

These studies of "Science, Technology, and American Diplomacy" aim to identify some of the main areas of congressional concern under this title. This study focuses on the Department of State as the operational and policy center of U.S. diplomatic involvement with the rest of the world. The study is concerned with elements of the Department that deal, or that might deal, with scientific or technological events and trends with international implications.

The study examines the organizational elements of the Department other than arms control (the Arms Control and Disarmament Agency), foreign assistance (U.S. Agency for International Development), and overseas information (U.S. Information Agency). Of primary interest in the study are:

—The core science and technology unit of the Department, recently renamed the "Bureau of Oceans and International Environmental and Scientific Affairs." (With so cumbersome a title, it is understandable that the term "and Technological" was omitted, but the present scheme of organization shows that it is implicit. Its code designation in the Department is "OES".);
—The system of science attachés in U.S. Embassies abroad;
—The Bureau for International Organizations;
—The functional bureaus generally; and
—The Policy Planning Staff.

Collectively, these units provide liaison on scientific matters to other governments, service U.S. representatives to international organizations, coordinate foreign activities of U.S. technical agencies, provide support for U.S. activity in bilateral agreements, participate in international technical conferences, contribute to policy formulation in the National Security Council, prepare speech drafts for the President and the Secretary of State on international technical matters, and identify priority technical problems and issues for diplomatic preparation and treatment.

Several other elements in the Department could contribute to its capability in these functions, but do not appear to have realized their potential. One of these is the Foreign Service Institute, charged with

performing the inhouse training function for the Foreign Service. In 1964, the Institute had underway an ambitious program in science and technology, but it has gradually dwindled away. Another element with some promise is the Bureau of Intelligence and Research. Here, too, a small effort in science policy analysis was tentatively begun and then abandoned in a time of departmental retrenchment.

The many other agencies involved in international technical programs will be discussed only as they relate to the Department of State. No comparisons will be drawn between the U.S. Department of State and comparable institutions of other governments, although this would probably be an instructive exercise.

The approach taken here will be to describe first the evolution of the present structure of State Department science and technology activities and then to consider the functioning, the strengths and weaknesses, and the future prospects, of these activities. Inferences can sometimes be drawn as to possibilities of legislative action to eliminate weaknesses and exploit opportunities.

Some Necessary Definitions of Terms

Up to this point in the series the individual papers have dealt essentially with mission-oriented subjects. Except for the International Geophysical Year (IGY) study,[5] the papers have emphasized issues of applied research and technology. These fields produce most of the issues that require diplomatic resolution. However, the present study proposes to deal with the entire spectrum of science and technology. Since one possible question concerns the desirability of organizing separately the institutions for diplomatic handling of different parts of the science-technology spectrum, the terms should be defined that mark off the divisions of the spectrum.[6]

For purposes of this study, then, *Science* is defined as any systematic activity to discover facts and relationship in some discrete category of the physical world. *Research* is an indeterminate term because it can apply equally to science and technology, or to the manipulation of literature. In technical fields, *basic research* is "scientific" while *applied* research is associated with "development" as a kind of technological activity.

Put simply, basic research or "science" seeks knowledge; applied research and development seek useful options; and technology puts these options to productive uses.

Another way of explaining these terms in the present context is that science ascertains what is theoretically possible; technology determines what is feasible and economically practicable; and politics rules on what is publicly acceptable. For convenience, the terms "scientific" and "technological" are sometimes lumped together under the more general term "technical" in this study.

Technology transfer is a process by which a given technique (i.e., technology) is substantially moved from one set of users to another.

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[5] U.S. Congress, House, Committee on Foreign Affairs, *The Political Legacy of the International Geophysical Year*, in the series, Science, Technology, and American Diplomacy, prepared for the Subcommittee on National Security Policy and Scientific Developments, by Harold Bullis, Analyst in Science and Technology, Science Policy Research Division, Congressional Research Service, Library of Congress. See vol. I, pp. 293–360.

[6] For a more extended treatment of the terms used in this section see: U.S. Congress, House, Committee on Science and Astronautics, *Science Policy: A Working Glossary*, 93d Cong., 1st sess., 1973, 99 pp. (Committee print.)

Technology forecasting is an emerging set of techniques for estimating probable future changes in specific applications of science and technology, including both what and when.

Discussions of international science and technology tend to assess relative levels of accomplishment among nations. National achievement in science is measured in such terms as outstanding discoveries, Nobel prizes awarded, funds available for scientific research, and numbers of persons awarded highest academic degrees in scientific fields. On the other hand, technological level is measured by a nation's gross national product and its rate of growth, military potency, achievements in such difficult fields as space and atomic energy, the productivity of industry, numbers of patents awarded its nationals, number of graduate engineers, and—speaking internationally—a favorable balance of royalties received over royalties paid and contributions of industry to balance of payments.

Distinctions can also be drawn between the "community of science" and the "community of technology." A later section will discuss the character and structure of the community of science. Traditionally cooperative, international, highly discipline-oriented, this community characteristically exchanges information, judges the excellence of the work of its own members, discipline by discipline, and tends to coalesce in specialized research centers. The "community of technology" is much less coherent, if indeed it is a "community" at all. In the United States, most of its members serve private industry. Although technical societies are common, with perhaps several million members, and technical journals disclose a great deal of technical information, the most valuable information tends to be withheld from publication. International associations of engineers are neither very large nor very active.

In drawing this distinction between scientists and technologists, the national role of the scientist should not be neglected. Despite the many international attachments, scientists are commonly aware of and tend to serve their own country's interests. Technologists also may divide their attention between national and international interests, although their international affiliations tend to be more commercial than intellectual.

It is commonly held that the main means of international transfer of technology is the multinational corporation. The extent to which the patent system of the United States effects technology transfer is somewhat controversial because what is disclosed in a patent may be less useful than what is withheld (i.e., "trade secrets"). It is common for American corporations to have a hierarchy of "security classifications" of their technology ranging from "company private," "proprietary," "company confidential," to "company secret."

One last distinction should be made between science and technology: the amount of money invested. Few fields of science involve large costs, and in these (for example, large particle accelerators, astronomical observatories, seabed drilling, Antarctic expeditions, space exploration, and weather studies), the bulk of the outlay is for the technology used in the research. Because of these high costs, there has been a growing tendency for scientists of several nations to work in multinational research teams sharing costly facilities. However, apart from these "big science" fields, costs of technological development

tend to be larger by orders of magnitude than the investment in the scientific discovery on which a new technology is based.

It is a commonplace observation that science provides the "seedbed" of technology, and to some extent this is true. But a great deal of technology evolved almost independently of science—for example, the processing of steel, copper, and aluminum; vulcanizing of rubber; and many of the early American inventions in agricultural implements and machinery. It might also be said that technology is the "seedbed" of science, in that the successful development of a new technique raises questions that only science can answer, and whenever science departs from theory for experiment it must resort to technology for its instruments.

The point is that while science and technology interact at many points and merge into each other, it is possible that they can be differentiated and separately treated.

Some Issues To Be Explored

Under the broad question of how to mobilize the resources of the Department of State in the uses of science and technology for U.S. diplomatic goals, five subordinate issues warrant consideration. These are: (1) the ad hoc approach of diplomacy versus the systems approach of technology; (2) the issue of specialist versus generalist; (3) the issue of emphasizing present problems versus planning for a longer range future; (4) the issue of distinguishing the diplomatic impacts of science versus those of technology; and (5) the issue of emphasizing policy versus operations.

UNIQUENESS VERSUS COMMONALITY OF PROBLEMS

Some critics allege that every diplomatic problem tends to be approached as unique, and that therefore no orderly, systematic diplomatic method is acceptable to the practitioners. To the extent that this is so, it is presumably because the main preoccupation of diplomacy is with a complex, infinitely varied process of accommodations between people—people of widely differing cultures—rather than with the relatively straightforward process of accommodation between man and nature or man and machine. The scientist or engineer, by contrast, seeks to find simplifying common elements and workable general methodologies to help solve his problems in a universe that he recognizes as dynamic and ever-changing. Such generalizations, of course, are at best approximate and partial. Yet to the extent that they are valid they suggest a problem of communication and an obstacle to cooperation between the technical and the diplomatic communities.

SPECIALIST VERSUS GENERALIST

A persistent issue in the manning of the U.S. Foreign Service is whether to emphasize recruitment of persons with special expertise or persons having a broad, general education with presumed adaptability. The issue is many-sided: what specialties are most needed? Can they be recruited and trained up to the necessary level? Should promotion be arbitrarily given equally as between specialists and

generalists? Might specialists be brought into the Service at appropriate levels as needed, on a temporary basis? Is it fair to specialists to convert them into generalists in order for them to merit progress up the promotion ladder? Can the Foreign Service Officer be both? There appears to be merit in the contention that the Foreign Service Officer needs to know quite a lot to qualify, and to learn a lot more to succeed. To expect him to be both broad and deep, adaptable and authoritatively knowledgeable, is asking a good deal.

PRESENT VERSUS FUTURE ORIENTATION

Another allegation is that the U.S. diplomatic community tends to take problems as they arise, and has difficulty in projecting future problems or opportunities. Schools of international affairs have developed no diplomatic literature or predictive techniques that compare with the extensive speculative literature of science and technology, all the way from Steinmetz's forecasts of the early 1920s to contemporary "Delphi" projects. The predictive power of technology forecasting is significant and growing. But even though there is an abundance of observations of the ways in which technological change has altered the world of diplomacy in recent years, there are few responsible attempts to derive from present-day technology forecasts an idea of how the anticipated technological changes will modify the future diplomatic world. Further, the literature on the specifics of diplomatic adaptation to technology-induced changes in the diplomatic world is singularly bleak.

DIPLOMACY OF SCIENCE VERSUS DIPLOMACY OF TECHNOLOGY

An issue that has not really surfaced in the Department of State is that of distinguishing the diplomatic impacts of science from those of technology. In the definitions presented above, a number of distinctions were drawn between science and technology. From the point of view of the diplomat, some of these distinctions may be useful. For example, the diplomat has learned that he can make extensive use of the international orientation and cooperativeness of the scientist to help bridge across national cultural differences. The diplomatic impacts of science seem to be mainly in human relations and largely intradisciplinary.[7] On the other hand, the diplomatic impacts of technology are more profound and broader: military weaponry and arms control, technical assistance and technology transfers, international standards, mineral resource exploitation and control, competition in computers, international communications and air transportation systems, patent policy, economic growth, energy embargoes, the green revolution in plant genetics, chemical fertilizers and pesticides, and many other problems and opportunities in technological diplomacy come to mind.

One possible difference between science and technology—in terms of diplomatic impact—concerns timing and predictability. Since technology is usually based on known scientific phenomena, its impacts tend to be more predictable and on a somewhat shorter time scale than those of scientific discovery. On this basis, diplomatic attention

[7] That is to say, the high energy physicists, geneticists, geophysicists, solid state scientists, and practitioners of all the myriad of other sub-disciplines of the sciences communicate freely across national boundaries—perhaps more freely than across disciplinary boundaries or from the field of science to the "other culture."

to technological trends would seem to be a rewarding exercise in policy planning. On the other hand, the bridging effect of international scientific cooperation also offers opportunities for diplomatic exploitation.

POLICY VERSUS OPERATIONS IN THE DEPARTMENT OF STATE

One issue that appears to be inherent across the entire spectrum of the responsibilities and missions of the Department of State is that of policy versus operations. Ever since World War II, the Department has been caught up in an enormous volume of day-to-day operations:

—Foreign travel of U.S. nationals;
—Trade problems;
—Exchange students;
—Foreign aid;
—Telling the American story abroad;
—Assisting other Federal agencies with overseas missions,
—Greatly expanded consulate system;
—Increased size and number of embassies;
—Great array of U.N. and other international activities;
—Digesting incoming flow of cables;
—Increased number of contacts with new countries; and
—U.S. leadership in making these contacts of increasing moment.

Operations inherently impose insistent demands for immediate attention while planning for the longer term future can always be put off. The planning may be more important, but operations tend to be more urgent.

In principle, operational chores ought to be handled at the lowest possible level in the administrative hierarchy, but diplomatic errors at this level tend to generate headaches higher up. (An injudicious postcard can turn into an international incident.) Yet, urgent operational demands on staff attention can distract attention from the thinking-through of big problems, the planning of large new initiatives, and the sorting-out of uncommon subtleties. This unresolved administrative issue will become increasingly nagging as short-term problems of science and technology multiply, while at the same time the opportunities for large initiatives tend to be neglected for want of staff time and attention.

II. Emergence of Science and Technology as Major Factors in Diplomacy

In the early years of the Republic, science and technology were quite closely interrelated with American diplomacy. Representing the revolting colonies in Paris, Benjamin Franklin as both scientist and technologist won respect on this account. When the first patent law was adopted in 1790, its designated administrator was the first Secretary of State, Thomas Jefferson, himself a technologist of note. Similarly, the U.S. Mint (whose first director was the distinguished American astronomer, David Rittenhouse), and the first efforts to establish a bureau of weights and measures, were associated with the Department of State.

It was an interesting feature of the early 19th century that wars did not foreclose international scientific activity. Franklin wrote a circular letter to all naval commanders in 1779 recommending that they give safe passage to "that most celebrated Navigator and Discoverer Captain Cook." British scientists lectured in Paris during the war that followed the French Revolution. Throughout the War of 1812, Ferdinand Rudolph Hassler remained in London to arrange for the procurement of precision instruments for the survey of the U.S. coast.

However, after the presidency of John Quincy Adams, interactions of diplomats—and Government officials generally—with science and technology appear to have diminished. In the main, the modern concern of the Department of State with science and technology dates from the close of World War II. It was from here in 1946 that the Acheson-Lilienthal Report [8] was drafted, proposing a diplomatic initiative to bring the newly developed technology of atomic energy under international control.

Atomic energy, though a major factor, was only one of a number of developments that called attention to the postwar importance for diplomacy of science and technology. For example, consider the following summary:

—A major element of the newly created United Nations Organization was the creation of subordinate international institutions with a large content of science and technology (the World Health Organization; the United Nations Educational, Scientific, and Cultural Organization; the Food and Agriculture Organization; and others);

—There was the recognition of the need to restore the global network of scientific societies, disrupted by war, that offered many positive values of international communication;

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[8] U.S. Congress, Committee on Foreign Affairs, *The Baruch Plan: U.S. Diplomacy Enters The Nuclear Age,* in the series, Science, Technology, and American Diplomacy, prepared for the Subcommittee on National Security Policy and Scientific Developments, by Leneice N. Wu, Analyst in International Relations, Foreign Affairs Division, Congressional Research Service, Library of Congress, 1972. (See vol. I, pp. 53–122.) The Committee that prepared the Acheson-Lilienthal Report was appointed by James F. Byrnes, Secretary of State; it was chaired by Dean Acheson, Assistant Secretary.

—There was an early recognition of the need to mobilize technology to repair war damage and to restore the economies of devastated nations of Europe, and to afford an avenue for economic development of poor countries elsewhere;

—There was the recognition of the many important contributions of scientists to the U.S. war effort, under the leadership of Vannevar Bush as Director of the wartime Office of Scientific Research and Development (OSRD), and the expectation that a great impetus in industrial technology would follow the close of the war; and

—Less evident, but still consequential, was the concept that national excellence in science and technology was a form of demonstration of national power and world influence.[9]

Postwar Elevation of Science and Technology

Faith in the contributions of science and technology to national well being, which had waned during the Great Depression of the 1930s, appeared to have been restored by the demonstrated wartime accomplishments in technology. A remarkable ferment was evident in scientific and technological agencies and their associated communities in the National Capital immediately after World War II. The activity centered on the highly dramatic issue of what to do about the "Manhattan District" that had produced the atomic bomb. But the transition of this wartime arrangement into the U.S. Atomic Energy Commission was accompanied by revelations of the "now it can be told" variety from many other sources. The War Department released details about its secret proximity fuze. The Department of the Navy disclosed its radar achievements. The Senate Mobilization Subcommittee held lengthy hearings on U.S. science at war, and entertained proposals for a permanent postwar science establishment. (These eventuated in 1950 in the National Science Foundation.) The Office of Naval Research (ONR) was stimulated to undertake an impressive expansion in the sponsorship of basic research. The report by Vannevar Bush and his associates in OSRD[10] calling for a national research foundation was followed in 1947 by the report of John R. Steelman to President Truman on national science policy.[11] Bush himself was brought into the Pentagon in early 1947 to chair a new Research and Development Board to sustain in peacetime some of the wartime cooperation between academic science and the military services.

An important feature of much of this activity was the emphasis on "science" by scientists whose labors during the war had been mainly in technological development. The atomic scientists were able to cite the complex interaction of basic science with technology in their urgent program, but most of the other technical achievements of the war had resulted from the successful conversion of laboratory scientists into technologists. At the close of the war they desired to return to basic

[9] As Secretary Kissinger has written: "The impact of Sputnik, after all, had little to do with its strategic importance. President Eisenhower's constant claim that space was militarily insignificant—even if correct—missed the crucial point. To many of the new nations Soviet supremacy in space may have the kind of attraction Western technological mastery had in the late nineteenth century." In *The Necessity for Choice: Prospects of American Foreign Policy* (New York: Doubleday, Anchor Edition, 1962), p. 334.

[10] U.S. Office of Scientific Research and Development, *Science, the Endless Frontier*, a report to the President on a program for postwar scientific research, by Vannevar Bush, Director of the Office of Scientific Research and Development (Washington, D.C.: U.S. Government Printing Office, July 1945; National Science Foundation, reprinted July 1960), 220 pp. See especially pp. 34–40.

[11] U.S. President's Scientific Research Board, *Science and Public Policy*, 5 vols., a report to the President by John R. Steelman, Chairman (Washington, D.C.: U.S. Government Printing Office, 1947), see vol. 1, p. viii.

research and justified future public support for this activity on the grounds of their past technological successes and expectation of future technological development from future basic research.

LONDON SCIENCE OFFICE

Particular emphasis in both the Bush and Steelman reports had been placed on the importance of restoring the international flow of scientific information and contacts that the war had interrupted. One channel for this flow was the London office of ONR. This office, still in active operation in 1975, had been established in 1941 to maintain scientific liaison with the British military research installations. By 1947 its scope was still largely in "classified" subjects. To develop a flow of scientific and technological information for industrial use, the Department of Commerce sent John C. Green with a substantial technical team to gather up as much information as possible from captured German files, photo-reproduced materials collected by the British Intelligence Objectives Subcommittee, and British scientific papers then being declassified. Green's time was divided between service in London and with Gen. Lucius Clay, head of the U.S. occupation force in Germany in an organization under the acronym of "FIAT." Here, 600 subject area specialists, supported by German scientists, were gathering information on German industrial technology. A separate team, Project ALSOS, was sent by the Manhattan District to assess the state of German progress in nuclear energy development and other matters of technological interest.

WARTIME PROBLEMS OF THE DEPARTMENT OF STATE

During the war the Department of State had experienced considerable difficulty in finding an appropriate role for its staff in the face of all the "emergency" agencies operating abroad. A critical assessment of State's problem was offered in a history of war agency administration prepared in 1964 by the Bureau of the Budget:

> The inability of the Department of State to deal vigorously and aggressively with the economic and cultural problems of foreign affairs in total war contributed to the creation of special emergency agencies to deal with some aspects of foreign relations. This inability of the Department was due largely to the dominance of the foreign-service tradition, procedure, and tempo. The Department was not equipped with the technical personnel, or with the experience necessary for the day-by-day activities in such fields as export control, preclusive buying, the business details of lend-lease, and the conduct of psychological warfare. For these and other reasons, the emergency agencies sought to operate directly with only the unavoidable minimum of control by the Department of State.

A prime difficulty was in distinguishing between policy and operations, and "it seems from the evidence available that the Department never clearly understood its role as coordinator and policy guide." [12]

Experiment of the Department of State in the Diplomacy of Science

A first effort by the Department of State to become involved in the emerging field of "Government science" began to take shape in 1947. Apparently with the encouragement of President Truman, the Department proposed to set up at the U.S. Embassy in London an

[12] U.S. Bureau of the Budget, War Records Section, *The United States at War; Development and Administration of the War Program by the Federal Government*, prepared under the auspices of the Committee of Records of War Administration (Washington, D.C.: U.S. Government Printing Office, June 19, 1946). pp. 407–408.

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office paralleling one that the British had maintained in Washington since 1940. Its purpose was "to expedite the interchange of basic scientific information" by assigning to it distinguished scientists from this country.[13]

The plan initially called for the establishment of a permanent "United States Mission on Science and Technology" of five officers (i.e., Foreign Service officers) and two clerical personnel. Chief of the Mission would be Dr. Earl A. Evans, Jr., professor and chairman of the department of biochemistry of the University of Chicago. He was to be supported by Mr. Ervin Anderson, of the International Resources Division of the Department of State who had been active in the "development of the economic offices science and technology program." [14]

The new mission would replace Green's group, located in the Embassy but reporting to the Department of Commerce. (This mission had been transferred to the Department of State and Foreign Service the previous year—December 15, 1946—by Secretary Averell Harriman, when he replaced Secretary Henry Wallace as head of the Department of Commerce; apparently it had remained inactive throughout 1947.)

The new mission started bravely enough. It had been designed by an interagency committee under the chairmanship of the Assistant Secretary of State for Economic Affairs, and composed of representatives of the Departments of Army, Navy, Commerce, Agriculture, and Interior, and of the Federal Security Agency, the Research and Development Board, and the National Academy of Sciences. This committee would continue, it was understood, in a backstopping role as "parent of the mission in all substantive matters. . . ." The "mission" had received support and endorsement from such members of the scientific community as Dr. Bush; Dr. Steelman; Dr. Frank Jewett; and Dr. Merle A. Tuve and Mr. Paul A. Shearer of the Carnegie Institution of Washington. The Secretary of State had also obtained assurances of support for the mission in correspondence from four members of the cabinet.

In notifying the Embassy in London of the program, the Secretary of State in a memorandum of October 22, 1947, indicated that the mission would be "permanently attached to the Embassy." A later memorandum, December 26, from the Acting Secretary of State, explained that to "make it clear that the group under Dr. Evans is an integral part of the Embassy staff and is not operating as an independent organization," he was designated "Chief Scientific Officer." To differentiate the new arrangement from the previous "Mission for the Exchange of Industrial Technology" (the Commerce Department's science office, which had also been attached to the Embassy), its functions were explicitly directed toward the expediting of the flow to the United States of *basic* scientific information.

OUTPUT OF THE LONDON OFFICE

Dr. Evans began his tour of duty in London during Christmas week, 1947. Two months later he rendered a first report of accomplishment.

[13] U.S. Department of State, Memorandum, no. 506, from Acting Secretary of State to the Officer in Charge of the American Mission in London, December 26, 1947, p. 2.

[14] U.S. Department of State, Memorandum, no. 425, from Secretary of State to the Officer in Charge of the American Mission in London, October 22, 1947, p. 2. Also, background supplied by interview with John C. Green.

His long-term staff of four professionals and two secretarial personnel was in operation, and two short-term scientists were expected early in March. Contacts had been established with 40 senior scientists and science administrators in England. In addition: (a) a report was in preparation on the structure of British science in universities, government, and industry; (b) special reports were in preparation on the current status of British research in organic chemistry, biochemistry, surgery, and metabolic diseases; (c) arrangements were being made to supply the U.S. Information Service library in London with current U.S. scientific publications; (d) attention was being given to exchanges of science students; (e) various requests had been received for him to participate in British science functions; (f) discussions were in progress with the Dutch Embassy in London regarding enlargement of Dutch scientific representation in Washington; and (g) cordial working relationships had been established with the ONR London office.

On November 8, 1948, Dr. Evans submitted his first annual report. In it he recapitulated the rationale for setting up his office. (It was based on the propositions that scientific research and technological application were an essential factor in the economy of any nation and that the formulation of foreign policy required an on-site mechanism to acquire expert information for this purpose.) The report listed the many "despatches" generated from the new office and offered a number of recommendations to strengthen the operation. In particular, Evans suggested the need for an "office or officer at a high level in the State Department to bring together all the activities of all its scientific and technological experts." Such an office, he suggested, could direct information to appropriate users, analyze it, and give guidance to the various (hypothetical) field offices. He also suggested that when short-term scientists had completed their tours in embassies abroad they be detailed (or called back) to serve in the proposed home office, or as members of an advisory committee to that office, or for additional tours abroad. Dr. Evans urged establishment of posts similar to his own in embassies in other Western European countries. And, significantly, he urged that the emphasis of the London office be changed from basic science to industrial technology, as being of more immediate value.

PROBLEMS IN RECRUITING SCIENTISTS

Meanwhile, back in the Department of State, the flood of correspondence associated with finding outstanding scientists for short-term and long-term appointments for this small office, confirming their qualifications, their recruitment, and arranging for their travel, was becoming onerous. There were many applicants who had to be tactfully turned away, and many regretful refusals from desired candidates. When his year was up in London, Evans was replaced by W. R. Woolrich, dean of engineering at the University of Texas, who had already served for 6 months under Evans. Woolrich, in a "semi-annual" report, April 5, 1949, repeated the recommendations of his predecessor, urged that scientists be "briefed" before going to their posts, and complained that for much of the year the "scientific personnel of this office was reduced . . . to the Chief of the Section and the essential secretarial assistance. . . ." Moreover, he said, "It is most confusing to both the personnel and to the British scientists to

have an indefinite policy of procedure for the Scientific Office." He urged that the office be given "more permanent status," suggesting a keen sense of insecurity which his staffing problems seemed to justify.

Assessment of the State Science Experiment

This first essay of the Department of State into the interaction of diplomacy with science and technology, despite the apparently strong initial support it had received, must be accounted a failure. There were many reasons for this:

There was no continuity in the relationship between the backstopping committee and the team in the field. There was no committee secretariat to ensure that reports were directed to the appropriate members, and there was no "feedback" to show Evans and his team that anybody was listening. It is not known whether the committee ever met to consider the progress of the team in the field, or gave it guidance, but the chances are that it did not. The needs of the people or institutions the team was supposed to be serving were apparently never communicated or ascertained. The burden of staff recruitment was altogether disproportionate to the size of the staff and its productivity. The utility of the reports generated by the team was doubtful; there is no evidence that any action resulted from them, either as useful information or as inputs to policy analysis. The dwindling size of the enterprise suggests that it was not especially useful to the Embassy either. While the team was evidently able to establish cordial relationships at high levels in the host country, the achievement is not impressive because failure would have been most remarkable under the circumstances. However, no durable relationships or arrangements appear to have been established.

The asserted lack of preparation of the London science team was certainly a factor. But it was symptomatic of a more fundamental weakness: what sort of briefing would be useful to equip a team of narrowly specialized scientists whose mission was so indeterminate?

A sampling of the technical reports from the London science office shows some of the difficulties. The writers were not sure what their readership was. Some reports describe the broad structure of the British science establishment but in vague and imprecise language. Other reports present a mixture of scientific detail (unreadable outside of the discipline) combined with broad general discussion of technological applications, educational arrangements, research facilities and funding, and details of legislation. Conceivably the identification of research centers and the direction of their research programs might have been used to establish contacts with U.S. investigators in like fields. Discussion of research organization might have been of interest to U.S. research administrators. But how these reports could have been used in the formulation or conduct of foreign policy in the Department of State is difficult to understand.

The purpose of this rather detailed criticism of a small diplomatic experiment nearly three decades old is not to criticize those involved but to make explicit the problem. The scientists who urged and manned the experiment appeared to assume that the mere presence of highly qualified scientists in a diplomatic setting would be beneficial. It is this assumption—that discovering facts is meritorious—that governs all science. The earlier activity of John Green had been explicitly to transmit to the United States large volumes of documents

containing mainly technological information. But neither the expertise possessed nor the information accumulated by the Scientific Officer in the London office of the Department of State was useful to the parent organization. There was no strategy to use the expertise and there was no procedure to assure use of the information. The diplomats had at hand the technical expertise but they did not know how to use it and the scientists did not know how to be used. Their activities did not appear to be relevant to the diplomatic problems of the day; no effort was exerted to show how they could be relevant; no preparation was undertaken to assure that they would be relevant.

The Berkner Report on Science and Foreign Relations

Shortly after the close of World War II, President Truman had turned to former President Herbert Hoover for advice in undertaking a postwar reorganization of the executive branch. The proliferation of agencies and functions had made the bureaucracy virtually unmanageable and the Hoover Commission received a broad charter to recommend its consolidation. With particular respect to the State Department, the Commission transmitted to the Congress, February 18, 1949,[15] its report on "Foreign Affairs." The report took note of the rapid increase in the size of the Department and of the proliferation of overseas responsibilities of other agencies:

> In the Presidency new factors affecting the conduct of foreign affairs include the Chief of Staff to the President and statutory interdepartmental bodies such as the National Security Council. The State Department itself, in terms of appropriations, is 12 times larger and, in terms of personnel, almost 5 times larger in 1948 than it was in 1938. In the interdepartmental field there are more than 30 committees concerned with economic, social, military, and other aspects of foreign affairs. Of 59 major departments and agencies in the executive branch, at least 46 are drawn into foreign affairs to a greater or lesser extent. Certain units are deeply involved, such as the National Military Establishment in connection with the administration of occupied areas abroad, the Economic Cooperation Administration in connection with the financial assistance overseas, the Treasury Department in international financial matters, and the Commerce Department in connection with export control. Finally, Congressional participation in the conduct of foreign affairs has become particularly evident in the enhancement of the role of the House of Representatives in connection with appropriations for foreign programs.[16]

Neither the report nor an accompanying Task Force Report on the same subject dealt explicitly with the role of the Department of State in science and technology. However, in a letter to Mr. Hoover in comment on the Task Force Report, Henry L. Stimson, who had served as Hoover's Secretary of State, highlighted the growing importance for diplomacy of science and technology and their products. He wrote:

> . . . The world today is faced with two great challenges. Can it keep the peace, and can it build a secure foundation for ordered freedom? We have reached a stage in history when it is absolutely vital that we meet both of these challenges successfully. The scourge of war has now acquired an expanding destructive power enormously greater than ever before. We must have peace. At the same time mankind cannot and will not abandon its long upward struggle toward freedom and the good life. Challenges to freedom continue, and the tension between free societies and their opponents must be recognized as a grave threat to peace. In such circumstances, the conduct of American foreign policy takes on a new order of importance.

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[15] Pursuant to Public Law 80-162, approved July 7, 1947, setting up the "Commission on Organization of the Executive Branch of the Government".

[16] U.S., The Commission on Organization of the Executive Branch of the Government, *Budgeting and Accounting: A Report to the Congress*, Rept. No. 7, (Washington, D.C.: U.S. Government Printing Office, February 1949), p. 4.

The great scientific and industrial revolution of the nineteenth century profoundly affected both the nature and effect of war and the hope for human progress toward freedom from want. . . . During the nineteenth century our Nation, and many other nations too, were absorbed in the pursuit of this great new opportunity. . . . During this century the people of the United States treated their foreign affairs as a minor problem. . . .

For we had grasped only one-half of the meaning of the industrial revolution. The progress of science and invention brought with it a vastly increased interdependence among the nations of the world. The civilization it created was brittle, for the same science and invention which had produced new riches had produced at the same time a wholly new power of destruction. . . .

. . . We must recognize, therefore, that as a participating member of the world community, in time of peace as in time of peril, the United States must continue to play a major part. . . .

. . . I urge upon the Commission the absolutely critical importance of leaving nothing undone that may make us better able to ward off the danger of catastrophe, and to bring nearer, in so far as in us lies, the lasting peace which all mankind demands. . . . [17]

Out of the deliberations of the various task forces, staffs, and steering groups serving the Hoover Commission a recommendation emerged that the Department of State needed a capability to evaluate the foreign policy aspects of scientific activities.[18]

Apparently in response to the thinking communicated by unpublished papers of the Hoover Commission, the Secretary of State on October 4, 1949, appointed Lloyd V. Berkner as Special Consultant to advise him on:

1. Responsibilities and functions of the Department in formulating and implementing international aspects of national science policy;
2. How these responsibilities and functions should be assigned within the Department;
3. Staffing;
4. Interagency relations of the Department (with emphasis on science and intelligence); and
5. Functions, staffing, and operational methods in science and technology missions overseas.[19]

At the same time the Secretary appointed a Departmental Steering Committee on International Science Policy. This committee agreed that the broad objective of the study would be:

To develop detailed recommendations on the most effective means of utilizing the functions and facilities of the Department for meeting the needs of United States science and for strengthening national security to the end that the De-

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[17] Letter from Henry L. Stimson to Herbert Hoover, November 22, 1948, in *The Organization of the Government for the Conduct of Foreign Affairs: A report with recommendations*, prepared for the Commission on Organization of the Executive Branch of the Government, by Harvey H. Bundy and James Grafton Rogers (Washington, D.C.: U.S. Government Printing Office, 1949), p. x.

[18] In the report, U.S. Department of State, *Science and Foreign Relations: International Flow of Scientific and Technological Information*, General Foreign Policy Series, no. 3860, May 1950 (hereafter called the Berkner Report), it was explained that the "Steering Committee of Reorganization Task Force No. 2" had reported, May 2, 1949, that:

> The Department is dealing on the one hand with foreign policy matters which have a great effect upon United States scientific policy and on the other hand with international scientific activities which have an impact on foreign policy. These matters are being handled at various points without adequate scientific evaluation. . . . We believe that the extent of the Department's responsibility for international scientific matters requires top policy consideration and the aid of professional scientific judgment, and cannot properly be determined in the course of a necessarily hurried review of the Department's organizations. (p. 1)

Also, subsequently, a "special Department of State Task Force" reviewing the "separate and detailed consideration of the interdependence of science and foreign relations" had recommended that:

> A scientist of national repute should be asked by the Department to serve as a temporary consultant to analyze and submit recommendations on (a) the role of the Department in national scientific policy and activities, and their interrelationships with foreign policy, and (b) appropriate organization and staffing required to carry out its responsibility. (p. 15)

[19] Berkner Report, p. 16.

partment may fulfill adequately its role with respect to the international aspects of science.[20]

The report itself defined the objective of U.S. international science policy as being:

. . . The furtherance of understanding and cooperation among the nations of the world, . . . promotion of scientific progress and the benefits to be derived therefrom, and . . . maintenance of that measure of security of the free peoples of the world required for the continuance of their intellectual, material, and political freedom.[21]

Benefits of the proposed international science policy were considered to be:

—Effective influence on the preservation of an international environment of freedom;
—Growth and progress of science and technology;
—Economic welfare; and
—Security "of free peoples everywhere." [22]

The report attached principal importance to the desirability of an international flow of scientific and technological information. Five chapters (pp. 25–85) were addressed to this subject. Only four chapters (pp. 86–114) dealt with the relation of science and technology to the formulation of foreign policy, a science advisory unit in the Department, interagency coordination, and the design of overseas science missions.

The chapter of the Berkner Report on "The Role of Science in the Formulation of Foreign Policy" identified this role as twofold: (1) how to use diplomacy to further science, and (2) how diplomats could use science and technology to solve world problems.[23] It concluded:

. . . That consideration of the natural sciences and technology is often lacking within the Department of State. This lack appears to stem from a failure of communication channels between many areas of the Department and United States science and technology, both government and private, arising from a lack of consciousness of the bearing of science on the problems at hand.

It is true that science contributed to many of the operations of the Department, but it has generally been on an *ad hoc* basis. This is not enough. For science to be properly effective in its influence, accepted procedures must be established to assure that the scientific and technological aspects of each problem are continously considered, both from the point of view of science itself, and of equal importance, from the point of view of the relation of the scientific to the other aspects, political, social, and economic.[24]

There were three deficiencies in the Department's expertise in science and technology:

First, insufficient scientific competence is presently available within the Department to insure rapid, accurate selection of the type and source of scientific assistance required in the formulation of foreign policy. Current procedures for the utilization of outside scientific consultants are based on random personal contacts between the Department and outside agencies or upon complete reliance on the advice of representatives of government agencies. The selection procedure is neither systematic nor reliable and is susceptible of serious errors of judgment. Nor is this assistance immediately available.

Second, there is no mechanism for keeping the Department apprised of the implications of its actions as they affect science, and consequently it may fail to call for competent technical advice when needed. For example, the success of a recent international high altitude biology conference in Peru was jeopardized by

[20] Ibid.
[21] Ibid., p. 19.
[22] Ibid., pp. 20–21.
[23] Berkner Report, p. 86–87.
[24] Ibid., p. 87.

delayed action on the part of the Department in naming an official United States delegation. Lack of official United States recognition could have seriously affected Peruvian Government support of this research. In addition, such failure could impair international scientific relations and good will.

Third, departmental non-scientific personnel are substantially insulated from the scientific community. Much closer relations with this important element of the community would appear productive on many scores. The Department will become aware of the aid that the scientist can render on the one hand, and on the other can make the scientist more keenly aware of the fundamental issues that enter into the administration of policy.[25]

The proposed solution was to establish a small science staff in the Department of State "at the policy level." This staff, said the report, should serve:

—To apply "highly competent scientific and technological judgment and guidance . . . in [the] formulation of foreign policy";

—To serve as "advisory body in the day-to-day operations of the Department to assure . . . due consideration [of] scientific and technological aspects of these operations";

—To represent the Department "from the point of view of science on interdepartmental committees"; and

—To enlist the cooperation of "government and private science in assisting the Department in carrying out its full responsibilities in the field of international relations." [26]

The report also suggested periodic use of preeminent scientists as "top level advisers" on major problems (and that they be periodically briefed on the international situation). The report completed its policy discussion with the suggestion that extraordinary effort was needed to assure the availability of scientists with diplomatic experience, commanding the confidence of colleagues in both fields.

A separate chapter of the report, "State Department Organization for Science," offered a plan for an operational office that overlapped somewhat the policy office just described.[27] In the discussion preceding the prescriptive conclusion, two alternatives were offered: (1) a "Science Office," or (2) "a scattering of men of scientific training throughout the operating units of the Department." The report opted for the first but not without some internal inconsistency: in the discussion preceding the conclusion the staff function was stressed, while the functions actually proposed were largely operational.

BERKNER DESIGN FOR SCIENCE OFFICE

Thus, the report recommended (paraphrase):

1. Creation of a science office at the policy level, charged with staff functions.

2. The office to be headed by a science adviser, appointed as Special Assistant to the Under Secretary of State. Staff would include a deputy; three scientists (physical, life, and engineering); a scientific and technological information branch; and liaison officers from "political, economic, and public affairs of the Department, and from other government agencies having international interests in science and technology."

[25] Berkner Report, p. 89.
[26] Ibid., pp. 91–92.
[27] In fact, it was not clear whether what was being proposed was two offices or one.

3. The science office would:

(a) Support science missions abroad (i.e., recruit, brief, and backstop science attachés, and help them program their activities; promote international exchanges of information and scientists; and maintain registries of scientists and scientific activities in foreign countries);

(b) Provide liaison with domestic scientific activities (i.e., serve as point of access in the Department of State for U.S. scientists; relate to U.S. scientists and scientific institutions; identify main issues and represent "science" in policy councils; assure appropriate representation of the United States in scientific meetings abroad and help arrange similar meetings in the United States; and generally support international science and U.S. objectives);

(c) Review and advise on policy and administrative decisions as they relate to or affect science and technology (i.e., seek ways for science and technology to interact with diplomacy to benefit U.S. objectives; shed light on the impact of diplomatic decisions on science and technology; assure competent scientific and technological advice on diplomatic policy issues; coordinate the scientific and technological input to program planning; and provide access for the Department to best scientific and technological advice on policy issues); and

(d) Evaluate effectiveness of programs and policy in the light of progress and potentialities of science and technology.

4. Other elements of the Department should consult the office on scientific and technological matters.

5. Other elements of the Department, while consulting with the Science Office, should retain responsibility for action on scientific and technological issues.[28]

In sum, under Berkner's plan, the State Department's Science Office would keep track of other agency programs relating to overseas technology. Formalized advisory procedures would be set up. Closer liaison would be established with persons with higher technical qualifications. The nongovernmental science community would be involved in the Government process more extensively, with particular emphasis on the National Research Council. Close liaison would be especially important between the Department of State and the newly created National Science Foundation.[29]

THE PLAN FOR SCIENTIFIC ATTACHÉS

The report addressed at some length (pp. 103–114) the question of placing scientific and technological expertise in U.S. embassies abroad. It concluded that the London Mission under Dr. Evans had been rendered less effective by "a limited budget, inadequate supporting operations at home, and insufficient weight assigned in the Department to the importance of scientific and technical implications in foreign policy."

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[28] Berkner Report, pp. 93–98.
[29] Ibid., pp. 101–102.

Among the problems and issues in the design of an overseas science and technology mission were:

—Defining the functions of the mission;
—Regional versus country contacts;
—Maintenance of office continuity;
—Preserving contacts with the home office;
—Maintenance of up-to-dateness of resident scientists;
—Assurance of prestige and a voice within the Embassy;
—Matching size of delegation to level of activity in the country;
—Assuring uses of information obtained; and
—Use of Foreign Service personnel versus appointment of scientists.

There was no discussion of the distinction between "scientific" and "technological" activities abroad, although this had been a feature of the reports of Evans and his successor. However, the text of the Berkner Report made clear that the subject being addressed was "science" with technology as an incidental adjunct.

The report concluded that overseas missions should include science staffs administered by the Department and backstaffed in Washington. Needs of other agencies should be met by the Department, although funded by the using agencies. The personnel should be part of the Foreign Service, with the rank of attaché and should be highly qualified scientists. Appointments should be for 2 years, broken by at least one visit home for consultation. These officers should have nine functions: (1) reporting science trends, (2) assistance in the exchange and evaluation of scientific and technological information, (3) assistance in the exchange of scientific personnel, (4) mutual assistance in procurement of scientific materials, (5) aid to U.S. scientific groups abroad, (6) representation of U.S. science at foreign meetings, (7) scientific advice and coordination with the Embassy staff, (8) arrangements for international collaboration on scientific projects, and (9) "general promotion of better understanding and closer relations between United States and foreign science."

Two kinds of science missions were envisioned: (a) larger staffs serving as "centers for investigations" on a regional basis (e.g., London-Western Europe; Johannesburg-South Africa; Rio de Janeiro-South America; Sydney- or Canberra-Australia); (b) single country staffs (two or three scientists) constituting representation to the one country (nine were suggested).

The report also took note of the fact that there were already two U.S. science offices in London, one operated by the Department of State and the other by the Office of Naval Research. It proposed their merger into one State Department office.[30]

EFFECTS OF THE BERKNER REPORT

The detailed description of the Berkner Report has been presented here because for more than a decade it prescribed the organizational framework and philosophic concept of science and technology in the

[30] However, this recommendation was not adopted. The ONR London office still exists. Its functions are essentially to serve as a scientific window on Western Europe and to coordinate NATO research in naval matters. It is staffed by 8-10 civilian scientists serving, usually, for two years, and a like number of naval officers. The civilian role is scientific information exchange, technical overview, and special topical reports. Emphasis is on highly qualified scientists able to contribute to technical exchanges, to avoid the appearance of "intelligence" gathering. (Source: conversation with Dr. Russell C. Drew, formerly director of the ONR office and currently director of the Science and Technology Policy Office.)

Department of State. The durable effect of this report was beneficial in a number of ways:

(1) It emphasized the importance of science for diplomacy.

(2) It identified important functions of a scientific apparatus as a component of the U.S. diplomatic apparatus.

(3) It prescribed the necessary interaction of overseas scientific attachés with a strong backstopping unit at home.

(4) It addressed the need for coordination of the State scientific office with other agencies with scientific functions.

(5) It called attention to the importance of the U.S. nongovernmental scientific community for the Department of State—and vice versa.

On the other hand, the report had a number of adverse consequences:

(1) The array of proposed functions for science attachés was unrealistically wide in scope, without establishing priorities of emphasis.

(2) The important distinction between science as somewhat international, and technology as more closely related to national policy and objectives, was neglected; similarly the heavy emphasis on science and the interchange of scientific information obscured the larger importance of technology for diplomacy and on the role of technological analysis as an input to foreign policy formulation.

(3) No assessment was presented of potential scientific and technological interests of the Department of State in the geographic and economic bureaus, in State Intelligence and Research, in the in-house educational activities of the Department, and especially in the Policy Planning Staff.

(4) The relationship of the proposed new scientific organization to the White House and the National Security Council was not discussed.

III. Implementation of the Berkner Report: 1951–1965

The Berkner Report of June 1950 on *Science and Foreign Relations* recommended creation of a science staff in the Department of State, headed by a scientific adviser who would be Special Assistant to the Under Secretary. He would also be supported by science staffs in certain overseas missions, integrated into the Foreign Service. Accordingly, the following February, Dr. Joseph B. Koepfli, of California Institute of Technology and at one time Dr. Evans' deputy at the London science mission (1947–1948), was appointed Science Adviser and Special Assistant. Dr. J. W. Joyce, who served as chairman of the Department committee that had helped Berkner prepare the report, was made his deputy. A number of other scientists were invited to serve on Dr. Koepfli's staff in Washington and others were assigned to embassies abroad.[31]

As Dr. Koepfli and his associates were getting underway with their new assignment, an inventory of the State Department's numerous scientific interests included the following items:

—Funding of U.S. memberships in 14 international organizations with a scientific content;

—Support for international conferences (140 in 1950);

—Participation in programs for international exchanges of scientific personnel (23,179 persons in 1950) and assistance to non-governmental organizations for this purpose;

—Assistance in exchanges of scientific publications;

—Preparation and distribution abroad of scientific newsletters (circulation 78,000);

—Distribution abroad of scientific films in the Department's collection; and

—Science programs on the Voice of America.

Somewhat optimistically, this report in 1951 observed. "As the world's outstanding user of science, the United States not only profits from but positively depends upon active international cooperation in science. Such cooperation is a national interest of highest magnitude, a major concern of foreign policy, a continuing preoccupation of the Department of State." [32]

Brief Tenure of the Office

During its brief period of operation, this first "Office of the Science Adviser" does not appear to have scored any noteworthy successes. Presumably, most of the 30 months of Dr. Koepfli's tenure were consumed in organization and recruitment. While it may also have purveyed to other units and agencies "advice and assistance on foreign relations questions in which scientific factors were intertwined," the need for this service does not seem to have become insatiable.

[31] Under this original program "more than 14 American scientists served at various posts abroad for an average period of 15 months as members of the U.S. Foreign Service Reserve. . . ." (U.S. Department of State, *The Science Adviser of the Department of State*, Department and Foreign Series, no. 97, Publication no. 7056, November 1960, which supplied some of the background of this part of the study.)

[32] Gerhard J. Drechsler, "The U.S. State Department and World Science," *Bulletin of the Atomic Scientists* 7, No. 4 (April 1951), pp. 121–122.

Unfortunately, the advent of this new program was soon followed by a departmental retrenchment. As a Department publication in 1960 delicately expressed it: "Despite its successful operation, however, the program was curtailed after a few years because of a number of factors, of which undoubtedly the most important was the competing demands of other departmental activities for their share of a limited budget." When Dr. Koepfli returned to California Institute of Technology, July 1953, Dr. Joyce became "Acting" until he resigned in February 1954, and Walter M. Rudolph, a Foreign Affairs Officer, took over. The attachés (in London, Paris, and Stockholm) were replaced with other scientists and a fourth was named to the Embassy in Tokyo, but at the end of 1955 the scientific attaché program was completely terminated.

Reassessing in 1967 this decline of State Department interest, Eugene B. Skolnikoff attributed it mainly to the fact that "under pressure to cut back the leaders of the Department did not feel they were sacrificing a needed or important function." [33]

Reactivation of the Program After Sputnik

By 1956 the State Department science organization had dwindled to a caretaker Foreign Service Officer, Walter M. Rudolph (an economist), supported by two secretaries. Of this situation *Chemical and Engineering News*, in a staff article, protested:

> Science today has an even greater impact on society than it did when State first recognized it. To let the science function die now, say the scientists, would be next to criminal and an enormous waste of their time and the taxpayers' money. The course of events mystifies them.[34]

An editorial comment by Dael Wolfle in *Science* magazine took the same line. He rejected a proposal by the second Hoover Commission that would have transferred the science attachés (of whom by February 1956 there were none in the field) to the Central Intelligence Agency. Science, he said, should be considered along with all the other elements that were involved in foreign policy. "Whenever scientific and technologic elements are significant for foreign relations," he wrote, "they should be brought to the attention of the embassies and the Department of State and be weighed with political, economic, and other relevant factors." [35]

Rudolph himself went into print, early in 1957, to make a mild appeal for support. Identified as "Assistant to the Science Adviser" (a vacant office), he noted that his Department "—specifically the Office of the Science Adviser—[had been asked by the National Academy of Sciences] to serve on the U.S.-IGY National Committee as *ex officio* member." He promised that "As the IGY planning proceeds, the Department will continue its liaison with the . . . Committee to insure the reconciliation between its scientific activities and our foreign policy objectives." [36]

Apparently, appeals of this sort had some effect. "Following a review of the Department's science program, the decision was made in the

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[33] Eugene B. Skolnikoff, *Science, Technology, and American Foreign Policy* (Cambridge, Mass.: MIT Press, 1967), p. 257. (Hereafter, Skolnikoff).

[34] "What's Happened to Science in State?" *Chemical and Engineering News*, January 9, 1956, p. 115.

[35] Dael Wolfle, "The State Department's Opportunity in Science," *Science*, February 10, 1956, editorial page.

[36] Walter M. Rudolph, "The Mutual Influence of Scientific Activities and Foreign Relations," *Journal of Chemical Education* 34, no. 3 (March 1957), p. 110.

summer of 1957 that the growing importance of scientific developments as an element in formulating foreign policy and carrying on relations with other governments called for a new emphasis in this field." [37]

THE IMPACT OF SPUTNIK

However, the trauma of Sputnik, in October of that year, galvanized the Department into action. According to Skolnikoff:

> Sputnik . . . was the turning point. With the reaction to the Russian achievement came the realization that, had there been adequate coupling of science and technology with foreign policy formulation, the United States might have been able to avoid a humiliating and dangerous incident in its history.[38]

Accordingly, in January 1958 at the suggestion of Dr. James R. Killian, Jr.—who had been named Special Assistant to the President for Science and Technology—Secretary Dulles reestablished his science office, naming it "Science Adviser to the Department of State," and appointed to the post Dr. Wallace R. Brode, associate director of the National Bureau of Standards. During World War II, Brode had served as OSRD scientific liaison in London and later Paris. He remained in the State Department position until September 1960.

An enthusiastic article in the *Foreign Service Journal* [39] greeted Dr. Brode's appointment. It noted that Dr. Brode was president of the American Association for the Advancement of Science and a member of the National Academy of Sciences. It noted the expressions of professional and editorial approval of his selection. And it described the role he and his associates would play in the Department:

> Assist other Federal agencies and private groups . . . encourage our own scientists during their initial participation in such new groups as the International Rocket Society and a new society of bio-chemists . . . work on the Law of the Seas . . . cooperation with Mexico and Canada in scientific research in the field of contamination . . . air and water pollution . . . the International Geophysical Year . . . meteorological progress . . . technical provisions in treaties and intergovernmental agreements covering such items as ship and plane travel and navigational equipment . . . radio and radar communications and other advances in the field of electronics work in close partnership with the military . . . space and space control . . . (possibly) an international Science for Peace program.

Like his predecessor, Dr. Brode spent most of his time in office recruiting and organizing. The expansion came at a time when science budgets everywhere were rising rapidly, and Brode's insistence on "top-level scientists" made recruitment difficult in a time of scientific manpower shortage.[40] Upon his retirement in 1960 he was followed by

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[37] *Science Adviser of the Department of State*, p. 8.

[38] Skolnikoff, op. cit., p. 257. However, the issue is by no means clearcut. The Soviet sputnik had been put up by a military booster. The U.S. program to put a satellite into orbit was relying on a "Vanguard" system managed by the Navy but with no military significance. The IGY program in the United States was represented as pure science and accordingly totally visible, hence without the use of secret hardware. It is not evident that the Department of State could have influenced a departure from this principle, or that it could have been persuaded by a vigorous science office to do so, or that such a science office would have desired it, or that the science community that would have been its prime constitutency would have supported such an effort to persuade. However, it is more probable that a science office could have alerted the Department to the need for countermeasures in anticipation of the Soviet success; the Soviet satellite program was no secret and its use of military hardware heightened the probability of its succeeding. Much could have been done to lessen the shock of the Soviet success, and to prepare a more measured U.S. response.

[39] C. Edward Clark, "Science and Diplomacy," *Foreign Service Journal* 35 (April 1958), pp. 31–34. A career Foreign Service officer and later an Ambassador, Clark was then executive assistant to the Assistant Secretary of State for Administration.

[40] According to Skolnikoff, op. cit., p. 258:

> The emphasis of the office during Dr. Brode's tenure and, indeed, during the tenure of his successors, was again on international scientific activities. Disarmament, space, and atomic energy were handled by another office: the Secretary's Special Assistant, at that time Mr. Philip Farley. Other policy areas such as military policy, foreign aid, international organization, or information activities were all but ignored, or the technical inputs were provided by the White House science office.

Dr. Walter G. Whitman, who had chaired the department of chemical engineering at MIT, and the Research and Development Board of the Department of Defense.

An assessment of the work of the office under Dr. Whitman concluded that he had performed "brilliantly" in mending relations between the Department and U.S. scientists over such issues as participation in international organizations with some members not recognized by the United States. (However, the assessment continued, ". . . There was much more to be done and the Science Adviser's Office was not doing it.")[41]

PRESSURE FOR EXPANDED SCIENCE FUNCTION

Secretary Dulles had shown little interest in the diplomatic role of science and technology, and during his tenure the Department's science office had not flourished despite the many activities subsumed under the IGY which were generating pressures for the revival of the office. His successor, Christian Herter, told a Senate subcommittee that "I think there will be a gradual development in this field." This observation was in response to a question by Senator Henry M. Jackson, who had expressed the "feeling that science and technology has become a very important element in your work" and had asked the Secretary's opinion as to the "need for raising the prestige and status of the scientific advice within the Department of State."[42]

An appeal for a strong science program in the Department of State was expressed by James R. Killian, Jr., long a leading presidential adviser on science. In a speech delivered in New York, December 13, 1960, and reproduced in *Science* January 6, 1961, he advanced an 11-point program for "enhancing the contributions of science and engineering to the formulation of sound foreign policy and to Free World Strength." His program—

(1) Recognize and stress the contributions which science can make to peace and encourage scientific activities abroad—as, for example, the betterment of health, the improvement of agriculture, and basic research—which are manifestly peaceful and benign.

(2) Encourage more the IGY type of programs which are managed by nonpolitical, private scientific organizations.

(3) Encourage more international conferences such as the Conference on the Peaceful Uses of Atomic Energy. Specifically support the proposed U.N. conferences on the peaceful uses of outer space and on technical aid.

(4) Despite aggravations and difficulties, continue to encourage exchange of scientific personnel between East and West. Reduce petty restrictions on scientists invited to the United States.

(5) Undertake periodically a thorough review of our technical aid policies and programs to insure that they are well adapted to the countries they are intended to help. Seek the advice of knowledgeable scientists and engineers in conducting these reviews and strive for programs which bring the benefits of science in all its phases to less-favored countries.

(6) Provide in Washington a mechanism for coordinating research programs and other scientific activities which government agencies sponsor abroad and make sure that our ambassadors have the opportunity, in each country where such work is conducted, to coordinate it locally.

(7) Widen the role of the science adviser to the Secretary of State and continue to build strength in the corps of science attachés. Give this science adviser a role to play in strengthening the competence of the State Department to deal

[41] Skolnikoff, op. cit., p. 259.

[42] U.S. Congress, Senate, Committee on Government Operations, National Policy Machinery Subcommittee, *Organizing for National Security*, Vol. 1, Hearings, 87th Cong., 1961, p. 706. Statement of Hon. Christian A. Herter, Secretary of State.

with the technical aspects of arms limitation. Support the continuation of NATO's science advisory services.

(8) Encourage regional programs to strengthen science not only in Europe but in other parts of the world. Science lends itself well to international efforts. CERN is an example.

(9) Encourage international efforts to develop more engineer-managers or project engineers who can direct the successful development of intricate engineering systems, who can deal with new orders of reliability, who can bring wisdom and social foresight to the difficult task of handling technological change so that it benefits and does not hurt people, and who can mobilize technology with this in mind to increase productivity.

(10) Do not misuse science and technology by distorting them for propaganda purposes. We will build greater prestige in the long run by insuring the quality, vigor, and integrity of our science and technology. We gain prestige by being better in more areas.

(11) Encourage more scientists and engineers to prepare themselves for foreign service and for advisory and administrative responsibilities in government. Encourage universities to establish programs to educate scientists having this orientation. . . .[43]

At the close of Dr. Whitman's tenure, Dean Rusk, Secretary of State, sought the advice of Dr. Jerome Wiesner, the President's Science Adviser, on the reconstitution of the science office in State. What should be its mission and how should it be staffed?

The matter was referred to a panel of the President's Science Advisory Committee (PSAC). The report of the "Science and Foreign Affairs Panel," endorsed by PSAC, went to the Department of State in March 1962, and after some modification was promulgated (and the officer's appointment announced) in September 1962.[44] The thrust of the recommendations was that the status of the office should be elevated, the scientific functions emphasized, and the related functions of space and atomic energy consolidated within it. The office would combine operational and staff policy duties.

RESPONSE BY THE STATE DEPARTMENT

Thus, in September 1962, Dr. Ragnar Rollefson, professor of physics at the University of Wisconsin, was named to succeed Whitman and at the same time the title was changed to "Director of International Scientific Affairs." His rank and duties were spelled out in a Foreign Affairs Manual Circular, "Director of International Scientific Affairs," (No. 84, Sept. 14, 1962.) The Director would be "a principal officer of the Department with rank administratively equivalent to a bureau head." He would "serve as adviser to the Secretary and the Department on scientific and technological matters. . . ." His principal functions would be:

a. Participate actively in general foreign policy development, ensuring that appropriate consideration is given to scientific and technological factors.

b. Advise and assist the Secretary of State and other Department officers in reaching decisions on matters having scientific and technological implications.

c. Participate in policy planning for and provide guidance to U.S. international science activities.

d. Work with the Bureau of Educational and Cultural Affairs, regional bureaus, and other appropriate elements in formulating policy and planning programs for scientific exchange.

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[43] J. R. Killian, Chairman of the Corporation of the Massachusetts Institute of Technology, first presented this plan at the Silver Stein Award Dinner of the MIT Club of New York. Subsequently it appeared under the title "Making Science a Vital Force in Foreign Policy," *Science*, January 6, 1961, pp. 24–25.
A condensation of the speech also appeared in the *Christian Science Monitor*, December 21, 1960.

[44] Skolnikoff, op. cit., pp. 259–260.

e. Recommend activities to further U.S. foreign policy objectives in the field of science and technology.

f. Provide guidance to the science attachés developed in collaboration with other Department elements, particularly the regional bureaus.

g. Serve as the point of coordination within the Department and between the Department and other organizations, governmental and non-governmental, on matters concerned with science and technology, including the non-military uses of atomic energy and outer space.

h. Represent the Department on appropriate interdepartmental committees.

ISA [later changed to SCI] will be staffed to enable the Director to carry out the above functions, and to provide professional staff support to other bureaus and offices of the Department on all scientific and technological matters.

According to one Washington observer, the Kennedy Administration exerted some pressure to strengthen the State Department's science office by the 1962 reorganization into the "Office of International Scientific Affairs." However, he went on to note the "incredibly uneven" results of injecting scientists into a diplomatic environment for which some were and others were not prepared. Even so, Dr. Rollefson was insistent that the "State Department's science program requires people with thorough scientific training." [45]

Dr. Rollefson's tenure ran from September 1962 to September 1964. He came to the Department to head a largely "paper" organization; he continued the work of his predecessors in providing a bridge to the scientific community but apparently broke no new ground. His deputy, Dr. Edwin M. J. Kretzman, earlier professor of political science at Brown University and a career Foreign Service officer, after Rollefson's departure, served as "acting." He was credited with several innovations during this period: the introduction of a "science course" at the Foreign Service Institute [46] and the organization of a series of "science luncheons" of the Secretary of State. When he retired, in December 1964, he was replaced by another Foreign Service Officer, Herman Pollack, as "acting." The search continued for several years for an "outstanding scientist" to take the post, but even though the "Office" was made a "Bureau" in April 1965, and its Director "equivalent" to an Assistant Secretary, there were no takers.

Before discussing the development of the new Bureau under Herman Pollack's direction, it is useful to consider why the Office of Science Adviser up to July 1967 had been only marginally effective.[47]

ASSESSMENT OF EARLY SCI PERFORMANCE

In September 1966, Prof. Eugene Skolnikoff assessed the effectiveness of the State Department's science office as one of "poor performance." There was no question, he said, but that the function of "providing scientific inputs in the policy process" was needed. Given stronger leadership it could have performed better. Substitution of an "outside group of consultants" was no answer because they would lack "the close tie to operating needs" and "effective points of contact." (They could, however, be useful in conjunction with a central

[45] Daniel S. Greenberg, "Science and Foreign Affairs: New Effort Under Way to Enlarge Role of Scientists in Policy Planning," *Science*, October 12, 1962, pp. 122–124.

[46] See p. 120 and thereafter.

[47] The time sequence: Pollack had joined the office in September 1964 as deputy director, became acting director January 1965, and was appointed director in July 1967. His deputy was the late Dr. J. Wallace Joyce, followed by Dr. John Granger. Pollack retired in July 1974, and Granger continued as "acting" until after the reconstitution of the office, October 15, 1974, as the "Bureau of Oceans and International Environmental and Scientific Affairs."

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office.) Nor would it serve better to diffuse scientific specialists throughout the bureaus of the Department having scientific concerns, although, again, this arrangement might usefully be coupled with a strong central science office. He suggested also that Foreign Service officers could receive specific training for "science affairs competence."

What, he asked, were the functions of the office? They were at three levels: participation in policy making, operational responsibilities, and bridging from State to the science community. The latter two were easy, inescapable, and excessively time-consuming; the first—help in policymaking—was "broadest, hardest, and most important." It was the key job. It meant that the office should be not only on call but prepared to take the initiative "when opportunities are seen for using science and technology to advance political objectives." It should be highly selective in the issues it studied. It could tap the reservoir of expertise in the "outside" science community. The Science Officer needed the rank of Assistant Secretary, but more importantly such leadership qualities as "scientific stature," skill in technology forecasting relative to foreign policy, a competence for representing the State Department's interest in domestic scientific and technological developments, and "concern for the general ability of Foreign Service officers to deal with the day-to-day interactions between science, technology, and foreign policy." [48]

NEED FOR ATTENTION TO TECHNOLOGY

One of the problems of the State Department's science office that persisted during this period was the constraining effect of focusing heavily on science to the neglect of technology. For example, a study of the international role of Federal agencies, conducted by the International Committee of the Federal Council for Science and Technology (FCST), June 20, 1961, began by noting the "revolutionary influence" of "science and its application in technology" and the need for taking these into account in U.S. foreign policy. But the aspects addressed in the report were mainly in science: international scientific organizations, support of research abroad, participation in international meetings and exchange of persons, and the "image of U.S. science abroad." Consideration of technology was limited to its role in foreign aid.

On the other hand, Burton M. Sapin, writing in 1966, expressed hope that the expanded responsibilities of the office would "provide an opportunity . . . to enter into some of the main currents of foreign policymaking and play a more vigorous and influential role in the Department." He conceded that in the past its general orientation had been "toward the research activities of the scientific community, primarily the physical and biological sciences, and the various ways in which these affected and were affected by foreign policy." It had had "very little to do with the major problems stemming from the convergence of foreign policy, military policy, and scientific and technological advance. . . ." [49]

[48] Skolnikoff, op. cit., pp. 265–278.

[49] Burton M. Sapin, *The Making of United States Foreign Policy* (Washington, D.C.: The Brookings Institution, 1966) pp. 228–231. The author noted also, p. 227, that the President's Science Adviser and OST had helped offset the science gap in the Department of State.

Other assessments available to the author suggest that the role of the science office was not fully appreciated or accepted at this time by other bureaus of the Department. Moreover, the specifications for the "Director" were exacting: not only should he be an outstanding scientist, but also sophisticated in international relations and diplomacy, aggressive and knowledgeable in administration, and skilled in bureaucratic maneuver.

INSISTENCE ON SCIENTIFIC EMINENCE

During the years between 1950 and 1965 the emphasis was on recruitment of a "top flight scientist" to run the office. The science community generally insisted that the incumbent should be given a high enough rank so that he would automatically command "political clout" in the Department matching his "scientific clout" in the community. (It is not evident that any "clout" automatically accompanies rank; the clout comes from the skill with which the rank is exercised.) However, the insistence on high rank and scientific achievement combined to make recruitment difficult, and the results fell short of expectation. From the Berkner Report on, the arguments in favor of a strong "science" office in the Department of State were persuasive in force and impressive in scope. But the actual product never came close to justifying the claims, and the resources allocated to the effort were meagre and sporadic. Possibly almost as large an effort was devoted to recruitment as to execution.[50]

FURTHER REVIEWS OF SCIENCE IN STATE

Shortly after Dr. Rollefson returned to the University of Wisconsin, a seminal critique appeared in the *Bulletin of Atomic Scientists*. Authored by W. Murray Todd of the Foreign Office of the National Academy of Sciences, it suggested that a time of "changing of the guard" was also an opportune moment to take stock. He noted that the 1962 change in title of the office had served to decide a persistent controversy over its function and purpose.[51] The issue was: "Should the incumbent preside over scientific policy matters as the personal adviser to the Secretary of State and hopefully to the Assistant Secretaries, or should he administer the scientific attaché apparatus, provide guidance on matters of international scientific policy, and coordinate the multiplicity of international scientific commitments of agencies of the U.S. government?" The change in title pointed in the latter direction. At this time (December 1964) the office consisted of 21 officers, 15 clerical personnel, 15 overseas attachés, and six deputy attachés.

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[50] According to the recollection of Professor Dean Rusk of the School of Law, University of Georgia:

> In the mid-60s we tried very hard to find an internationally recognized scientist to head up SCI. For a variety of reasons we failed in our recruitment effort but not through lack of trying. We turned to Herman Pollack who had a real talent for calling upon outside help in the scientific community and for injecting scientific dimensions into policy studies.
>
> My own view is that the Department of State should have a good scientist or scientists in such places as the Policy Planning Staff, the Arms Control and Disarmament Agency, and with special groups dealing with such questions as the Environment, Hunger, the Law of the Sea, etc. These might be based in the new Bureau of Oceans and International Environmental and Scientific Affairs but spend much of their time outside the Bureau—somewhat as does the Legal Adviser's Office. I am quite sure that the Department should not attempt to staff itself with top personnel from all fields of science and technology—but it should have people who know where to go for the best scientific advice possible on given problems.

(Dean Rusk, Professor of International Law, University of Georgia School of Law, to Franklin Huddle, March 18, 1975.)

[51] W. Murray Todd, "Science in the State Department," *Bulletin of the Atomic Scientists* 20, no. 10 (December 1964), pp. 27-29.

Among the questions raised by Todd were: Should the office be headed by a bona fide scientist or by a Foreign Service officer? The responsibility was a divided one: to maintain communication with the scientific community and to "nurture a climate of confidence and influence within the Department of State." There were impressive reasons in support of both courses. Todd also noted that "Fortunately, for the last several years the office has had as deputy directors Foreign Service officers who understand the subtleties of both the scientific and Foreign Service attitudes." But as to the principal officer, in Todd's opinion:

> The acceptability of the director to the scientific community is clearly a matter of the highest import, both to that community and the State Department. It is vital for the scientific community to recognize, however, that the director's effectiveness is directly proportional to the confidence he instills in the Secretary of State and the officers of the Foreign Service. He must be an eloquent spokesman both to and for the American scientific community. As a member of the Department of State his first responsibility is the foreign policy of the United States. The strong likelihood that the next director will be drawn from the ranks of the scientists is largely a measure of the success of past incumbents in being diplomats among scientists and scientists among diplomats.

The proprietary interest of the U.S. scientific community in the healthy growth of scientific institutions in the Federal Government is generally reflected in the numerous articles in *Science* magazine, the organ of the American Association for the Advancement of Science. The decision of the Department of State in May 1965 to change the title of the office from "International Scientific Affairs" to "International Scientific and Technological Affairs" was reported without comment.[52] The main thrust of the report was that the Department had attempted to make the office more attractive by making it explicitly equivalent in "rank and authority" to that of an Assistant Secretary. The article also noted that at that time the office was headed by Mr. Herman Pollack (acting). He was identified as "a career officer with long experience in administration, but no scientific training."

Another article in *Science* in 1966 took note of State's inability to fill its "top scientific job" and suggested that the role of this office had not been well defined. It was not clear whether the science director was an administrator of the considerable science functions (attaché program, international organizations, etc.) or "policy adviser and scientist-diplomat." As a result—

> The scientific community has not rallied energetically to the aid of State, perhaps because of a feeling that science has, up to now at least, not been taken seriously in Foggy Bottom. It is probably true that in international matters scientists have preferred to work through the National Academy of Sciences, which the scientists regard as their own and as essentially nongovernmental despite the federal source of most of its funds.[53]

UNSUCCESSFUL QUEST FOR NEW SCIENCE DIRECTOR

As time went on and the Office remained under Herman Pollack ("acting"), the concern of the science community deepened. An article in *Science* by Skolnikoff in November 1966 repeated the suggestion

[52] "State Department: Rank, Authority of Science Office is Emphasized," *Science*, May 9, 1965, p. 776.
[53] John Walsh, "International Science Activities: Some New Vistas Open," *Science*, June 17, 1966, pp. 1605-1607.

that State's inability to recruit a bona fide scientist for the post lay in failing to define properly the role of the office.[54] In his view:

> The most important function of the science adviser can be summed up simply, if academically, as ensuring that the relevant scientific and technological aspects of central issues of foreign policy are integrated in policy deliberations. For an astonishing range of policy concerns these aspects are of critical importance to the choices facing the policy makers. And for those foreign policy issues of the greatest interest, these technical aspects are not simply background facts to be provided by an "expert." Instead, representing them effectively in the policy process requires good scientific judgment, involves estimates of future developments in both science and technology, and, most important, demands a thorough appreciation of the ways in which the technological alternatives may depend on and interact with the political alternatives. Moreover, science and technology are also available to the policy maker as new instruments of policy—instruments that can be used appropriately only when there is adequate understanding of their special characteristics and of the relationship between those characteristics and policy objectives.

He warned that:

> The Secretary of State's role as chief foreign policy adviser to the President will, in fact, be increasingly in jeopardy if the Department under him continues to be deficient in effective technical-political competence while the issues with which it must deal involve ever more sophisticated scientific and technological elements.

The Department's policy role in arms control, weaponry transactions, space, and atomic energy required at least a degree of technical skill to ask the right questions of mission agencies to provide a diplomatic input to Presidential decisions.

Even in domestic scientific matters, there was a role for the Department. In particular, there was the need—

> . . . to estimate the future, to examine the ways in which international relations and perhaps the international political system will be altered as science and technology continue their explosive advance, and to explore the likely changes in what constitutes the "national interest." [55]

By this time the question began to be asked as to whether it was realistic to expect to find and recruit a willing, outstanding scientist with diplomatic and administrative skills. It was still "desirable." But as Skolnikoff put it:

> Lastly, need the science adviser be a scientist? If one looks only to the nature of the required "technical" inputs into policy, the answer is preferably, but not necessarily, for those inputs require as much understanding of the political side of an issue as of the technical. With good technical associates, and experience in dealing with technical questions, a nonscientist could provide the bridge. However, he would have to surround himself with individuals with good technical judgment, and this would not be easy.[56]

And in point of fact, "scientific stature will not make any difference whatever unless the science adviser has the basic ability to relate science and technology to foreign policy matters and the force and energy to make his views known and felt within the Department."

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[54] Eugene B. Skolnikoff, "Scientific Advice in the State Department," *Science*, November 25, 1966, p. 980.
[55] Ibid., p. 983.
[56] Ibid., p. 984.

IV. Growth of the Science Office, 1966–1974

The various obstacles that had retarded development of the science office of the Department of State were overcome in part by the activity and accomplishments of the office during the directorate of Herman Pollack, a career Foreign Service officer with no pretensions to scientific preeminence but with considerable administrative experience and flexibility.

During these years the office expanded in personnel, increased in effectiveness and impact, and somewhat bettered its acceptance by other elements of the Department. However, while it undertook many experiments in bringing science understanding into the Department there were few unqualified successes. It was never adequately manned to perform both operational and staff policy functions. It became overloaded with operational chores and tended to neglect other commitments. The differing intellectual demands of science policy and technology policy, and the differing administrative requirements of science programs and technological programs, made it difficult to allocate effort to deal with these four functions in a balanced way. Still, these are criticisms of a dynamically evolving function in a Department and an administrative environment that tended to resist change and new directions of growth.

Endorsement of Science Program by Secretaries of State

Secretary Rusk appears to have appreciated quite fully the importance of science and technology for diplomacy. He was receptive to the communications from the office, gave many speeches to public groups and much testimony to congressional committees stressing the importance of science and technology for diplomacy, and responded generously to proposals for innovative approaches to the problem of making State science conscious. However, in general the Foreign Service tended to be unresponsive. Assignments to SCI were not usually welcome, liaison between SCI and the geographic bureaus was not close, and the function was not highly regarded as a ladder to promotion or an interesting career.[57]

Secretary William P. Rogers, who took office in 1969, similarly appealed the cause of science and technology as a major concern of his Department. In a number of speeches within the Department and to congressional audiences he called for staff expertise in such technological problems as the nuclear nonproliferation treaty, Intelsat, and the control of the seabed; and pledged that "Our basic goal is to put science and technology at the service of human—and humane—ends.[58]

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[57] These impressionistic observations are gleaned from many conversations with Foreign Service officers, comments in the literature, and statistics of age in grade.

For example, the 610 page study carried out under the direction of the Deputy Under Secretary of State for Administration (U.S. Department of State, *Diplomacy for the 70s, A Program of Management Reform for the Department of State*, Department and Foreign Service Series, no. 143, Publication no. 8551, December 1970) gave only one-half page to science; it said in effect science was important for diplomacy, reporting should be a two-way proposition, and field officers need not be trained scientists (p. 491).

[58] For example, his remarks to the Scientific Attachés, January 29, 1970 and his address, "U.S. Foreign Policy in a Technological Age" in U.S. Congress, House, Committee on Science and Astronautics, *International Science Policy*, proceedings before the Committee of the Panel on Science and Technology, Twelfth Meeting, January 26–28, 1971, pp. 2–8.

Secretary Henry A. Kissinger has also expressed concern for the role of science and technology in his Department. His most explicit statement of the theme was contained in his first speech as Secretary of State, before the United Nations General Assembly, September 24, 1973, when he addressed the delegates as—

> . . . members of a community drawn by modern science, technology, and new forms of communication into a proximity for which we are still politically unprepared. Technology daily outstrips the ability of our institutions to cope with its fruits. Our political imagination must catch up with our scientific vision.

And later, before the special session of that body, April 15, 1974: ". . . Science and technology are becoming our most precious resource."

With this receptive leadership and recognition the science office in the Department of State during the years from about 1966 on was increasingly active. Principal tasks of the Bureau during these years included:

—Testimony before numerous committees of Congress;

—Backstopping and annual briefing sessions for U.S. scientific attachés;

—Preparation of numerous policy memoranda to the Secretary;

—Participation in studies under the aegis of the National Security Council;

—Management of the International Science and Technology Committee (formerly under the Federal Council for Science and Technology, but now delegated to the Department of State);

—Providing a central advisory service for the Department of State on issues with scientific and technological content;

—Attendance at international scientific conferences;

—Assistance in negotiating bilateral agreements and subsequent follow-on implementation;

—Providing input to international programs of other agencies—the National Science Foundation, U.S. Atomic Energy Commission, Department of the Treasury, and others;

—Supporting U.S. delegations at U.N. agencies, Organization for Economic Cooperation and Development, North Atlantic Treaty Organization, and others;

—Various expedients to increase the technical competence of the Foreign Service; and

—Publication of literature and speeches describing State Department science activities.

Evolution of SCI; Expanded Duties

After Dr. Rollefson left the Department, and first Kretzman and then Pollack took over as "acting," a vigorous search turned up no acceptable and willing replacement. Accordingly, Pollack was designated Director of International Scientific and Technological Affairs, July 14, 1967. His previous service as deputy and acting executive director of the prestigious Bureau of European Affairs (EUR) and as Deputy Assistant Secretary for Personnel, a point of bureacratic influence, significantly contributed to his effectiveness in his new post. He was reconfirmed in it September 18, 1969, and remained there until he resigned August 15, 1974. In this post his task was—

> . . . to advise and assist the Secretary in his consideration of scientific and technological factors affecting foreign policy, to coordinate and provide guidance to the international scientific and technological activities of the Government,

to represent the Department in appropriate international cooperative programs in science and technology and to direct the Scientific Attaché program.[59]

When the new Director took office, he assumed charge of a staff of 32 persons in Washington, plus 22 scientific attachés or deputies (12 in Europe). The home office was organized into three sections: Atomic Energy, Outer Space, and General Science. Functions of the office were described in a departmental statement in 1966 as follows:

(1) Providing advice to the State Department and Foreign Service on the relationship of science and technology to international relations and foreign policy developments;

(2) Providing evaluation of scientific matters related to the peaceful uses of atomic energy and outer space and other science matters involved in international affairs;

(3) Participating in foreign policy decisionmaking to assure consideration of scientific and technological factors; and

(4) Maintaining liaison with Federal agencies engaged in the administration of scientific programs and with private groups engaged in international science activities, for the purpose of providing foreign policy guidance; recommending the initiation of cooperative scientific and technological activities to advance foreign policy objectives; and obtaining information of the status of internationa scientific and technological activities.[60]

The growth in resources and influence of the office during these years was attributable to the combination of a vigorous and sophisticated Foreign Service officer as leader, a general governmental interest in the strengthening of science and technology programs, the need in many technical activities for State Department help and intervention abroad, a growing interest of the Congress, and a series of sympathetic Secretaries of State.

A tabulation of the (mainly operational) tasks within the office in mid-1966 would include the following:

General

—Administer foreign policy aspects of "certain" bilateral science agreements;

—Coordinate briefing programs to improve departmental understanding of major scientific and technological developments (e.g., desalinization, high altitude photography, remote sensing devices);

—Motivate interdepartmental exchanges of personnel for training purposes;

—Assistance to Foreign Service Institute in presenting Foreign Service courses in science, technology, and foreign affairs;

—Coordinate international scientific activities of other agencies; and

—Chair and staff International Committee for Science and Technology of the Federal Council for Science and Technology.

Atomic Energy Section

—Assist on matters relating to peaceful uses of atomic energy;

—Help negotiate bilateral agreements for cooperation (36 countries);

[59] U.S. Department of State, Press Release, No. 270, "Appointment of Herman Pollack as Director of International Scientific and Technological Affairs," September 18, 1969.

[60] Statement submitted by Department of State in U.S. Congress, House, Committee on Appropriations, *Departments of State, Justice, Commerce, The Judiciary, and Related Agencies Appropriations for 1967*. Hearings, 89th Cong., 2d sess., February 15, 1966, p. 42.

—Assistance on such projects as desalinization, nuclear ship propulsion, peaceful nuclear explosions (Plowshare); and
—Cooperation with Euratom.

Outer Space Section

—Recovery of astronauts landing on foreign soil;
—Negotiate agreements for space cooperation;
—Participate in United Nations Outer Space Committee; and
—Assist in U.S.-U.S.S.R. space cooperation program.

General Science Section

—Participate in international environmental (ocean and atmospheric) science programs;
—Maintain relations with other offices and agencies with science programs;
—Present policy advice and assistance concerning technological matters; and
—Maintain "geographic" officers in science.

Exposition by Pollack of SCI's Role

On May 17, 1967, shortly before his appointment as Director of SCI, Pollack in a formal address described "the present and future importance of the interaction between science and foreign affairs, the attitude of the Department of State on the subject, and the administrative response . . . to the challenge of science in foreign affairs." [61] There was a technological revolution underway, he said, that was without precedent in its combination of "scale, pace, and impact on the affairs of men." In less than 10 years man had progressed from a first satellite to working weather and communications satellites. He foresaw "natural-resource sensing" in the future. Nuclear power, desalinization, weather modification, computer technology, changes in military hardware, supertankers of 500,000 tons, were at hand or near.

All of these technological innovations implied work for the Department of State: nuclear safeguards, changed national and international patterns of energy usage, easing of international tensions over allocation of scarce water, agreements on space and weather modification, agreements on uses of the ocean and the seabed, resolution of "brain drain" and "technology gap" issues, and policies in response to the changed vulnerability of nations to the new weapons. Thus:

> . . . Not only do scientific and technological developments affect the basic geopolitical-economic considerations which underlie foreign policy decisions, but they become increasingly the very subject of international negotiations. They are providing a host of new problems, with awesome potential for the disadvantage of the amity of nations. On the other hand, their beneficial potential, imaginatively and effectively employed, could have immense favorable impact on the climate of international relations over the next century or more.

Numerous international agencies and agreements had appeared in response to the onrush of technological innovation: International Atomic Energy Agency, World Health Organization, Intergovernmental Oceanographic Commission, U.S. agreements with Japan and

[61] Herman Pollack, "Science, Foreign Affairs, and the State Department," *Department of State Bulletin*, June 19, 1967, pp. 910–917. Reprinted in U.S. Department of State, Department and Foreign Service Series, no. 139, Publication, no. 8204, July 1967.

Germany. Many present and future concerns required "worldwide integrated action":

. . . Such immediate problems as population pressures, protection of basic food crops and the development of new sources of food, and water management require a joint approach now. For the the future, international action will be needed in disease control, resource exploitation and conservation, weather modification and control, and in the search for new energy sources. For the far future, mastery of and competence in the ocean depths and outer space will require a massive, sustained, and cooperative effort.

Then Pollack went on to describe the organizational response of the Department of State to these challenges—the role of SCI, the scientific attachés, relationships with other scientific and technical agencies, and science training in the Department. But there remained a persistent problem:

We have found that scientists, like many others, frequently lack an awareness of the realities of world politics and, correspondingly, foreign affairs specialists are frequently resistant to the acquisition of knowledge about scientific and technical developments applicable to foreign affairs. I don't mean to be disparaging toward either group—after all, some of my best friends are scientists, and I must live with the diplomats. The challenge is, in part, to our educational systems.

He quoted a statement by Secretary Rusk that: "For any American involved in public affairs today, scientific literacy is a must; and that is particularly so in foreign affairs. We are firmly convinced that the Foreign Service officer should be familiar with the ways, the concepts, and the purposes of science." And he called for the next generation of Foreign Service officers to add "scientific literacy to the wide range of skills and knowledge already required in their profession."

Continued Growth During the Nixon Presidency

The influence of SCI continued to grow when the new Republican administration took office in 1969. During the first 2 years, bilateral science agreements were developed with France, Spain, Romania, the U.S.S.R., and Taiwan China. Technical assistance programs were being formulated in cooperation with the Organization of American States. Programs were under study for Africa. A new AID Office for Science and Technology was organized. SCI participated in a joint United States-Canadian Conference on Arctic Research. The use of Public Law 480 funds for science programs in several countries was under study.

Early in 1971, William P. Rogers, who succeeded Rusk as Secretary of State, told a House Committee that "This administration is adapting American foreign policy to the fact that never before have the global characteristics of science and technology held so many consequences for so many people." He spoke of the vanishing resources of petroleum and metals, of environmental quality, satellite technology, seabed resource development, nuclear benefits and dangers, and the need for international cooperation to exchange scientific knowledge and technological capability.[62]

ADVISORY COMMITTEES

When the Federal Council for Science and Technology (FCST) was first organized, in 1958, one of the first subordinate elements

[62] William P. Rogers, "U.S. Foreign Policy in A Technological Age," in Proceedings, Panel on Science and Technology, Twelfth Meeting, *International Science Policy*, pp. 2–8.

created under it was the International Committee. At about the same time, the President had created the President's Science Advisory Committee (PSAC), and under this group had been organized a "very active Panel on Science and Technology in Foreign Affairs." The FCST group had been concerned mainly with coordinating the international interests of Government agencies with scientific or technological missions. The PSAC group was—

> . . . A source of advice on the role of science and technology in supporting [U.S.] foreign policy objectives. It seeks to assist Government departments and agencies in using science and engineering effectively in our foreign programs, and in furthering international cooperation in science and technology.
>
> The interaction between science and foreign affairs is similar to that between science and public policy in general; that is, there are two clear areas of emphasis. One is the impact of scientific progress or scientific activities on foreign policy, on aid to underdeveloped countries, on our military alliances; the other is the requirement placed on our international policies to further and encourage scientific development by creating the necessary climate for effective interchange of ideas and international scientific cooperation.[63]

The scope of the PSAC panel and the level of its expertise is suggested by the following explanation. They ranged—

> . . . over the entire broad field of the impact of science on U.S. foreign affairs and the furthering of international scientific cooperation and exchange. . . . One of the major aids in the work of the Panel is the representation on it of those whose regular responsibilities include the day-to-day integration of science and foreign affairs, e.g., the President of the National Academy and its foreign secretary, the present and the past science adviser in the Department of State, the director of the National Science Foundation, the U.S. representative on the NATO Science Committee, a past president of ICSU, and a vice president of the ICSU special committee on space research.[64]

ADVISORY CONCENTRATION IN STATE

The President, early in 1973, dissolved the Office of Science and Technology (OST) and PSAC and transferred the responsibility for the functions of the President's Science Adviser (including the management of FCST) to Dr. Guyford Stever, Director of the National Science Foundation. In NSF a small Science and Technology Policy Office (STPO) was then set up to take the place of OST.

Subsequently Director Stever undertook a review of the various committees that had been formed under the Council. One of these was the International Committee. At the time of the President's reorganization, this committee was chaired by Herman Pollack, was staffed by SCI, and had representation from a wide array of departments and agencies.[65] Dr. Stever, in an effort to simplify and reduce his organiza-

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[63] U.S. Congress, Senate, Committee on Government Operations, Reorganization and International Organizations Subcommittee, *Science Program—86th Congress*, Report no. 120, 86th Cong., 1st sess., March 1959, p. 12.

[64] Ibid., pp. 12–13.

[65] The Department of State was represented by SCI, AID, and USIA; other departments represented were Agriculture, Commerce, Defense, HEW, HUD, and Transportation. The Office of the President was represented from OMB and OST. Independent agencies represented were AEC, NSF, and NASA. Also included were the Library of Congress and the quasi-governmental Smithsonian Institution and the National Academy of Sciences. A more extended account of the FCST International Committee is presented in U.S. Congress, House, Committee on Foreign Affairs, *U.S. Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange*, in the series Science, Technology, and American Diplomacy, prepared by Genevieve J. Knezo, Analyst in Science and Technology, Science Policy Division, Congressional Research Service, Library of Congress, April 1974. See vol. II, pp. 865–1035.

tional responsibilities, transferred the jurisdiction over the International Committee from FCST to the Department of State.[66]

The FCST committee had been involving itself in a wide scope of interests but rarely in great depth. Perhaps its principal function—like that of most FCST committees—was that of an interagency information exchange. This function, sometimes referred to facetiously as "the chowder and marching society," has a practical value when a number of agencies are engaging in related or parallel functions. On the other hand, it is difficult for essentially voluntary interagency coordinating committees to undertake large studies or surveys, particularly on a sustained basis, unless the White House is closely related to the enterprise. With the termination of PSAC and its International Panel, and with the transfer of the International Committee of FCST to SCI, the committee became in effect the residual claimant to both planning and operational coordinating functions but without interagency and Executive Office support. This, at least, was the status of the Interagency Committee on International Science and Technology at the point when SCI turned into the "Bureau of Oceans and International Environmental and Scientific Affairs."

SCI Efforts To Bridge State With the Science Community

Among the initiatives undertaken by SCI to bring a fuller appreciation of science and technology into the Department of State were—

—Science luncheons at which leading scientists lectured to senior officers of the Department;[67]

—Science lectures to broader audiences;[68]

—Annual briefing sessions of science attachés to review new trends in U.S. science and technology;

—A "Scholar/Diplomats Seminar," that exposed eight younger professors to problems of diplomacy;[69] and

—A seminar course on science and technology at the Foreign Service Institute.[70]

A related activity was the organization of a nongovernmental "Department of State Advisory Committee on Science and Foreign Affairs." This committee, announced by Secretary Rogers February 23, 1972, held its first meeting July 13–14, 1973; held its latest of four meetings, July 13–14, 1974; and expired in early 1975. The concept of such an advisory committee to tap a wider range of opinion and thought in the scientific and technological community had long been advocated. It was to have four objectives: (1) to advise on technically related problems of foreign policy, (2) to advise on long-term

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[66] However, the responsibility for "international scientific and technical activities performed by OST" was transferred by Dr. Stever, June 30, 1973, to the Director of NSF—and by him to the Assistant Director for National and International Programs. These activities included:

—Serving as a focal point for selecting cooperative programs with the international science community and participating in international programs in which civilian science and technology are vital elements.

—Facilitating the flow of people and exchanging of ideas to aid in achieving the foreign affairs and trade objectives of the United States.

[67] These had been initiated by Kretzman and were continued by Pollack with the support of Secretary Rusk.

[68] The first of these were presided over by the Secretary and heard a presentation by Dr. Rene Jules Dubos on "The Human Landscape," December 9, 1969.

[69] This item and the one preceding were reported in U.S. Department of State, *International Science Notes*, no. 30 (June 1973), pp. 13–15, item 8. The item expressed regret that the meetings with science attachés were attended from the Department by only staff members of SCI.

[70] Two experimental four-week seminar courses were held in 1965, with support of the Ford Foundation, and subsequently training programs were continued at FSI on a semiannual basis. However, the course in the latter part of 1974, by then reduced to one week, was cancelled for want of students. See U.S. Department of State, *International Science Notes*, no. 12 (January 1966), p. 5, item 5.

trends that presaged diplomatic impacts; (3) to advise on the international control of technology, and (4) to advise on departmental management in international scientific and technological affairs.

During its brief period of activity the Advisory Committee appears to have served a useful purpose in providing an "outside" view of four technological problem areas of concern to U.S. foreign policy. Four subcommittees were formed dealing with (1) the control and management of the export of technology, (2) international aspects of uranium enrichment (as nuclear fuel), (3) the collection and distribution of information produced by the Earth Resources Satellite, and (4) weather and climate modification. Principal emphasis was given to items (1) and (3). Perhaps the most important contribution that this committee could make, if revived, would be by serving as a two-way communication link between the technical and policy groups in State and the broad technical community at large, while at the same time giving committee members a continuing education in diplomatic science policy problems and issues. The Advisory Committee had been selected with attention to the need for a very wide array of disciplines and professional experience [71] and could usefully bring their varied experience to the Bureau on demand.

Dr. Lewis Branscomb who had been a member of the Advisory committee gave it as his opinion that the committee had served a useful purpose during its short life. Its "mixed" composition—including both scientists and non-scientists—had helped SCI to deal with issues that began as technological but always went beyond technology to social, economic, and political areas. It provided an independent point of view on such subjects as bilateral science negotiations, international technology transfer, use of Public Law 480 funds, and problems of food. He offered two criticisms: that the Committee had insufficient contact with principal policy officials in other agencies with international science and technology missions, and that the Department of State had no funds with which to assure that other agencies fulfilled diplomatic commitments engaged in by State on their behalf.[72]

Growth of the State Science Office

Programs goals of the State science office were described by Mr. Pollack in a prepared statement to the Senate Committee on Foreign Relations in April 1973.[73] Said the statement: "SCI's basic mission is to promote the effective utilization internationally of U.S. capabilities in science and technology to advance our national interests and to strengthen our international economic, political, and cultural relationships." To carry out this mission there were four program goals:

(1) Promote Constructive Utilization of the Peaceful Benefits of Science and Technology to Advance U.S. Interests and to Strengthen U.S. Policy Relationships while Forestalling the Diversion of Such Technology to Military or Other Programs Inimical to Those Interests.

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[71] The Committee was chaired by Mr. Pollack. Its members were:
Dean Rusk, former Secretary of State; Simon Ramo, vice chairman of TRW; John Hightower, former Associated Press State Department correspondent and now professor of journalism, University of New Mexico; Gordon J. F. MacDonald, professor of environmental studies, Dartmouth College, and chairman of the National Academy of Sciences Environmental Studies Board; Kenneth Davis, Bechtel Corp.; John Leddy, former Assistant Secretary of State for European Affairs; Eugene Skolnikoff, professor of political science, and head of M.I.T.'s Center for International Studies; and Lewis Branscomb, vice president of IBM and formerly Director of the National Bureau of Standards.

[72] In a telephone conversation with the author March 17, 1975.

[73] U.S. Congress, Senate, Committee on Foreign Relations, *Department of State Appropriations Authorizations, Fiscal Year 1974*, Hearings, 93d Cong., 1st sess., April 3, 4, 30, 1973, pp. 527–529. He asked for $1.7 million for salaries for a staff of 50, plus operating expenses of $364,000 for the fiscal year 1974.

(2) Establish and Retain U.S. Influence in International Scientific, Technological and Environmental Programs and Organizations to Promote U.S. Political or Economic Interests.

(3) Ensure that the International Activities for U.S. Scientific, Technological and Environmental Agencies are Conducted with Full Knowledge of, and in Consonance with, U.S. Foreign Policy Interests.

(4) Identify Foreign Policy Issues Emerging from Scientific and Technological Developments, Direct the Focus Within the Department to Deal with These Issues, and Provide Foreign Policy Decision Makers with Appropriate Policy Analyses and Recommendations for Decision.

The statement then provided a quantitative analysis of some of SCI's operational tasks:

The workload associated with pursuing these goals and objectives continues to grow. The quickening pace of international cooperation in science and technology is indicated by the fact that there are now eighteen bilateral agreements for general cooperation in science and technology. SCI negotiated eight of these agreements alone during the past year and a half. During this same period the U.S. has been host to five formal ministerial delegations and even more informal ministerial level visits. These groups looked to the Department of State for statements and interpretations on U.S. policy on technical subjects. Responsibility for organization of these visits also fall on SCI. In addition, there are innumerable high-level individual visitors whose visits and consultations require detailed coordination and briefings.

In the past year, we also prepared major statements of policy on a wide range of issues such as remote sensing of the earth, space launch assistance, export of technology, post-Apollo cooperation, the environment, ocean dumping, endangered species, etc.

Pollack concluded by predicting a major expansion in both duties and manpower requirements for the future:

In the past, the Department's concern with activities and problems dealing with science and technology have been somewhat limited. Such a situation no longer exists. S&T have significantly augmented the business of the Department of State. The great change which is occurring is altering the very structure of society and relationships among nations and is moving at a pace which challenges present policies and institutions.

Functions and Tasks of SCI by 1974

The following is a listing of the jobs that the State Department science office appeared to be responsible for executing at the time it was being consolidated with offices of Oceans and Environmental Affairs, as of October 1974. (The list was compiled on the basis of a review of SCI publications of recent date.) These fall roughly into seven categories, about as follows:

CONTRIBUTIONS TO POLICY PLANNING

In this category are activities that relate to U.S. decisionmaking in the foreign policy field. They include:

—Preparing quick responses to emergency questions involving science, technology, and diplomacy;

—Responding to requests for technical assistance from policy-oriented levels in the Department of State;

—Providing technical input on behalf of the Department of State to matters before the National Security Council;

—Analyzing the contributions of U.S. and world basic science to U.S. diplomatic objectives;

—Identifying major technological developments of highest significance for diplomacy, present and future, and preparing and bringing to the attention of high-level decisionmakers the in-depth analysis of such developments;

—Preparing broader surveys of ongoing technology, and assessing the general trend of the interactions of technology with diplomacy;

—Securing policy-oriented inputs from the U.S. technological community, including the funding of analytical, historical, and policy studies in the area of diplomatic problems involving science and technology;

—Designing diplomatic initiatives involving technical matters; and

—Providing input in congressional hearings and assisting in deliberation on legislative issues involving the interaction of science or technology with U.S. diplomatic objectives.

RELATIONS WITH OTHER COUNTRIES

In this category are included the functions of negotiation of agreements, maintenance of the scientific attaché system, and other support functions.

They include:

—Conducting international negotiations on technical matters and bilateral agreements on behalf of the U.S. Government;

—Providing staff assistance to accompany and backstop senior U.S. Government officials in negotiating agreements with foreign governments that involve technical substance;

—Coordinating the development and negotiation of bilateral technical agreements; and

—Monitoring and supporting follow-up actions to implement bilateral technical agreements.

COORDINATION OF U.S. TECHNICAL MISSION AGENCIES

In this category are included the functions of planning and supporting joint programs, and assisting other agencies in arranging for foreign contacts and the like. They include:

—Providing secretariat and staff support for interagency committees involved in international technical matters;

—Providing assistance to U.S. agencies whose technological programs involve international cooperation;

—Generally coordinating international contacts on technological matters and programs of U.S. mission agencies; and

—Assessing and supporting appropriations for U.S. agencies whose technical programs are supportive of U.S. diplomatic objectives, and for programs of international technical agencies supportive of U.S. diplomatic objectives.

MANAGEMENT AND DISSEMINATION OF TECHNICAL INFORMATION

In this category are activities that serve generally to facilitate the flow of technical information to users in the United States. They include:

—Facilitating the development of international exchanges of scientific information;

—Directing the flow of technical information transmitted from U.S. embassies;

—Assuring that information accumulated by U.S. scientists abroad flows widely to the U.S. science community; and

—Improving the efficiency of use of scientific information from translated books and reports, especially from the "difficult" languages (e.g., Chinese, Japanese, Hungarian).

FACILITATING THE WORK OF SCIENTISTS

In this category are included actions to help scientists from the United States make contact with appropriate foreign scientists, and easing travel problems. They include:

—Assisting U.S. scientists in international matters of scientific organization, conferences, and the like;

—Coordinating the policy aspects of the basic scientific contacts of other U.S. agencies abroad; and

—Facilitating the international exchange of scientific personnel and monitoring it to anticipate and alleviate such problems as "brain drain."

INCREASING "TECHNICAL LITERACY" IN THE DEPARTMENT OF STATE

In this category are included actions to provide informational material to increase the visibility to State Department officials and others of technical interactions with diplomacy. They include:

—Preparing and updating educational materials needed in training and retraining Foreign Service officers, the U.S. scientific and technological communities, and others whose work involves the interactions of science and technology with diplomacy;

—Promoting technical sensitivity and perception in the Foreign Service; and

—Acquainting the U.S. public with the importance of technical matters for U.S. national and diplomatic objectives.

ADMINISTRATIVE CHORES

In this category are included various detailed activities of a non-policy nature. They include:

—Recruiting, training, and retraining personnel for service as science officers or technology officers in U.S. embassies;

—Providing close support for U.S. science officers in U.S. embassies;

—Maintaining facilitative contacts with science officers of foreign governments in Washington; and

—Assuring adequate U.S. participation in United Nations and regional international organizational affairs;

It would not be easy to identify which of these jobs could most readily be dispensed with, but there seem to be quite a number of them. They evolved as the office grew over the years, and certainly they are not all of equal importance. The problem of allocating resources among them is rendered the more difficult because in general the urgent tasks received priority attention while the longer range policy-oriented studies were performed on an "as time permits" basis. It is possible that a sharper focus of the effort in the future might enhance the net utility of the office with only minor cost in services.

The growth of the staff of the State science office is indicated by the growth in its appropriations: from $558,430 in 1965 to $933,782 in 1970, to an estimated $2,439,400 in 1975 (all fiscal years).[74] By February 5, 1975, the Washington staff numbered 98, as compared with about 40-odd in 1965. The question is worth exploring as to how many people are needed to manage the science and technology aspects of U.S. foreign policy in the Department of State. If the Bureau is expected to continue to conduct both policy analyses and international operations it would appear to be seriously undermanned, in view of the expanding requirements on it. If it can divest itself of operational responsibilities, these would need to be provided for somewhere else, but the Bureau could manage without expansion, or even contract somewhat if (a) heavy emphasis was placed on high quality professional personnel, and (b) great restraint was exercised in the selection of issues for analysis.

Organization of the Bureau of Oceans and International Environmental and Scientific Affairs

A new page in the story of science in the State Department was written by the Congress in 1973. Two legislative proposals had been introduced in the first session of the 93d Congress, one by Senator Claiborne Pell to create a "Bureau of Oceans" and another by Senator Howard Baker to create a "Bureau of International Environmental Matters." During hearings in the Foreign Relations Committee on H.R. 7645, Department of State Appropriations Act of 1973, it was agreed that both measures should be combined into a general action: to create within the Department a "Bureau of Oceans and International Environmental and Scientific Affairs" (OES), headed by an Assistant Secretary responsible for "matters relating to oceans, environmental, scientific, fisheries, wildlife, and conservation affairs."[75] The new bureau, it was understood, would incorporate the functions of SCI.

A State Department directive circular dated October 8, 1974, announced that the change specified in the 1973 law would become effective October 14, and that the scope of the new bureau would include matters relating to international scientific, technological, environmental, weather, oceans, atmosphere, fisheries, wildlife, conservation, health, population, and related subjects. In addition, the scope of its "technological matters" was to include "atomic energy and energy related research and development, space technology, and other advanced technological developments, except those which are primarily defense related." All personnel and functions of SCI, and the other two offices,[76] were transferred to the new Bureau.

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[74] For 1965 figure see U.S. Congress, House, Committee on Appropriations, *Departments of State, Justice, Commerce, the Judiciary, and Related Agencies, Appropriations for 1967*. Hearings, 89th Cong., 2d sess., 1966, p. 41.

For 1970 figure see U.S. Congress, House, Committee on Appropriations. *Departments of State, Justice, Commerce, the Judiciary, and Related Agencies, Appropriations for 1972*. Hearings, 92d Cong., 1st sess., 1971, p. 42.

For 1975 figure see U.S. Congress, Senate, Committee on Appropriations, *State, Justice, Commerce, the Judiciary, and Related Agencies Appropriations, Fiscal Year 1975, part 2*. Hearings, 93d Cong., 2d sess., 1974, p. 1486.

[75] U.S. Congress, House, *Conference Report*, Report no. 93-367, July 10, 1973, text appears p. 3, and explanation p. 13. The Act was approved as Public Law 93-126, October 18, 1973.

[76] These were the Office of the Special Assistant to the Secretary for Fisheries and Wildlife and Coordinator of Ocean Affairs (S/FW-COA) and the Office of the Special Assistant to the Secretary for Population Matters (S/PM).

The circular defined six functions for the new Bureau (paraphrase):

(a) "Primary responsibility for the development of comprehensive and coherent U.S. policies in the areas where it has been assigned functional responsibility and for advising the Secretary on the functional and technical considerations arising in its areas of responsibility as they relate to the formulation and implementation of foreign policy;"

(b) Analysis and evaluation of relevant policies and programs of international agencies and bilateral activities to assure their compatibility with U.S. objectives;

(c) Liaison with other U.S. agencies and the private sector on relevant matters to provide policy guidance; advice and support as appropriate on these matters to other personnel of the Department;

(d) Recruitment assistance for the Department and for attendance at relevant international meetings;

(e) "Represents the Department, with the assistance of other concerned bureaus and offices, in international negotiations and on interagency policy groups and committees concerned with subject matter for which it has primary responsibility. Develops U.S. substantive positions and strategy in dealing with these matters when considered within international organizations and bilateral programs;" and

(f) "Heads or participates, as appropriate, on U.S. delegations to international conferences and negotiations concerned with subject matter within the bureau's area of responsibility."

Prospects and Plans for the New Bureau

Chosen to serve as the first head of the newly created Bureau was Dr. Dixy Lee Ray, former Chairman of the U.S. Atomic Energy Commission. Dr. Ray upon confirmation, took office as Assistant Secretary for Oceans and International Environmental and Scientific Affairs January 30, 1975. Her appointment was greeted by *Science* magazine as a challenge to her "bureaucratic skills" as well as a test of the interest of the Secretary of State and his senior associates in "upgrading science in the State Department and . . . making it an effective ingredient in foreign relations." [77]

There were obvious questions as to the extent of support that the new bureau would receive from the Secretary of State, the relationships to be established with other bureaus of the Department, and the rapport with the National Science Foundation, its National and International Division, and the new Science and Technology Policy Office, among other interested agencies.

Internally, the new Assistant Secretary would also have the opportunity to chart a number of new courses. For example, how would she respond to the Inspector General's report and recommendations (described below)? More specifically, what trends and directions would she chart for the expanded Bureau with respect to:

Operations versus staff policy analysis?

Science versus technology?

[77] Robert Gillette, "Ray's Shift to State Department Will Test Kissinger's Interest in Science," *Science*, November 15, 1974, pp. 612-613.

Concentration of attention to science and technology matters in OES versus diffusion throughout the Department of State?

Emphasis on recruiting specialists or training generalists? (Relations with the Foreign Service Institute?)

The building of an OES data base and research capability or encouragement of the Bureau of Intelligence and Research to do so, with imputs from the science attachés?

The development of in-house policy analysis capability, or reliance on advisory committee and contract studies, or both?

Encouragement of bilateral or multilateral science and technology relations, or both, or neither?

Policy regarding use and development of the attaché system—fewer and larger teams or wider coverage? What services to be expected from them? What arrangements to enhance the use of their product in the U.S.?

The allocation of emphasis as between the established functions of SCI and the mission functions of oceans, environment, and population matters stressed by Members of the Senate?

As this study was being written, Dr. Ray was too recently in the post to have determined what shape her organization would eventually take, or what program priorities would be adopted. It is probable that her initial concern would be to meld the added new elements into the core group represented by the former SCI.

By early April, conversations with staff members of OES gave an indication that consideration was being given to establishment of some kind of a small reserved staff or longer range policy analysis within the Bureau. It would be interesting to see whether the thinking in OES is that such an activity might serve to answer the kind of criticism expressed in a 1972 analysis by Howard Margolis of the Institute for Defense Analyses. He observed that "there seems to be no one dealing with *policy* in the department whose standing depends substantially on his ability to make and provide his principal with a line of argument to effectively defend judgments on the relationship of technical considerations to larger political issues." Parenthetically he noted that "the most likely exception" was the "Science Bureau" but that it did not have access at that time to "high policy areas to which technical arguments are likely to be relevant. . . ." So he concluded:

> Consequently there is, I believe, no one at State who has the combination of access to high policy levels, interest in policy questions, and a particular stake and interest in how technical arguments bear on such questions. But it is only that sort of person who is likely to be in the position of credibly telling senior State officials when and why the technical assessments they take for granted may be unsound, or when and why the assessments they are inclined to dismiss as inconsequential really are important.
>
> This has, I think, the effect of weakening State's capacity as an organization to adequately assess some policy issues, and it weakens State's ability to play a leading role in advocating its view on any policy issue on which other agencies can bring technical arguments to bear.[78]

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[78] Howard Margolis, *Notes on Technical Advice and Political Issues*, Paper P-841, International and Social Studies Division, Institute for Defense Analyses, April 1972, p. 63.

See the accompanying tentative organization chart (figure 1, p. 49) for a description of the way in which it was proposed—as of May 21, 1975—that the elements of OES were to be assembled.

The Inspector General's Assessment of SCI

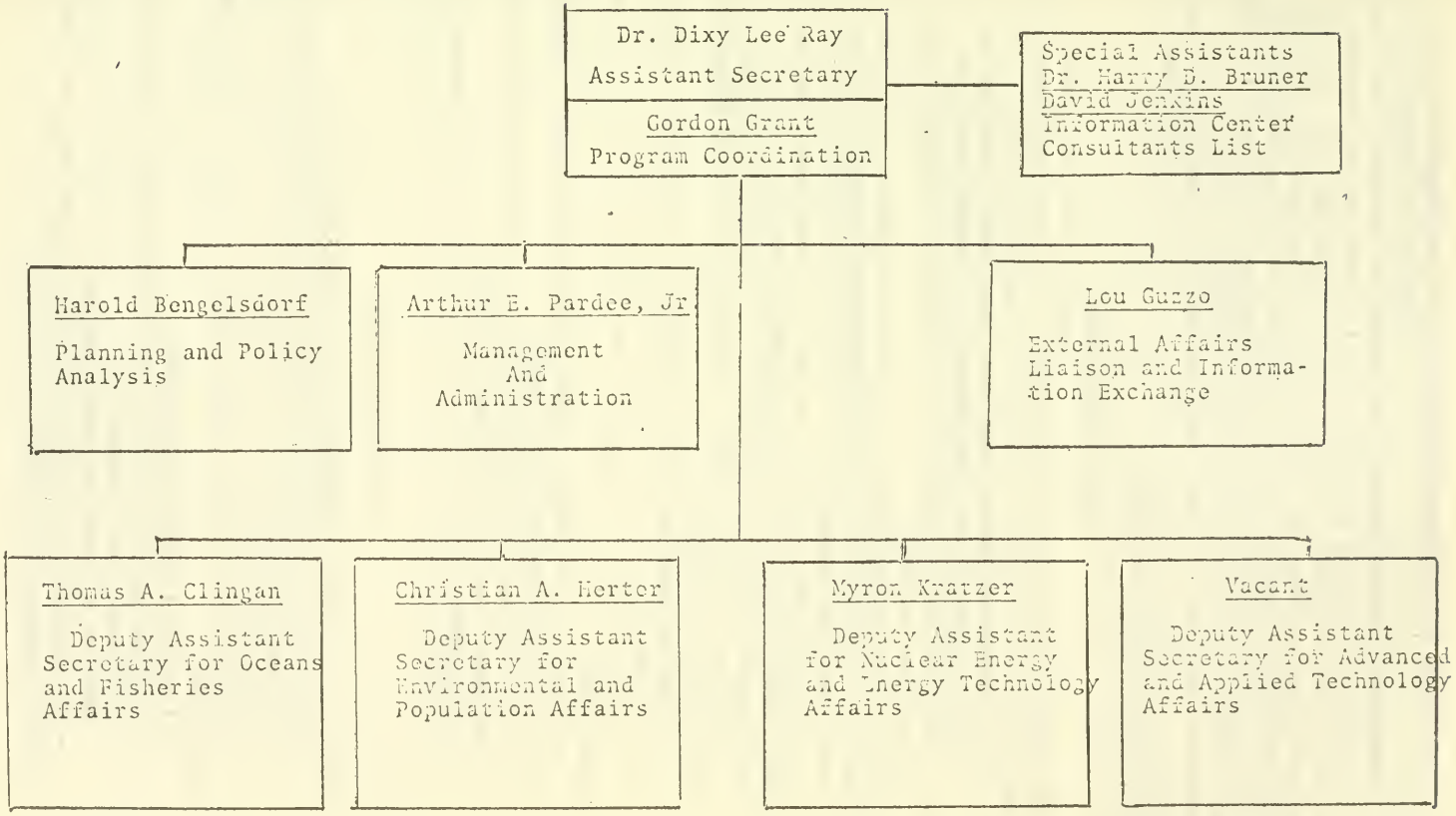
At about the time the Congress was deliberating the question of reorganizing SCI, the Office of the Inspector General of the Department of State was completing a study in depth of the State Department's science office. The study culminated in an internal inspection report, "Science, Technology, and the Environment in the Conduct of Foreign Relations," in September 1973. The substance of the report was in four categories: (1) importance of the function for the mission of the Department, (2) weaknesses in the present system, (3) strengths of the present system, and (4) recommendations for improvements.

IMPORTANCE OF THE FUNCTION

The report identified five reasons why the Department ought to involve itself in science and technology:

1. International science and technology was a vehicle of cooperation to enhance U.S. foreign relations.
2. With respect to both economic health and military security, science and technology were yielding developments that were significantly altering U.S. bilateral and multilateral relations.
3. Legal obligations required the Department to deal in technical subjects.
4. The foreign technical activities of other U.S. agencies affected the Nation's relations abroad.
5. The Department was called on to assist U.S. technical agencies with overseas support, guidance, and cooperation.

FIGURE 1.—BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL AND SCIENTIFIC AFFAIRS ORGANIZATIONAL CHART



OES/EX 5-21-75 (Proposed)

It concluded that science and technology were inherently international in scope and impact, that they would grow in importance for diplomacy, and that programs of the Department in these areas needed to be executed vigorously and effectively. It also noted that dissolution of the President's Office of Science and Technology was generally recognized as imposing an added burden of responsibility on SCI. The four goals suggested by Mr. Pollack in his recent testimony before the Senate Foreign Relations Committee (see p. 41) were noted with approval. Clearly the Department of State needed a vigorous focal point for science and technology, especially for interagency cooperation, policy development, and interpretation of technological issues and options.

WEAKNESSES OF SCI

The IG report identified weaknesses to be corrected, as well as strengths to be commended. Among the former were:

—Too remote relations with client activities in the Department;

—The need for more in-depth analyses of policy issues;

—A lack of continuity ("short institutional memory") because of personnel mobility;

—Poor communication with the private sector on matters of mutual interest (incomplete, untimely, frustrating, poor channels, key policy lacking);

—More bilateral and other tasks were started than could be managed; some were kept alive to avoid termination repercussions;

—SCI was weak in staffing—personnel review and long-range planning were needed;

—Problem areas were well identified but priorities of effort were neglected;

—Liaison with other agencies on foreign technical matters was weak;

—The series of departmental science lectures had been excellent but there had been too few of them;

—Attachés needed more guidance on top priority problems and departmental needs for information; and

—There was evidence of a lack of confidence in SCI elsewhere in the Department.

STRENGTHS OF SCI

Among the favorable comments offered in the report were:

—The shift in emphasis of attachés from science to technology;

—Management of U.S. participation in the Stockholm environmental conference;

Development of the U.S.-U.S.S.R. science cooperation secretariat;

—A study of technology transfer;

—Negotiation of the Great Lakes water quality agreements;

—Service of atomic agreements;

—Work in weather modification policy.

—On meeting the obligations of law and follow-up on Presidential statements SCI rated a "very good";

—In identifying future technical issues for the Secretary, SCI was "excellent"; and

—Definition of authority and responsibility were adequate.

RECOMMENDATIONS OF THE REPORT

In conclusion, the report proposed a number of ways in which SCI service to the Department could be improved. For example:

—Increased consultation with policy-oriented departmental clients to ascertain their needs more precisely and to meet them more fully;

—The use of former science attachés in other bureaus, and designation of science officers elsewhere in the Department; also, designation of geographical officers in SCI as point of contact for other bureaus;

—Collation of U.S. policy in science and technology with that in key countries;

—Select a small number of priority analyses in depth (one or two a year for two future years) and carry them out fully;

—Perform an annual review with departmental clients served by SCI;

—Make more systematic use of the departmental Science and Technology Advisory Committee to perform policy studies, identify program gaps, and serve as an information and recruitment channel; and

—In general, to emphasize more strongly the policy analysis function, and reduce the allocation of effort to operational tasks.

V. Scientific Diplomacy

The rise of the United States to military, technological, and diplomatic preeminence may have diminished somewhat the apparent need for U.S. scientists to be posted around the world to secure knowledge, establish contacts, and promote the flow of "brains" to this country. It is possible that the move to establish systematic scientific representation in U.S. embassies abroad came too late to be fully useful. However, this section of the study, recounting the erratic history of the use of U.S. scientific attachés, suggests that with certain modifications in emphasis these officials can be much more important in the future than they have been permitted to be in the past.

Early Stirrings: Ad Hoc Scientific Attaché

As near as can be determined, the first person to serve in a U.S. embassy and be called "scientific attaché" was Charles Wardell Stiles (1867–1941).[79] He served in the Embassy in Berlin 1898–1899 as a zoologist "especially accustomed to the use of the Microscope." His mission was to ease German restrictions on the importation of pork products from the United States. The problem was trichinosis. The United States had instituted microscopic inspection of pork products for export but local governmental levels in Germany were insisting on reinspection and obstructing sales of U.S. pork in a lucrative market. Accordingly Ambassador Andrew D. White wrote to Secretary of State John Sherman asking for "one or more experts fit to deal with the whole subject . . .," and the Department of Agriculture, in turn, was approached to provide the required expertise. "The State Department [then] commissioned Stiles as Agricultural and Scientific Attaché to the United States Embassy in Berlin." Stiles had excellent qualifications for the assignment. He had connections with a number of European scientific societies, had been U.S. delegate to the International Zoological Congress, and was secretary of the International Commission on Zoological Nomenclature. In the Department of Agriculture, after taking his doctorate at Leipzig, he had specialized in helminthology and thus spoke with authority on the subject of animal parasites.

At the Embassy he was referred to as "our scientific attaché." His work "involved more areas of science than those ordinarily associated with agriculture." Thus, in the judgment of this source, "White had good reason to use the term scientific attaché." Even so, it represented "something of an innovation in America's handling of its international scientific affairs."

As part of the growing maturity of United States society and the increasing vigor of its intellectual institutions, American science was rapidly expanding in size and complexity in the post-Civil War decades. Up to this point diplomatic activities which were scientific in nature had usually been taken care of by the ministers or consuls themselves, with occasional matters handled directly by

[79] The source for this account of early scientific diplomacy is James H. Cassedy, "Applied Microscopy and American Pork Diplomacy: Charles Wardell Stiles in Germany 1898–1899," *Isis* 62, No. 211, Part I (Spring 1971), pp. 5–20.

Washington or by designated scientific organizations or individuals. However, until late in the nineteenth century, the American government had but few substantial scientific problems or formal continuing scientific relationships with other countries. The main official science activities were those occasioned by participation in the work of *ad hoc* international commissions or by the need to have delegates at international congresses.

The lack of international scientific involvement was fortunate, for chiefs of mission who had scientific backgrounds or interests were few. Before 1800, it is true, the American diplomatic corps had included several representatives—Benjamin Franklin, Thomas Jefferson, Dr. Arthur Lee, John Quincy Adams, and Dr. Edward Stevens—who had medical competence or general interest in science. During the nineteenth century, the pioneer ecologist and etymologist George P. Marsh served some twenty-five years prior to 1881 as envoy to Turkey and Italy, while the chemist Henri Enri was United States consul in Basle during Grant's presidency, and the physician Nathaniel Niles served in various European posts from 1830 to 1850. But such men were exceptions. American diplomats then were drawn conspicuously from the ranks of poets, lawyers, educators, and historians. Andrew D. White was himself an historian and educator, but he also had a strong appreciation of the scientific ideas and forces of his time. Now, as ambassador, he acted as something of a midwife in assisting one phase of America's emerging scientific internationalism.[80]

Toward the conclusion of Stiles' mission, Ambassador White wrote Secretary of State John Hay that "Stiles is exceedingly valuable to us." It was "absolutely necessary" that he stay on to help look out for American interests.

One consequence of Stiles' scientific work in Germany was that officials of the Department of Agriculture came to realize that "having an 'agricultural attaché' was highly useful to the Department." And, according to this source ". . . The success of Stiles' assignment ultimately led the department to designate attachés to other countries and, in the 1930s, to operate its own Foreign Agricultural Service." By 1975 there were 58 agricultural attachés serving in U.S. embassies and a total of about 112 professional staff in the Foreign Agricultural Service of the Department of Agriculture.

Nongovernmental Scientific Attachés in World War I [81]

The necessity for close technical cooperation among allies in wartime led in both World Wars I and II to the establishment of U.S. scientific/technological missions to European countries. During the first World War, U.S. participation lasted only from April 1917 to November 1918. Nevertheless, three scientific missions were established—in London, Paris, and Rome. Almost entirely military in function and scope, the program was viewed at the time of its termination as something of continuing value. "The War," said the (unpublished) Final Report of the Research Information Service (p. 37), "has demonstrated the importance of science and of scientific research to the national [security] and therefore the importance of keeping in touch with scientific and technical developments in other countries and of promoting cooperation as well as of avoiding duplication of effort." The report continued: "Surely no more effective way of fulfilling this purpose can be devised than the appointment of scientific

[80] Ibid., p. 11. Other examples of scientific diplomats, as cited in *The Science Adviser of the Department of State* (op. cit., p. 4), were Joel R. Poinsett, the first American Minister to Mexico, interested in military science and archeology, as well as the "naturalist who introduced the poinsettia from Mexico" and Ephraim George Squier, who also saw diplomatic service in Latin America, and was a distinguished archeologist. More recent examples were: Dr. James B. Conant, scientist and educator and former U.S. Ambassador to Germany, and Carl W. Strom, former professor of mathematics who served, as of 1960, as Ambassador to Bolivia.

[81] This section is based on information from unpublished correspondence and manuscripts in the Archives of the National Academy of Sciences, particularly a final report, *Research Information Service, Foreign Service, 1918–1919,*" and an interview with the late Warren Jay Vinton, a junior member of the science team in Paris, on his personal recollections of this activity.

attachés at our principal embassies to continue and extend the work carried on for 17 months by the Research Information Service."

The report then quoted a recommendation by the "International Research Council," of delegates from national academies of the Allied Powers, at its first meeting in Paris (no date), as follows:

> The International Research Council, assembled in Paris and attended by delegates of the national academies of sciences of Belgium, Brazil, the United States, France, Great Britain, Italy, Japan, Poland, Portugal, Rumania, and Serbia, has the honor to request the Governments of these countries to appoint permanent scientific attachés to their principal embassies. The function of the scientific attachés shall be to collect and forward information regarding scientific and technical matters, and to insure the continuity of the relations established during the war by the various scientific and technical missions.

Other benefits of the scientific attaché concept suggested in the report were: representation of U.S. scientific and technical interests, attending scientific meetings, keeping in touch with the progress of research, providing a base for U.S. scientists abroad, responding to substantial inquiries, and promoting international cooperation in research.

EARLY ORIGINS OF WORLD WAR I SCIENTIFIC ATTACHÉ PROGRAM

Immediately after U.S. entry into the war, an "American Committee dealing with Inventions" wrote the British Comptroller of Munitions Inventions, offering support. A reply to this communication was drafted by the Comptroller, May 15, 1917.[82] The following day Dr. R. T. Glazebrook, to whom the Comptroller's letter was addressed, passed it on to Sir Ernest Rutherford, asking him to take it with him to America. Apparently this exchange stimulated thought on both sides of the Atlantic as to the value of closer cooperation in technology to advance the war effort.

The next item of correspondence was a letter from the British War Mission in Washington to the Research Council of the Council of National Defense, October 22, 1917, suggesting that "about 20 scientific men from American universities" be sent to England to work in defense research laboratories. After a good deal of milling around, the various boards, committees, and military liaison groups—formal and informal—appear to have given the British proposal their blessing and the last item in the sequence is an announcement by the National Research Council (NRC), March 15, 1918, formally establishing the Research Information Committee, with a Washington headquarters office and branch offices in London and Paris (Rome was added later). There would be a Scientific Attaché in each of the foreign offices, along with a military and naval attaché or deputy. It was clear that the functions of these foreign units were closely war-related and operational. They were:

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[82] All we know of this gentleman is that his signature is undecipherable. However, the list of inventions he asked the Americans to provide was impressive:

(1) A pipe-pushing device which will ensure the maintenance of the required direction.
(2) A substitute for lead antimony alloy for shrapnel bullets, the alloy consisting of 7 parts of lead and 1 of antimony and the number of bullets being 41 to the lb.
(3) A means of dissipating gas clouds.
(4) Predicting apparatus for A.A. gunnery.
(5) Means for removing wire entanglements otherwise than by firing at them.
(6) A short-base height-finder for anti-aircraft use.
(7) Trench signalling apparatus for signalling back to the trenches from an advanced position.
(8) Message carrying rockets.
(9) Trench signalling apparatus for the transmission of messages which cannot be tapped.
(10) Apparatus for detecting the approach of aircraft by sound.
(11) Apparatus for the acoustic detection of hostile mining activities.
(12) Armour-piercing bullet for use against tanks.

(a) The development of contact with all important research laboratories or agencies, governmental or private; the compilation of problems and subjects under investigation; and the collection and compilation of the results attained.

(b) The classification, organization, and preparation of such information for transmission to the Research Information Committee in Washington.

(c) The maintenance of continuous contact with work of the offices of Military and Naval Attachés in order that all duplication of work or crossing of effort may be avoided, with the consequent waste of time and energy and the confusion resulting from crossed or duplicated effort.

(d) To serve as an immediate auxiliary to the offices of the Military and Naval Attachés in the collection, analysis, and compilation of scientific, technical, and industrial research information.

(e) To serve as an agency at the immediate service of the Commander in Chief of the Military or Naval Forces in Europe for the collection and analysis of scientific and technical research information, and as an auxiliary to such direct military and naval agencies as may be in use for the purpose.

(f) To serve as centers of distribution to the American expeditionary forces in France and to the American naval force in European waters of scientific and technical research information, originating in the United States and transmitted through the Research Information Committee in Washington.

(g) To serve as centers of distribution to our Allies in Europe of scientific, technical, and industrial research information originating in the United States and transmitted through the Research Information Committee in Washington.

(h) The maintenance of the necessary contact between the offices in Paris and London in order that provision may be made for the direct and prompt interchange of important scientific and technical information.

(i) To aid research workers, or collectors of scientific, technical, and industrial information from the United States, when properly accredited from the Research Information Committee in Washington, in best achieving their several and particular purposes.

OVERSEAS OPERATIONS

Before the final action of the NRC, its Military Committee had created a Research Information Committee, December 3, 1917, and given it marching orders; these were referred by NRC to the (official governmental) Council of National Defense, which approved the project December 12, appropriated $38,000 for the first year of operation and appointed Dr. H. A. Bumstead and W. F. Durand to London and Paris respectively as "Scientific Attachés." [83]

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[83] It is not clear what, if any, role the Department of State had in all this. It was Mr. Vinton's recollection that attaché commissions from the Department were given to principals and lesser ranks to the supporting staffs. However, his own claim for pension rights for service during this period were—he said—disallowed by the Civil Service Commission. The State Department has no record of attaché commissions for members of the Research Information Committee serving overseas. However, a typewritten note, unsigned and undated, attached to the Academy copy of the *Final Report of the Research Information Service* carried the notation that Professor George Ellery Hale had "pushed very hard to get the title 'Scientific Attaché' for the men, hoping to acquire for them and science the same status as military attachés." It added that he had been gratified by his success in doing so. (However, the unknown author admitted that "I cannot, at the moment, locate any supporting documents. . . .")

Apparently the scientific attachés had close personal relations [84] with the military services throughout. They were provided with military quarters, transportation, furniture, and facilities. The total budget for the three offices plus the Washington headquarters, from February 1, 1918 to June 30, 1919 was "about $60,000." [85] Clearly the costs were nominal, and it is to be inferred that the attachés paid part of their costs out of their own resources plus a good deal of scrounging.

The primary function of the scientific attachés was to collect or produce scientific reports for use in the United States. They sent home 1,650 such reports, mainly on aircraft and submarine matters (plus 86 on metallurgy, 19 on radio, 33 on gas engines, 30 medical, and 29 on photography). They also transmitted to the host countries upwards of 800 reports generated in the United States. Requests for information went in both directions by letter and cable (200 from London, 140 to London).

The report of the Research Information Service attached particular importance to the assistance of the scientific attachés in organizing the International Research Council and the Scientific Unions, and most of all to "the promotion of cooperation, mutual confidence, and good will among the Allies."

In summary, it can be concluded that the World War I system of scientific attachés was ad hoc, entirely operational,[86] and with a great deal of cornercutting. There was a war on. However: "On June 30, 1919, the government funds which had supported the Service, lapsed and the Service had to be discontinued. Arrangements were made at the various offices for attending to unfinished business; then the files were stored and the offices closed, it is hoped merely temporarily."

THE YEARS 1919–1939

Considerable private activity in the interaction of the world scientific community occurred in the interval between 1919 and 1939: the growth of the international scientific unions, exchanges of academic

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[84] According to the final report:

> The fact that Admiral Sims was an old friend of Dr. Durand's, a former classmate at the Naval Academy, and shipmate on the first cruise after graduation, led him to take the warmest interest in the Information Service and in the purposes for which it was established. He at once arranged to give Dr. Bumstead an office in his headquarters in London and to provide for the Paris office in a similar manner. By his kindness, Dr. Bumstead was thus settled in a comfortable office with all necessary furniture and facilities, only 2 days after his arrival in London, and was enabled to begin work promptly and without friction. Without this help the difficulty of securing a suitable office and furniture would have caused great delay and involved much waste of effort.

[85] It is amusing to note that in both 1918 and 1919 all field offices underspent their appropriations while in both years the Washington office went over its budget slightly.

[86] In the final report, the functions of the three foreign offices are described in more explicit and straightforward terms than in the original NRC charter. There were eight of these, as follows:

(1) *To establish and maintain effective contact* with as many research laboratories and organizations as possible.

(2) *To collect or compile and transmit promptly reports* of the work of these laboratories and organizations, especially those regarding methods and devices under development, whether promising or not.

(3) *To distribute each report* received from overseas to those individuals and organizations who should receive the information it contains.

(4) *To transmit requests* for special information and *to secure special information* requested from overseas.

(5) *To cooperate* with any existing agencies for collecting information in such a way as to *prevent duplication*.

(6) *To facilitate the work of special investigators* by furnishing them with available information, and by guiding them to the proper sources and by supplying introductions.

(7) *To maintain a file of the reports collected and an index* to make the information contained readily available.

(8) *To cover matters no one else was looking after*, act as financial agent and otherwise be as useful as possible.

personnel, and the emergence of multinational corporations and foreign affiliates serving their various purposes in the exchange of scientific information and transfer of technology. With the outbreak of World War II, and even before, the influx of refugee scientists to the United States provided abundant if unsystematic information about the status of research and development abroad. There did not occur, however, any strong movement toward establishment of the kind of system of scientific attachés envisioned in the National Research Council report following World War I.

Developments After World War II

Creation of a system of science officers abroad was proposed in the report *Science, The Endless Frontier*, prepared at the request of President Franklin Roosevelt by a team of scientists in the Office of Scientific Research and Development, and submitted in 1945 to President Truman. It suggested that, as an experiment, scientific attachés be assigned to serve at selected U.S. Embassies.[87] The first experiment of this kind was undertaken 2 years later at the U.S. Embassy in London, where Dr. Earl A. Evans, Jr. assumed charge of a science office in 1947.[88] During this same year, a report (*Science and Public Policy*) by the President's Scientific Research Board, chaired by Dr. John R. Steelman, recommended that "appropriate development of . . . scientific foreign service be considered an essential part of the national science program." [89]

An explicit statement calling for establishment of this kind of system had been made in one of Evans' reports from London in 1948. Specifically, he had recommended:

> The experiment that has been started in Great Britain should obviously be extended to other European countries. It would be unnecessary, however, to set up scientific offices in every one of the European countries. It would be more economical and convenient if officers were assigned from London to a number of other European areas: one man assigned to the Scandinavian countries, a second to Paris, Italy and Germany, and a third to Switzerland would, at present, give an adequate survey of the scientific and technological activities in these areas. In each instance an officer would have assigned to him, for the necessary period, specialists in any particular scientific area that was of especial or immediate significance.[90]

The Berkner Report (see pp. 17–22) gave considerable attention to the role of scientific attachés in U.S. Embassies as the principal means of effecting the collection and exchange of scientific information that was the primary preoccupation of the report. It called for a mixed strategy of large, regional science offices, at principal embassies, individual science attachés with small staffs at other embassies, and scientifically literate individuals (with science doctorates) to serve as points of contact in a third set of embassies of smaller countries. The implementation of the Berkner plan in 1951 began with the appointment of Dr. Joseph B. Koepfli, who had served in London under Evans, to head up the home office in the Department of State. He

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[87] U.S. Office of Scientific Research and Development, "Report of the Committee on Science and the Public Welfare," appendix 3 to *Science: The Endless Frontier*, a report to the President on a program for postwar scientific research, by Vannevar Bush, Director of the Office of Scientific Research and Development (Washington, D.C.: U.S Government Printing Office, July 1945), p. 108.

[88] See pp. 13–17 for an account of the evolution of the experimental London office and preceding activity under the direction of John C. Green of the Department of Commerce.

[89] U.S. President's Scientific Research Board, "A Program for the Nation," Vol. 1 of *Science and Public Policy*, a report to the President by John R. Steelman, Chairman (Washington, D.C.: U.S. Government Printing Office, August 1947), p. 40.

[90] Earl A. Evans, Jr., *First Annual Report of the Chief of the Scientific Section*, Embassy of the United States of America, London, England (1948), transmittal memo no. 2220, p. 5.

established a number of science missions (London, Paris, Stockholm, Tokyo), and from 1951 until this initial program was suspended at the end of 1955, more than 14 U.S. scientists served abroad for periods averaging 15 months.

Post-Sputnik Scientific Attaché Expansion

When the Department of State reactivated its science program under the leadership of Dr. Wallace R. Brode, in January 1958, it was made clear that the Department proposed to reactivate its system of foreign science missions as well; an intensive effort was begun to recruit for this purpose and "In December the Department's overseas Science Office Program was firmly reestablished with the appointment of seven distinguished American scientists to serve as scientific attachés at U.S. Embassies in Europe and the Far East. An additional group of seven scientists was appointed in February 1960, and the area coverage was extended to South Asia and Latin America." [91]

By the time Dr. Brode had completed his tour of duty 14 scientists were accredited "attachés" in 9 (of 10 authorized) embassies in Europe, Asia, and Latin America. They represented the fields of physical science (physics, chemistry), life and biological science (zoology, bacteriology, biophysics, genetics), earth science (geophysics, oceanography), and technology (engineering, electronics). Some of them operated out of one embassy to cover activities in several adjacent countries as regional attachés.

By this time also (1960), it was clear that the collecting of foreign scientific information was no longer the sole function of the scientific attaché as it had been in 1917–1919, nor even the primary function, as in 1950. The State Department [92] now saw the functions of the attaché about as follows:

—Advise and assist ambassador and other embassy officials on scientific developments and matters in which his expertise can be usefully applied;

—Evaluate the influence of various basic and applied scientific developments on U.S. policy;

—Report on major developments in organization and changes in leadership in the science community;

—Facilitate the flow of information and persons in scientific fields;

—Represent the U.S. science community to the counterpart groups and institutions in the country to which he is assigned (speak at or attend conferences and academic gatherings); and

—Assist U.S. agencies with overseas science interests.

By 1960, the Department was considering "a new procedure designed to provide certain scientific reporting services at posts which do not require the assignment of a full-fledged scientific attaché." This plan "would be achieved by building up within the regular Foreign Service a corps of officers who have had an educational background or experience in various fields of science which would equip them to report on scientific developments abroad as they relate

[91] *The Science Adviser of the Department of State*, op. cit., pp. 19–22.
[92] *The Science Adviser of the Department of State*, op. cit., pp. 17–23.

to U.S. policy." [93] However, the Department publication added: ". . . The major work of that program will continue, necessarily, to be borne by highly qualified professional scientists such as those who have been recruited in the past."

THE QUESTION OF LENGTH OF TENURE OF THE SCIENTIFIC ATTACHÉ

Throughout most of the history of scientific attachés from 1898 on, the concept was that very senior scientists would be borrowed for diplomatic service for periods of ("not to exceed") 2 years. They would then be restored to their laboratories. It was held that only scientists with outstanding professional reputations could properly represent the United States to the foreign science community, and play a proper diplomatic role. It was also discovered that most of these "highly qualified scientists" were reluctant to leave the scientific for the diplomatic environment for extended periods because in doing so they would forfeit their close knowledge of research at home. Even less desirable was the prospect of relinquishing permanently a scientific career for one as a diplomat. Yet, as the Department had discovered in 1948–49, and again in 1951–56, was to discover still again in the decade of the 1960s, recruitment of linguistically competent, senior scientists in mid-career for 2-year tours of duty abroad was a particularly difficult administrative burden.[94]

A recognition of the problems on the other side of the question was expressed in an editorial comment by editor Dael Wolfle, in *Science*, in 1960. He pointed out that "In the 18 months since the first attachés reached their posts, much of their time has gone into learning how to work most usefully." The longer they stayed, apparently, the greater the sense of accomplishment. Accordingly, Wolfle suggested the need to "work out long-term staffing policies."

> . . . The well-selected amateurs in diplomacy we now use have dedication, knowledge of American scientific activities, and considerable acquaintance with the language, customs, and scientific activities of the countries in which they work. Ideally, they should also have a greater understanding of national policy and of Department of State procedures and problems.

By way of solution he suggested that it would be possible to "combine the advantages of an amateur with those of a professional . . . by making periodic foreign service a recognized part of the career pattern of appropriate scientists and science administrators. . . ." [95]

Other criticisms of the system were offered by Daniel S. Greenberg in 1962. He asserted that "if the State Department finds it difficult to adapt itself to scientists, the scientists, with few exceptions, find it even more difficult to adapt themselves to the State Department." To secure "widely recognized" scientists, which the prevailing concept required, the practice was to recruit scientists about to retire from their university connections. However, the language qualification narrowed the choice severely. According to Greenberg, in a statement describing an aspiration rather than a general level of achievement:

> The attaché is provided with a deputy (usually his junior by a generation) with training in a discipline different from his own. Attaché and deputy have then

[93] Ibid.

[94] In the earlier part of the attaché program an effort had been made to match the special expertise or discipline of the appointees to the country to which they were posted. However, this further exacting specification proved to be unrealistically hard to meet and was dropped.

[95] Dael Wolfle, "Science Ambassadors," *Science*, July 29, 1960, p. 267.

been dispatched to the embassy with virtually no instructions but to make themselves useful to the diplomatic mission and to report back to Washington whenever they come across something they consider worth reporting.

The results, said Greenberg, were "incredibly uneven." (He had visited attachés in Rome, Bonn, Stockholm, Paris, and London.) He cited one case of a man who did not know what he was supposed to do or whether he was giving satisfaction—a man who had previously taken no interest in politics or international affairs. At the other extreme, Edgar L. Piret, previously professor of chemical engineering at the University of Minnesota, had established close and useful relationship with Ambassador (formerly General) James M. Gavin in Paris. ("Within the State Department," said Greenberg, "Piret's reports on French science developments and their relation to American foreign policy are considered models of the peculiar art of scientific-diplomatic reporting.") [96]

Qualifications of Scientists as Diplomats

It would appear that in addition to the requirements for scientific preeminence and language proficiency the scientific attaché needed the personality to establish good working relations with senior people at the embassy where he served, an appreciation of what information would be useful to the Department, the ability to express himself effectively in his reports, and—perhaps most important of all—an encyclopedic knowledge of political and international developments relating to science and technology and vice versa. The difficulty in meeting all these requirements for short-term representatives abroad is evident.

Nevertheless, the program continued to grow. By June 1963 the Department was able to report:

> Five attachés—two physicists, a chemist, a biochemist, and a physiologist—were appointed in 1962. Two of them became our first scientific attachés at Karachi and Tel Aviv. In all, 15 scientific attachés are today serving at 12 U.S. missions overseas. By the summer of 1963, the State Department will have on assignment 22 attachés serving in 16 missions overseas. It is hoped that in 1964 an additional attaché will be added in Warsaw.[97]

Two years later, in 1965, there were 23 scientific attachés serving in 17 embassies and an additional number of Foreign Service officers "especially designated" to tend to scientific problems. [98] In 1969 these "especially designated" Foreign Service officers numbered 99, and supplemented the 17 scientific attachés. In 1972, there were 24 scientific attachés in 18 embassies plus one each at the OECD mission in Paris and the U.S. mission to UNESCO. In 1974 the number went to 25. However, it is understood that by 1975 the "especially designated" Foreign Service science officer plan had been largely abandoned.

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[96] Daniel S. Greenberg, "Science and Foreign Affairs: New Effort Under Way to Enlarge Role of Scientists in Policy Planning," *Science*, October 12, 1962, p. 123. Dr. Piret was elevated to the rank of "Counselor of Embassy for Scientific Affairs" November 8, 1967.

[97] U.S. Department of State, *International Scientific Affairs*, Department and Foreign Service Series, no. 117, Publication no. 7550, June 1963. (Reprint from 152 page report *Department of State 1963*.)

By contrast, the overseas staff of the Foreign Agricultural Service (which had been returned from State to the Department of Agriculture in 1954) numbered in 1962 80–85 officers, 30–40 locally recruited staff, and a total of 270 clerical and professional people abroad. "All told, the Service employed 693 Americans at home and abroad in June 1962, and 137 foreign nationals at overseas posts." Source: Robert E. Elder, *Overseas Representation and Services for Federal Domestic Agencies*, Foreign Affairs Personnel Study no. 2 (New York: Carnegie Endowment for International Peace, 1965), p. 14.

[98] William H. Taft III, "The United States Scientific Attaché Program," *Department of State Bulletin*, January 25, 1965, p. 113.

To build a strong overseas scientific staff to meet U.S. needs for policy inputs, scientific representation, and early warning of significant technological trends and important scientific discoveries is a challenging personnel problem. Traditionally the persons sought are recognized scientists with language proficiency. The language requirement narrows the field of choice, and may be less relevant for scientists in view of the fact that English is probably the closest to a universal language of scientists. The requirement for "recognized scientists" tends to limit the time span the recruit is prepared to devote away from his research, in order to perform in an environment that takes considerable time to master. In addition, the more eminent the scientist the more likely he is to have narrowed his field of specialization and thus the fewer people he can communicate with in his own field.

A study by the Maxwell Graduate School of Citizenship and Public Affairs, Syracuse University, in 1959, identified five key elements that determined which people were most likely to succeed in performing effectively overseas. These elements were:

1. Technical skill: The versatility and willingness to improvise that requires both a thorough knowledge of a specialized field, but the attitude toward it of a general practitioner rather than a narrow specialist.
2. Belief in mission: A dedication to his work regardless of geography that enables a man to survive repeated frustrations and still retain a zest for the job.
3. Cultural empathy: The curiosity to study and the skill to perceive the inner logic and coherence of the other fellow's way of thinking; and the restraint not to judge it as bad just because it is different from the American way.
4. A sense for politics: The sensitivity to see oneself as a "political man" whose action (or inaction) affects the power structure around him; the ability to do one's work despite being conspicuously the object of curiosity, envy, or opprobrium; and the understanding of American civilization that qualifies a man to represent not only himself, but the culture and society from which he comes.
5. Organization ability: A tolerance for large-scale organization and an understanding of complicated headquarters-field relationships; and a special talent for building social institutions and teaching others to manage them.[99]

On these five general requirements were superimposed a long list of other special requirements for scientific members of overseas staffs. Thus, a document prepared by SCI (in 1967?) defined the requirements of scientific attachés in the following way:

Candidates for the Scientific Attaché Program should be able scientists who have mature insights into and understanding of international relations. They should have broad and responsible experience which would enable them to: recognize the relationship of science and technology to political and economic developments both at home and abroad; and understand the role of science and technology in the decisionmaking process on matters of international political and economic consequence. Thus, not only is a high degree of technical sophistication required, but also a catholicity of interest and appreciation for the complexity of the issues which face the United States in its international relations.

Candidates should be scientists of recognized competence based on responsible levels of performance in the academic world, in industry or in government science. Prior foreign experience should include close and understanding associations with foreign scientists and institutions and with international scientific activities, as well as with the culture of the area to which they may be assigned.

The personality of the candidates should be such that it will not only elicit cooperation but will command the respect and attention of the non-scientists with whom they must deal and work in the accomplishing of their missions.

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[99] U.S. Congress, Senate, Committee on Foreign Relations, *The Operational Aspects of United States Foreign Policy*, a study prepared by Maxwell Graduate School of Citizenship and Public Affairs, Syracuse University, 86th Cong., 1st sess., November 11, 1959, pp. 58–59. (As quoted in Arthur G. Jones, *The Evolution of Personnel Systems for U.S. Foreign Affairs; A History of Reform Efforts*, Foreign Affairs Personnel Study no. 1 (New York: Carnegie Endowment for International Peace, 1965), pp. 127–128.

In those countries where ability in the language is essential to the effectiveness of the work of the Attaché, command of the language is a requirement.

Expanding Functions of Scientific Attachés

Beginning with the function of collecting scientific information, and expanding to an array of policy analysis and reporting functions, the system of scientific attachés continued to enlarge in scope. By 1967, SCI had identified eight major missions that the attaché was expected to execute. He was to have the requisite prestige to provide entree to governmental and scientific leaders. He was to establish a good working relationship with the Ambassador to facilitate the flow of acceptable support on substantive matters involving science and technology. Countries where attachés were deployed would be those in which developments in science and technology were germane to U.S. foreign policy, or those in which U.S. foreign policy called for assistance to the nation in developing a native capability in science and technology. Within this framework the attaché, would have "the following duties and responsibilities":

1. Participates in the development of policy by bringing to bear on the problems confronting the Mission to which he is assigned the perspective and insights of a scientist through evaluation and guidance on the scientific and technical aspects of such problems.
2. Recommends areas of activity in the scientific and technical fields which will assist the Embassy in its conduct of U.S. relations in that country. Such recommendations include analysis of the technical implications involved; possible actions for broadening the area of associations of the Embassy which can contribute to international understanding; interpretation and evaluation of the interaction of science and technology with local political, economic, military and commercial developments in that country; and providing assistance in the correct and adequate presentation of U.S. scientific and technological developments and interests. Help to identify areas of bilateral cooperation in the fields of science and technology which can contribute to closer association and collaboration.
3. Coordinates the activities of the technical representatives of other U.S. agencies at the Embassies on U.S. scientific and technological programs and activities in that country in order to provide them with adequate foreign policy guidance and to ensure their full participation in the objectives of the U.S. Mission. The Attaché and the other agency representatives work as a science team so as to make a maximum contribution to the mission of the post and to the objectives of U.S. science.
4. Serves as point of liaison with, and provides foreign policy advice and guidance to U.S. scientific missions in the country of assignment and visiting U.S. scientists. Arranges appropriate briefings and visits with Embassy personnel.
5. Studies in depth and prepares analytical and evaluative reports on significant scientific and technological developments, and on the organization or administration of science. Provides reports required by standard reporting requirements, ad hoc request from the Department of State or those prompted by his own awareness for matters which should be the concern of the Department and the scientific agencies of the Government.
6. Represents the Ambassador to the foreign scientific community as a means for broadening the area of association for the Embassy, for explaining U.S. policies, for encouraging broader areas of cooperation and exchange in scientific and technological information and activities and to explore ways of developing meaningful dialogue which can contribute to understanding between that country and the United States. This involves visits to universities, scientific institutes and laboratories, and with individual scientists and technologists in the discussion of mutual problems and concerns.
7. Represents the Ambassador, the Department, and other agencies at scientific and technological meetings, conferences, ceremonies and similar activities. Arranges the Ambassador's participation where appropriate and assists in the preparation of statements to be given before such scientific groups.
8. Analyzes and reports on scientific and technological developments in nearby countries, when so assigned. Maintains liaison and working relationships with

Foreign Service Officers at such posts who are assigned continuing responsibility for scientific and technological matters. Provides them with technical advice and guidance as necessary.[100]

Brief Survey of the Contemporary Role of the Science Attaché

In an effort to establish how the attaché system works in practice, the author provided a questionnaire to the attachés on the occasion of their return for their annual meeting in Washington. The arrangement was that responses by individual attachés would be consolidated by SCI into a single reply which would be provided to the Congressional Research Service on an informal basis. It is believed that the responses, provided to the author on November 19, 1974, are sufficiently instructive to warrant inclusion in this study, along with the questions that prompted them. Accordingly they are presented here, as follows:

QUESTIONNAIRE FOR U.S. SCIENTIFIC ATTACHÉS

1. What is the "critical mass" of a science staff in an embassy?

Varies with the size of the Embassy and the scope of the programs which the Counselor or Attaché is involved in. At the smaller posts an Attaché and a secretary suffices. At the larger posts where the involvement of the Attaché in the policy issues concerning the Embassy is quite broad then the ideal size and make-up of the staff would be an Attaché, an assistant, an American secretary and a local assistant. [101]

2. What are the program priorities?

Program priorities are determined by current government to government foreign policy relationships having significant S&T content. Consequently these are more technology oriented and differ from country to country. There is little involvement with the basic sciences or basic scientific research unless problems occur which may be resolved through Embassy intervention. Higher priority is given to policy contacts which usually involve ministry officials rather than academic representatives. Lower priority is given to "scientific" visits.

3. What contacts does the science attaché have with the U.S. science community, apart from the occasional facilitating of contacts and travel in the country?

Again depending upon the country of assignment, contact with the U.S. scientific community is through visitors. In the more developed countries i.e. Europe, there is a continuous stream of U.S. scientific visitors both government and academic. In the developing world or in less traveled areas the contact is usually through U.S. government science officials visiting the country. Direct contact with the U.S. community is usually left to visits to the U.S. for home leave or during the annual conference for the Scientific Attachés.

4. How much opportunity is there for laboratory visits or professional contacts in the host community?

This is sporadic depending on workload and opportunities provided by visitors. When workload slackens, laboratory or university visits are scheduled.

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[100] U.S. Department of State, *Functions of Scientific Attachés*, prepared by the Bureau of International Scientific and Technological Affairs, January 1967, pp. 2–3.

[101] On this point Herman Pollack observes:

> In every function, there is inevitably bread and butter work to be performed. Every attaché and counsellor needs an American or local assistant or two for this purpose alone. Otherwise, a senior, highly trained man is wasting part of his time.
>
> The size and configuration of a science office is a function of time and place. On the whole, every attaché or counsellor needs a junior assistant for the bread and butter work that must be done. Then the situation will vary with the size and importance of the science and technology activity in the country. Thus Paris, Bonn and Tokyo would naturally require and do have larger staff than Tel Aviv, Buenos Aires or Tehran. Speaking generally, the entire attaché program could make good use of an additional 10 positions, but I do not believe that any single post is hurting critically for manpower.

(Pollack to Huddle, March 25, 1975.)

5. *When an important scientific discovery, paper, technological advance, etc., is produced in the host country, how does it come to your attention and what do you do about it? How frequently has this occurred in the last eight months? If your attention is called to such a development by a communication from the United States, what process follows?*

Since the following of such matters or developments do not have high priority in the Attaché's area of responsibilities, it is generally assumed such matters will be duly reported or publicized in the professional journals. Such developments usually come to the attention of the Attaché through newspaper or journal publication and informal word-of-mouth contact.

Follow-up process varies with situation and extent of probable interest to the U.S. If requested by communication from the U.S. to follow-up, additional reports are gathered and forwarded to requestor.

6. *What yardsticks are available to you to draw comparisons between the level of technical sophistication in the host country and that in the United States, in any given discipline or technology?*

Primarily through the professional training of the Attaché, the technical literature available to him, and assisted by comments from qualified U.S. and foreign scientists.

In general these comparisons do not justify the effort necessary to assemble the data since such comparisons are not usually relevant to the job work requirements of the Scientific Attaché.

7. *What responsibilities, if any, does the attaché have for "overseeing" the administration of formal U.S. foreign and international Science and Technology programs in the country? (This might include, for example, the role of the U.S.-France agreement for exchange of scientists, or the role of the Mexican attaché in the U.S.-Mexico bilateral—which includes provisions for exchange of scientists as well as cooperation between agencies of the U.S. and Mexican government in cooperative projects. The role might include monitoring of the activities in the foreign or host country and assistance in determination of project priorities.)*

The Attaché is the local coordinator and "overseer" of U.S. cooperative S&T programs in his country of assignment. These responsibilities include the continuous monitoring of the program to ensure that it continues to support the purposes for which it was established. Also included are the appropriate foreign liaison and negotiating responsibilities relative to the carrying out of the program.

The Attaché plays a key role for the Ambassador in dealing with questions of content, substance, and priorities set for such programs where such factors may influence U.S. foreign policy objectives.

8. *What contacts, if any, does the science attaché have with Federal agencies who have S & T programs in the foreign country (in foreign countries where we do not have bilateral agreements)—for instance, EPA or HUD activities e.g. in United Kingdom, Fulbright-Hays activities, and the extensive NSF support activities which involve foreign activities?*

Contacts and liaison are usually arranged through the State Department communications channel based on instructions or requests originating in the other agencies. Since the Attaché is often called on by other agencies to assist in negotiations or in obtaining foreign government agreement to cooperative efforts the contacts are often close.

In some countries such agencies cannot operate except through the Embassy and therefore the contact and liaison between the Attaché and the other agency is very close.

9. *Does the Attaché have a role in the exchange of information between the U.S. and a foreign country—e.g. we frequently have visitors from other countries who despair of the difficulties in trying to get information about executive agency or congressional publications in S & T? They say they have only the resources of the USIS to use. Does the Attaché have, in his office lists of bibliographic sources such as the GPO catalogue, NTIS bibliography, or hard copies of documents?*

Limited resources sometimes restrict what might be immediately available. When the Attaché does get a request for information not available in his office he sends a telegram to OES in the Department which obtains the necessary information or forwards the request to the appropriate U.S. agency.

USIS and commercial libraries at Embassies are also very useful in handling such requests. The Attaché does not ordinarily have bibliographies or an ex-

tensive library. Generally he does have some information such as press releases, news and publication reports from a number of U.S. agencies, and key S&T reports issued by U.S. agencies and Congressional committees.

All U.S. technical agencies are encouraged to include the Science Attachés on their mailing lists for publications and reports.

Illustrative Products of Scientific Attachés

The principle that now appears to govern the role of the U.S. scientific attaché is that events, actions, and trends in science and technology that are important for U.S. foreign policy should be identified, described, and evaluated in reports back to the Department of State in Washington. Here they are disseminated to elements of the Department with a presumed interest in them, and, where appropriate, are also passed along to other interested agencies. Often the originating attaché will suggest which other agencies would be likely to be interested in a particular report.

Following are 10 brief abstracts of actual reports from scientific attachés that provide a fair sampling of their work.

ABSTRACTS OF ATTACHÉ REPORTS

1. Report from Bonn, May 2, 1973, 8 pages.

This was the third report on budget proposals of the Federal Republic of Germany, previous reports having been submitted November 24, 1971 and January 4, 1972. The report noted an increased emphasis on the "Quality of Life" and a 41-percent increase in expenditures for "new technologies." Details were supplied as to proposed distribution of funds among major programs, trends, and status of the planned program.

2. Report from Ottawa, August 11, 1973, 15 pages.

Subject: "Organization of Canadian Ministry of State for Science and Technology—Part I."

Suggested recipients of the report included NSF, NAS, NBS, USAEC, DOD, NIH, NOAA, Interior, Commerce, and others. Report provided an overview of the new ministry, its objectives, program, and organization. Also included were organization chart, statement of functions of subordinate elements, and biographical statements of principal officers.

3. Report from Rome, October 21, 1974, 1 page.

Subject: "Satellite Launch from San Marco Range."

Brief technical description and note on benefit of the demonstration in terms of recognition of U.S. technical achievements.

4. Report from Tokyo, October 1, 1974, 4 pages.

Subject: "GOJ R&D Budget Request for FY 1975."

Described and analyzed the budget request, identifying key items. (However, neglected to call attention to a $10 million increase in proposed funding of research and development of pattern information processing, an area which the Japanese have decided to emphasize.)

5. Report from Paris, October 22, 1974, 3 pages.

Subject: "Solar Energy for Heating and Cooling of Buildings, a View from Odeillo, October 1974."

Summarized views of national representatives (Greece, Germany, Holland, France, Denmark, Australia, Great Britain) to a solar energy conference, and noted the technical problems of a proposal for a "zero energy house" as being thermal storage capacity, insulation, and climatic differences among nations. Conclusion: solar energy is not important as an early prospect.

6. Report from Tokyo, November 18, 1974, 3 pages.

Subject: "Space Cooperation: GOJ Requests for Export Approval for Improved N-Rocket Items."

An update on the state of negotiations for U.S. assistance to the Japanese space program, explaining the rationale of a counterproposal to an earlier U.S. offer.

7. Report from Rome, November 21, 1974, 3 pages.

Subject: "First Report on Science and Technology Research in Energy in Italy."

Described reports of six working groups under the Ministry for Scientific Research on program directions in: "primary conventional sources (including nuclear energy)", "non-conventional primary sources," "transport, transmission, and storage," "large utilizations," "small utilizations," and "regulation problems." Suggested, among other items, generation of hydrogen fuel at nuclear sites.

8. Report from Tel Aviv, December 13, 1974, 4 pages.

Subject: "Absorption of Immigrant Scientists."

Unrestricted immigration adds congestion to Israeli science job market. 300–400 annually. Job placement "disappointing." Problems and plans for the future described.

9. Report from New Delhi, February 11, 1974, 10 pages.

(Suggested recipients included Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Food and Drug Administration; National Science Foundation; and others.)

Subject: "Summary and Analysis, draft fifth 5-year plan (1974–79): Health, Family Welfare Planning, and Nutrition."

The purpose of the report was to summarize and analyze the draft plan. It was explained that "A delineation of possible areas of U.S./Indo cooperation in these fields during the next 5 years will follow as a separate airgram."

10. Suggestion from French scientific counselor for an intensification of U.S.-French scientific cooperation under the bilateral agreement of November 1969.

The occasion of the bilateral agreement was the meeting of United States and French Presidents at Martinique. The suggestion was coupled with a report summarizing activity currently underway pursuant to the 1969 agreement. (No date) (This particular report was recast by SCI staff as an agenda item for consideration by a bilateral agreements subcommittee of the Interagency Committee on International Science and Technology.)

THE IMPORTANCE OF COUPLING

A heavy burden of responsibility rests on the attaché to spend his time wisely. How can he be reasonably sure that his reports are useful back home? What "feedback" does he get that directs his attention to pertinent items? What "feedback" does the State Department itself receive from the other agencies, presumed interested, to which these reports are forwarded?

While time did not permit full exploration of this question, a few comments can be made. First, SCI over the past decade made a positive effort to bring all attachés back to Washington annually for a 1-week briefing on scientific, technological, and political-economic developments in this country. Here they heard lectures and talks by the Secretary of State, White House officials, and various officers of the Department; they met with appropriate congressional committee members and staffs in technical sessions and receptions; they held question-and-answer workshops.[102]

In 1968, an assessment by Daniel S. Greenberg suggested that the utility of attaché reports was uneven: ". . . It is difficult to determine the role played by the science attachés, who are now posted at some 20 U.S. embassies around the world. Some convey the impression of being resigned to writing reports that are never heeded, even if read, and also of being somewhat out of things at the embassies in which they serve. Others, however, sound as though they feel themselves to be in the thick of important affairs, with an opportunity to move matters as they believe they should be moved." [103]

Inescapably, the quality of personnel will vary, as will also the range of opportunities for useful scientific and technological reports and services within the country to which they are posted. (Even more variable was the extent to which Foreign Service officers who were "especially designated" as science officers responded to their assigned task, which was "in addition to their other duties." [104]) Perhaps most variable of all is the relationship between the Ambassador and his scientific attaché. Much depends on the importance the principal officer of the embassy, the personal representative of the President in the country, assigns to science and technology as essential ingredients of diplomacy. It would be of interest to learn how much preparation new ambassadorial appointees receive on this subject before taking up their posts, and indeed how much sophistication or even awareness the

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[102] For example, the annual meeting in 1966, held for one week in November, brought 14 of the 17 attachés to Washington. They met with Vice President Humphrey who stressed the importance of science and technology for diplomacy; they heard discussions on the "technological gap," international cooperation in oceanography and space, political security aspects of nuclear power, and the "Water for Peace" program. ("Scientific Attachés Gather for Annual Conference," *Department of State Newsletter*, no. 68 (December 1966), p. 15.) It should be noted that recent meetings of the attachés have become very intensive and systematic.

A later meeting, the week of January 26, 1970, included sessions with the Secretary of State, the President's Science Adviser, the President of the National Academy of Sciences, a full day with the House Committee on Science and Astronautics; meetings with senior officers of the Departments of Commerce, Transportation, and HEW; a tour of National Bureau of Standards facilities and a lecture by the Director of NBS; and lectures by State Department officers on AID, Space, Oceans, Environment, Population, Export Controls, and the use of Public Law 480 funds.

[103] Daniel S. Greenberg, "Science Attachés: U.S. Aides Meet to Report on International Scene," *Science*, September 13, 1968, p. 1116.

[104] For an example of one Foreign Service officer who became interested in this assignment see: Bryan R. Frisbie, "A Science Liaison Officer Discusses His Work," *Department of State News Letter*, no. 89 (September 1968), pp. 40–41. The article appears to offer a case for extending the full attaché system to many additional embassies, in view of the wide range of significant scientific activities that enlisted the author's attention.

appointee has in the impacts of technological trends on the relations among nations. The classic instance of Ambassador Gavin's relationship with Dr. Piret demonstrates the kind of useful teamwork that can be achieved with a technically sophisticated Ambassador.[105] It is also to the point to ask the extent to which the Ambassador and his administrative officials are willing and able to provide the scientific attaché with the personnel and other resources he needs, or even to urge the appointment of an attaché where none exists.

The contemporary assessments of the role of the scientific attaché, both from observers with broad experience in the science-diplomacy interface, illustrate the difficulty of finding qualified personnel for overseas science posts. According to the view of David Beckler (Assistant to the President, National Academy of Sciences), the attaché needs to have a grasp of the broad implications for the United States of science—and especially technology—in the host country:

> The role of the science attaché has largely been passive—to respond to detailed requests and to make contacts for and assist visiting U.S. delegations. The passive nature of the science attaché role has been dictated in large measure by the limited staff and administrative resources at his disposal. There is little time for thoughtful assessment, appraisal, and initiative on his part, being submerged in day-to-day detail which cannot be avoided or delegated. I believe the caliber of most of our science attachés would permit them to perform a valuable creative role: a. to assess the implications for the U.S. government of important changes and directions in policies affecting the development and use of science and technology in the affairs of the foreign government; and b. to identify ways to stimulate, reinforce, reinvigorate, and expedite bilateral arrangements with the U.S. involving science and technology.
>
> To serve the U.S. needs, the science attaché must, in reality, become a *technology* attaché, looking at technological developments in relation to the country objectives and to U.S. objectives.[106]

In comment on the same point, Dr. Harvey Brooks (Division of Engineering and Applied Physics and the Kennedy School of Government, Harvard University), attaches importance to the personal role and contacts of the attaché, but without diminishing the importance of his scientific role:

> I think [writes Dean Brooks] all the functions of the science attaché you mention are important. I would probably rate them in the order: personal contacts, observation of major trends, information exchange, policy analysis, long range forecasts. I think the role of the science attaché should be more that of a true science and technology adviser to the Ambassador than has been the case in the past. The size and configuration of the Embassy science staff is less important than the personality and leadership of the Science Attaché himself. He should be a person who knows the local language and has good contacts in the local scientific community, and at the same time, good connections with the governmental science establishments in the U.S. He should be an individual with considerable political "savvy" and experience, as well as scientific stature—a difficult combination.

A possible expedient to ease the total burden on the individual attaché, Dr. Brooks suggests, might be the use of supporting personnel

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[105] Before Lt. Gen. James Gavin was named Ambassador to France, he had directed the research and development program of the Department of the Army, and upon retirement was named president of the private research and development company Arthur D. Little, Inc. His receptivity to scientific counsel as an Ambassador was unusually high.

[106] Beckler to Huddle, March 5, 1975.

from the home office to shoulder part of the load in short-term emergencies:

> I would hope that the staff of the S. and T. office in State could include some people who could be assigned on a temporary basis to a particular science attaché when there was an unusual work load. For example, Jack Tech, our science attaché in Moscow was ridiculously overloaded during the early days of the US-USSR scientific exchanges. There should have been a way of providing him with extra help. There ought to be a way special situations like that could be handled without a permanent staff build-up in the Embassy.[107]

Present Status and Emphasis on Science in U.S. Embassies

It would seem desirable to maintain field staff competence in some proportion to the diplomatic importance of the expertise. In the 128 countries where the United States maintains diplomatic relations it is not, of course, to be expected that special expertise would be universally required in science and technology. On the other hand, it would seem desirable as a matter of principle to maintain a continuity of expertise in every country where substantial scientific levels of achievement exist (e.g. the United Kingdom, France, Germany, Italy, Canada, Switzerland, Sweden, U.S.S.R., etc.). It would also be reasonable to expect that scientific representation would be useful in the major and most populous nations if only to formulate policy as these nations advance (e.g., India, Brazil, Indonesia, Nigeria, etc.). In still other countries the availability of a U.S. scientific attaché might be considered a diplomatic way of "showing the flag," or of coordinating technical assistance, U.S. training programs, and personnel exchanges.

Science and technology have been described by three successive Secretaries of State as preeminent elements of diplomacy. The interaction of science and technology with political affairs has undeniable force in the modern world. The predictive power of technological analysis would seem to be comparable to that of economics. The social impact of technology is approaching that of military potency, under the "nuclear umbrella." Then, how does the manpower allocation to political, economic, and military aspects of diplomacy in U.S. Embassies compare with the allocation to science and technology? What proportion of professional-level personnel is allocated overseas to this important field?

An examination of the Foreign Service List (Revised Nov. 30, 1974) of the U.S. Embassy personnel in major countries (including all those to which a U.S. science officer is sent) reveals that in these embassies about one-third of professional personnel are political officers, one-third are economic and commercial officers, and a little less than 30% are military officers; scientific and technological officers are about 4%. If all professional personnel in all embassies are considered, the science contingent would be less than 1 percent. (In the analysis, the executive staff, administrative staff, consulate offices, and agricultural, AID and USIA contingents were omitted.) (See Table 1.) (A roster of Science and Technology Counselors and Attachés, and Fisheries Attachés assigned to U.S. Missions abroad is also provided as Table 2.)

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[107] Brooks to Huddle, February 10, 1975.

TABLE 1.—POLITICAL, ECONOMIC, MILITARY, AND SCIENTIFIC PERSONNEL IN U.S. EMBASSIES, 19 SELECTED COUNTRIES [1]

Selected countries	Political officers	Economic and commercial officers	Military attachés	Physical science officers
Argentina	11	6	5	1
Australia	2	3	5	0
Brazil	10	6	6	0
Canada	4	4	3	1
France	10	13	11	3
Germany (Bonn)	12	12	7	1
India	9	9	6	0
Indonesia	8	10	9	0
Israel	4	4	5	1
Italy	11	9	8	1
Japan	12	12	5	1
Mexico	10	8	5	1
Poland	3	5	1	1
South Africa	3	3	5	0
Sweden	5	4	6	1
Thailand	13	8	6	0
Union of Soviet Socialist Republics	8	5	12	3
United Kingdom	9	13	19	1
Yugoslavia	4	6	3	1

[1] Source: Foreign Service list (revised, Nov. 30, 1974), Department of State, publication 7802. The method employed was to count political, economic, military, and science officers in the selected countries, excluding persons in the executive staffs, administration, consular and subordinate offices, and agricultural (FAS), U.S. AID, and USIA(USIS) contingents. Only professional personnel were counted. Countries selected were those 13 which had science officers in the U.S. embassy, plus 6 other major countries. Too much should not be inferred from this table. Its purpose is to show that the manpower allocation to "science" is comparatively modest, even to countries where scientific and technological developments are of particular concern for U.S. foreign policy.

TABLE 2.—*Science and Technology Counselors and Attachés and Fisheries Attachés at U.S. Missions Abroad*

Embassy or Mission and their Principals and Deputies

Europe:
- Belgrade—William Mills
- Bucharest—Sidney Smith [1]
- Bonn—Dr. Clyde L. McClelland [2]
- Copenhagen—Salvatore Di Palma [3]
- London—Dr. John Hulm
- Madrid—Dr. Duncan Clement
- Moscow—Dr. Egon Loebner, John K. Ward
- Ottawa—Miller Hudson [2]
- Paris—William Salmon,[2] Edward Malloy, Michael Coogan
- Rome—John Manniello
- Stockholm—Dr. Ernest Sohns
- U.S. Mission OECD Paris—Dr. Arnold Kramish
- Warsaw—Allen Greenberg
- Geneva—Gordon D. Cartwright [4]

Latin America:
- Buenos Aires—Robert Wilcox [2]
- Mexico City—Dr. Andre C. Simonpietri,[2] George H. Rees [3]
- Rio de Janeiro—Dr. Robert Goeckermann

East Asia and Pacific:
- Taipei—Dr. Chester Clark
- Tokyo—Myron Kratzer,[2] Douglas McNeal, Keith Brouillard (pending) [3]

Near East and South Asia:
- New Delhi—Dr. William W. Williams,[2] Mr. Clifford Metzner
- Tehran—Dr. Albert Chapman
- Tel Aviv—Dr. Herman Chinn

Africa: Casablanca—Norman L. Pease [3]

[1] NSF Representative also serves as Science and Technology Attaché.
[2] Counselor of Embassy for Scientific and Technological Affairs.
[3] Fisheries Attaché.
[4] NOAA Representative also serves as Science and Technology Attaché.

Source: U.S. Department of State, Bureau of Oceans and International Environmental and Scientific Affairs, January 24, 1975.

In the U.S. delegations to the United Nations, Organization of American States, International Atomic Energy Agency, North Atlantic Treaty Organization, Organization for Economic Cooperation and Development, and UNESCO, political officers numbered 24, economic officers 14, and science personnel 4.

POSSIBLE MODIFICATIONS

If the policy is adhered to of recruiting only senior-level scientists with language facility, serving for 2-year tours of duty, it is likely that the manpower percentile allocation for science expertise will never be much increased over present levels. In view of the sustained growth in importance of technology as a primary force influencing changes in national strength and international relations of countries, as well as the sustained growth in international contacts and programs of scientists, the need for formal nation-to-nation contact on scientific and technological matters seems likely to grow in scope and importance.

In order to facilitate recruitment and improve the product of the personnel in this field, several alternatives might be worth consideration: relaxing the initial language requirement, extending the duration of the duty tour, opening recruitment to senior-level technologists as well as scientists, taking account of the availability of persons trained in "science policy" as well as those in the disciplines of science, expanded programs of training of political and economic officers in science and technology policy, and recruitment of generalist Foreign Service candidates with substantial academic credits in the physical or biological sciences. It would seem to be less essential that "scientific" attachés be scientists than that they be competent in assessing the interactions of science and technology with diplomacy.

It is also to be recognized that communication across the disciplinary boundaries of individual sciences can be as difficult as overcoming language barriers; the increasingly specialized vocabularies and expertise of scientific subdisciplines is worsening the problem. Technologists tend to be more generalist than specialist in their training, but neither scientific nor engineering disciplines are an ideal foundation for diplomatic relationships. The task of scientific and technological representation in the diplomatic environment may indeed require a team effort, rather than an attempt to find an array of usually disparate skills in single individuals.

VI. Emergence of the Bilateral Science Agreement

The Department of State has a major role in a new dimension of diplomacy, the bilateral agreement of the United States and another country to conduct joint programs of scientific research and development on a long-term or continuing basis.

The bilateral science agreement takes so many forms, has so many objectives, involves so many participants, and is subject to so many variables of national character, that generalization must be undertaken with caution.

The importance of the bilateral science agreement for the present study is that it has become a principal operational responsibility of the science office in the Department of State, and is a principal vehicle for exploiting diplomatically the shared interest of the United States and other nations in science and technology.

Evolution and Multiplication of Science Bilaterals

The oldest of the ongoing agreements on science[108] is the "U.S.-Japan Cooperative Science Program." Upon the visit of Prime Minister Ikeda to President John F. Kennedy in 1961, a U.S.-Japan Committee on Scientific Cooperation was organized to "review and direct a program of cooperative research, scientific seminars, and direct collaboration" (i.e., a program in which U.S. scientists, U.S.-supported, work in Japanese laboratories but not *vice versa*). The scope of the program would include: exchange of scientists; science education; scientific and technical communications; earth and astronomical sciences; agricultural and life sciences; physical sciences and mathematics; engineering sciences; and such special problems as typhoons, earthquakes, and other natural catastrophic phenomena. The program was expanded in 1963 by a second agreement calling for a "U.S.-Japan Cooperative Program on Natural Resources Development" and again in 1965 by the "U.S.-Japan Cooperative Medical Program." The U.S. administration of the first is by the National Science Foundation, the second by the U.S. Department of the Interior, and the third by the U.S. National Institutes of Health in the Department of Health,

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[108] According to an item in a publication of the Department of State (U.S. Department of State, "U.S. Scientific and Technological Agreements with Other Countries," *International Science Notes*, no. 25 (September 1970), p. 2.):

> Until the nineteen sixties U.S. agreements to cooperate with other countries in areas of science and technology, with the exception of atomic energy, were few: such cases tended to be perfunctory and insubstantial, usually arrived at with the initiative coming from the other country. They hardly rested on the wish to pursue previously thoughtout projects or to solve particular technological problems. In a word, their existence did not appeal to the American sense of practicality. Also, diplomacy had not yet extended its horizons to embrace science, partly because science was unfamiliar to it and partly because U.S. science had not clearly emerged as superior and in consequence did not appear so desirable to others for association as it has since become. Furthermore the advantages of association were not generally recognizable to U.S. scientists after the holocaust of World War II, and the U.S. Government was not well organized to play its part.

The article goes on to note (p. 3) that "Excepting for the moment the biennially renewable exchange program with the U.S.S.R., which embraces more than science, the first chronologically of the new scientific agreements is the U.S.-Japan Cooperative Science Program."

U.S.-Soviet scientific personnel exchanges began in 1959 and were renewed biennially since than under terms of cultural relations agreements. With the exception of government to government exchanges in public health and atomic energy, the rest of social and physical sciences exchanges were carried out by nongovernmental agencies with government support. The 1972 agreement differs from previous agreements since it provides for cooperative research between government agencies in specified areas. For a complete background see section IV. United States and Soviet and Eastern European Inter-Academy Scientific Exchanges, in: U.S. Congress, House, Committee on Foreign Affairs, Subcommittee on National Security Policy and Scientific Developments. *U.S. Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange*, prepared by Genevieve J. Knezo, Science Policy Research Division, Congressional Research Service, Library of Congress, April 1974. See vol. II, pp. 982–1013.

Education, and Welfare. The science office of the Department of State exercises a general monitoring function of all three programs and the U.S. Scientific Attaché in Tokyo is required to maintain a watching brief at the other end.

The scope of the second program with Japan includes exchange of research information at periodic meetings of panels of United States and Japanese scientists on:

1. Desalting
2. Air Pollution
3. Water Pollution
4. Energy
5. Forage Seeds
6. Toxic Micro-Organisms
7. Mycoplasmosis
8. National Park Management
9. Wind and Seismic Effects
10. Diving Physiology and Technology
11. Protein Resources
12. Marine Resources and Engineering Coordination Committee
13. Marine Mining
14. Marine Facilities
15. Marine Communication and Electronics
16. Marine Environmental Observation and Forecasting
17. Marine Geology
18. Seabottom Survey
19. Aquaculture
20. Forest Resources Inventory [109]

A three-man team was appointed by John Ingersoll, Acting Under Secretary of State, July 26, 1974, to undertake a comprehensive review of the entire U.S.-Japanese science bilateral. Persons serving on this team are: Dr. Keith Glennan, earlier Administrator of NASA, Dr. Edward David, former science adviser to President Nixon, and Robert Hiatt, president of the University of Alaska. The findings of this survey are expected to be returned to the Department of State around the end of 1975.

An assessment of this bilateral by the National Science Foundation in 1973 described it as being "highly successful in bringing scientists of the two countries together to work on mutual problems." It had maintained an annual level of about 50 "active cooperative research projects," 25 seminars to exchange scientific information on specific topics, 6 long-term U.S. scientist visits to Japan and 6 to 8 exchanges of "eminent" lecturers on scientific subjects.[110]

The undoubted diplomatic and scientific success of this first bilateral led to a long succession of others until by 1975 there were some 28 different programs on the books. In the discussion that follows, two of the principal programs—with France and the U.S.S.R.—are discussed.

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[109] Ibid., p. 3.

[110] U.S. Congress, House, Committee on Science and Astronautics, *1974 National Science Foundation Authorization*, 93rd Cong., 1st sess., February 27, 28, March 1, 6–8, 1973, p. 315. In comment on NSF's role in international science bilaterals, Pollack says:

> NSF is par excellence this government's science agency. It is logical and natural that it should be expected to carry the principal responsibility for intergovernmental relations in Science. Indeed, the Department of State has looked to the NSF to become the "executive agent", i.e. the responsible action center, for numerous intergovernmental agreements. In my view the NSF has responded magnificently. The principal problems that have arisen have related to the lack of participation of other agencies in intergovernmental programs for which the NSF is the executive agent.

(Pollack to Huddle, March 25, 1975.)

THE UNITED STATES-FRANCE PROGRAM OF SCIENTIFIC AND TECHNOLOGICAL COOPERATION

A somewhat different scheme of cooperation was developed between the United States and France on the occasion of conversations between President Nixon and President de Gaulle in Paris in early 1969. Subsequently further discussion took place between M. Francois X. Ortoli, French Minister for Industrial and Scientific Development, and Dr. Lee A. DuBridge, the U.S. President's Science Adviser, in Paris and Washington. These resulted in a Joint Statement on Franco-American Scientific and Technical Cooperation, November 25, 1969. Dr. Allen V. Astin, retired Director of the National Bureau of Standards, was appointed by the Department of State to coordinate the U.S. side of the program. It operated without a formal agreement, apparently at the request of the French negotiators.

This program is quite widespread in scope. According to the first status report by Coordinator Astin, March 20, 1970, it involved participation by the following U.S. agencies:

- Atomic Energy Commission
- Department of Agriculture
- Department of Commerce:
  - Environmental Science Services Administration
  - National Bureau of Standards
- Department of Defense
- Department of Health, Education, and Welfare:
  - Environmental Health Service
  - National Institutes of Health
  - National Library of Medicine
- Department of Housing and Urban Development
- Department of the Interior:
  - Bureau of Commercial Fisheries
  - Bureau of Mines
  - Bureau of Reclamation
  - Federal Water Pollution Control Administration
  - Geological Survey
- Department of Justice:
  - Bureau of Narcotics and Dangerous Drugs
  - National Institute of Law Enforcement and Criminal Justice
- Department of Transportation
- National Aeronautics and Space Administration
- National Science Foundation
- Smithsonian Institution
- Veterans Administration

THE U.S.-U.S.S.R. SCIENCE BILATERAL

Probably the most elaborate bilateral science program evolved out of the agreement between the United States and the U.S.S.R., at Moscow May 24, 1972. The elaborate scope of this bilateral is attributable to the mutual effort of the two countries toward a political détente, a thawing of the "Cold War," as well as to the strong shared interest in science and the particular desire of the Soviet Union to raise the

technological level of its industry.[111] A summary of the eight articles of the agreement is as follows:

1. Mutual pledge of scientific and technical cooperation for "mutual benefit, equality, and reciprocity."
2. Objective: combine efforts of "their scientists and specialists" in solving major problems to benefit scientific and technological progress, both countries, and mankind.
3. Scope of the agreement to encompass:
   —Exchanges of scientists and specialists;
   —Exchanges of scientific information;
   —Joint programs of basic and applied science;
   —Institutional research cooperation;
   —Joint conferences and courses;
   —Help in establishing commercial contacts; and
   —Other forms of scientific cooperation as may be mutually agreed,
4. Facilitate institutional and commercial contacts and cooperation pursuant to law.
5. Costs of each participating country borne by that country.
6. Not to preclude other scientific and technological agreements.
7. "For the implementation of this Agreement there shall be established a U.S.-U.S.S.R. Joint Commission on Scientific Cooperation. Meetings will be convened not less than once a year in Washington and Moscow, alternately." The Commission to develop a program of cooperation, assign implementing responsibilities, and create subordinate working bodies. Respective executive agents and organizational details specified.
8. Consultation and program changes between meetings provided for.

The first meeting of the Joint Commission was held in Washington March 19–21, 1973. It reviewed results of supplementary agreements (1) "On Exchanges and Cooperation in the Fields of Science, Technology, Education, Culture, and Other Areas" for 1972–1973, signed April 11, 1972; (2) "Between the U.S. National Academy of Science and the U.S.S.R. Academy of Sciences" for 1972–1973, signed April 11, 1972; (3) "Between the American Council of Learned Societies and the U.S.S.R. Academy of Sciences" for 1972–1973, signed April 11, 1972; and (4) "the Memorandum on Cooperation in the Peaceful Uses of Atomic Energy between the U.S. Atomic Energy Commission and the U.S.S.R. State Committee on the Utilization of Atomic Energy for 1972–1973," signed September 28, 1972.

It was also noted that in July 1972, six areas of mutual interest had been identified for the program: energy research and development, application of computers to management, agricultural research, water resources, chemical catalysis, and "production of substances employing microbiological means" (i.e., technological uses of microbes). During the rest of 1972, six joint U.S.-U.S.S.R. working groups developed and reported substantial papers outlining proposed research, development, and organizational plans in these six areas.

An assessment of the U.S.-U.S.S.R. bilateral program was undertaken by the General Accounting Office during 1974. Results of the

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[111] On this last element, see U.S. Congress, House, Committee on Foreign Affairs, *U.S.-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer, and Diplomacy*, in the series Science, Technology, and American Diplomacy, prepared by John P. Hardt, Senior Specialist in Soviet Economics and George D. Holliday, Research Analyst in Economics, Economics Division, Congressional Research Service, Library of Congress, June 1973. See vol. I, pp. 525–606.

study were reported to the Congress, January 8, 1975. In its report GAO remarked on the protracted period of time required for "negotiating meetings for working out frameworks for cooperation." Exchange of information had been "limited and of little technical benefit to the United States." Exchanges of scientists and technicians were "just beginning to materialize." Time lags were attributed to "poor communications, differing priorities, misunderstandings, and security considerations." Problems of "funding, language translating facilities, and travel costs of visiting scientists should have been resolved during this period but were not." Accordingly, GAO recommended that the "coordinators for the environmental protection and science and technology agreements . . . formulate and execute improved plans which will:

—"Identify topics for early development into specific cooperative programs;

—"Assess the number of potential projects that can be efficiently managed;

—"Insure that projects of priority interest are adequately supported and vigorously pursued by the responsible agencies or institutions;

—"Emphasize the need to progress from merely exchanging visits to real cooperative efforts;

—"Require participating agencies to identify all costs associated with the program;

—"Determine the long-range funding and personnel requirements of the agreements; and

—"Arrange the necessary Russian language training and translating facilities to meet the needs raised by the agreements." [112]

GAO also recommended that the Congress "should consider the desirability of an annual progress report on each agreement," and consider monitoring program execution. It might also consider the desirability of specifically funding the agreements and observed:

> We are concerned that the present diffused funding of the programs under these agreements makes congressional overview and control difficult and could result in significant commitments prior to congressional authorization of funds.[113]

PROLIFERATION OF AGREEMENTS

It appears that from about 1966 on, President Johnson and then President Nixon regarded the bilateral science agreement as a frequently useful instrument of diplomacy. It was something tangible that could be announced in a joint communique on the occasion of meetings of Heads of State, something constructive and noncontroversial, offering a promise of continuing benefit to both parties. At any rate, agreements continued to mount up:

1961 Japan
1966 Germany
1966 India
1967 Italy
1968 Iran

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[112] U.S. General Accounting Office of the Comptroller General, *A Progress Report on United States-Soviet Union Cooperative Programs* (January 1975), p. iii.
[113] Ibid., p. 43.

1968 Australia
1968 Romania
1969 China (Taiwan)
1969 France (no formal agreement)
1970 Spain

By early 1975 there were upwards of 28 bilateral agreements or understandings of one sort or another in the fields of science and technology. (See Table 3.) An analysis of these by OES proposed two categories of programs: (1) those pursuant to formal government-to-government agreements, and (2) those evolved by mutual agreement in a less formal way. Each category was further subdivided. In the first category, eight bilaterals (with Australia, Argentina, Brazil, Taiwan, Italy, New Zealand, Romania, and Spain) involve a general agreement but with no joint implementing commission. Another nine (with India, Iran, Israel, Egypt, Mexico, Poland, Saudi Arabia, Yugoslavia, and U.S.S.R.) are pursuant to a government-to-government agreement, implemented by a joint commission.

In the second category, are bilaterals with "structured science and technology cooperative programs." Of these, four (Japan, France, Federal Republic of Germany, and Canada) are with countries in which "significant scientific relationships" exist, supplementing private industry which is the "main channel of technological relations." The remaining seven (Morocco, Tunisia, Sri Lanka, Burma, Pakistan, Guinea, and the Peoples Republic of China) are less salient, funded—except for China—with Public Law 480 funds.[114]

TABLE 3.—*U.S. Bilateral Science Programs, January 1975 (List supplied by Department of State)*

INTERGOVERNMENTAL BILATERAL S&T AGREEMENT	STRUCTURED S&T COOPERATIVE PROGRAM
Italy	Japan (1)
Australia	France
Argentina	Germany
Brazil	Morocco (4)
Republic of China	Tunisia (4)
Mexico (1)	Sri Lanka (4)
New Zealand	Canada
Yugoslavia (1, 4)	Burma (4)
Romania	People's Republic of China (2)
Poland (1, 4)	Pakistan (4)
USSR (1)	Guinea (4)
Spain (2)	
Israel (1, 3, 4)	
Iran (1)	
Egypt (1, 4)	
Saudi Arabia (1)	
India (1, 4, 5)	

1—Joint Commissions or Committees and similar arrangements.
2—S&T activities and exchanges in context of cultural, educational, or other cooperative programs.
3—U.S.-Israel Binational Science Foundation.
4—Public Law 480 programs.
5—U.S.-India Scientists Exchange Program.

[114] U.S. Department of State, "U.S. Scientific and Technological Relationships with Other Nations," *International Science Notes*, no. 33 (January 1975), pp. 12–14. In addition to these more general bilateral science agreements, there are also a great many other agreements of narrower scope directly involving individual U.S. departments and agencies in cooperation with their counterparts in other countries. These should be recognized as an important feature in relation to the subject matter of this chapter, but their total scope and diplomatic importance are not assessed in the present study.

Purposes, Advantages, and Disadvantages of Bilaterals

SCI analyzed the purposes and advantages of bilateral science programs in 1970. In general the diplomatic purpose was to provide tangible evidence of rapport between the two participating countries, especially on the occasion of a meeting of their political leaders. A further diplomatic purpose was to increase the interaction among their peoples in a professional and noncontroversial field. It was observed, however, that the political purposes of such programs are unlikely to be well served unless there are substantial scientific benefits to be shared. And the Inspector General's report on SCI, cited earlier, notes that discarding worn out bilateral science agreements is politically awkward. The scientific purposes were to exploit the principle of pooled expertise and exchange of knowledge.

ADVANTAGES

Among the "built-in advantages" of "scientific and technological agreements" as seen by SCI were the following:

a. *Provides an impetus for cooperation.*—A governmental agreement stimulates and encourages cooperation which might otherwise never occur. It focuses attention on and publicizes the opportunities for collaboration. Some cooperation with a country probably will take place spontaneously. This is largely a random, haphazard process depending upon accidental coincidence of interests, acquaintanceship, etc. An international agreement forces a more searching and systematic review of potential cooperation. Generally speaking, the success of an agreement can be measured roughly by the *new* collaboration it stimulates beyond that already taking place.

b. *Gives local scientists greater prestige.*—A formal agreement calls the attention of governmental officials to the scientific community. The participation of local scientists as equal partners with outstanding scientists of other countries provides a visibility and a stature not previously enjoyed.

c. *Increases likelihood of local support.*—Closely related to *b* above, is the increased financial support from local governmental agencies engendered by an agreement. An agreement represents a commitment by the government to hold up its end of the bargain. If the scientists cannot perform their agreed portion with existing support, this provides powerful leverage on the government for additional assistance.

d. *Facilitates exchange of personnel and information.*—Although exchanges of this type are possible informally, a formal agreement provides a useful mechanism for more extensive exchange. In fact, provision for exchange of persons and information is an integral part—and one of the most effective features—of all agreements now operating.

e. *Allows simpler and more expeditious exchange of materials and equipment.*—Cooperative research between countries inevitably involves shipments of specimens, laboratory equipment, instruments, etc. Agreements facilitate such exchanges by simplifying and standardizing customs clearance and related difficulties.[115]

One particular diplomatic virtue of the bilateral science program was identified by Secretary Rogers, January 26, 1971, in a keynote address to the 12th meeting of the Panel on Science and Astronautics of the House Committee on Science and Astronautics. It was the "general policy of this Administration," he said, "to permit the exchange of unclassified scientific and technical information with the scientists and institutions of any country, *regardless of the state of our diplomatic relations with that country.*" (Emphasis supplied.) He went on to identify bilateral scientific agreements as the vehicle for such ex-

[115] U.S. Department of State, "U.S. Scientific and Technological Agreements with Other Countries," *International Science Notes*, no. 25 (September 1970), pp. 2–3.

changes. The implication, of course, was that the bilateral science agreement could be an opening wedge to the restoration of normal diplomatic relations with otherwise unrecognized states.

DISADVANTAGES

The philosopher, asked by a friend how his wife was, replied: "Compared with whom?" In like manner, bilateral science agreements need to be assessed in comparison with some other organizational arrangement for accomplishing their purposes. For example, the close and rewarding relationship on science matters between the United States and the United Kingdom does not appear to require any formal method or institution for general coordination. At the other extreme, a bilateral science agreement with Nepal would not be likely to be of great significance to either country.

Compared with multilateral science arrangements, bilaterals involve larger funding in relation to the level of scientific effort because only two countries share the costs. However, political complications of multilateral programs are likely to be more exacting.

When a large number of bilaterals are in force, each involving many U.S. mission-oriented agencies, the administrative management function becomes quite difficult and even recordkeeping is not easy.

Compared with U.S. science programs using foreign scientists recruited on a personal basis as needed for their special expertise, the bilateral is probably a more expensive and cumbersome method of sponsoring research.

In particular cases, bilaterals have been initiated in a burst of diplomatic enthusiasm only to have it appear subsequently that there was no solid scientific basis for joint action, with the result that the agreement withered but without being crisply terminated because of the diplomatic repercussions abrogation would invite. Even with some potentially useful agreements, it is possible that a decline in interest would accompany loss of funding support, or other more pressing problems would divert interest and support. In short, to be diplomatically as well as scientifically useful, the science bilateral needs to have a solid technical justification, and sustained technical and administrative support on both sides.

One difficulty was invited by the Department of State by regarding the bilateral science agreement or program as an appropriate subject for experimentation. The 28-odd arrangements now in force did not come about as a consequence of a deliberate determination that these were the best places to have such arrangements, that all were meritorious and any others would be less so. Nor was there a conscious effort to design an optimal plan that could generally be followed in each case, with only minor modifications. Planning and priorities appear to have played little role in these decisions; instead, an ad hoc approach was followed, and the designs of the agreements evolved out of the circumstances at the time.

It should also be noted that to justify the experimental nature of the design variation requires that information be drawn from the experiment. Which designs work best and why? What criteria of effectiveness have been established? What principles can be adduced? If additional bilateral science programs are proposed, by what criteria will they be evaluated and how should they be designed for optimal

effect? If there are variations in existing programs, should they be reviewed and revised to enhance their effectiveness? If there are inactive or unrewarding programs, should they be rebuilt, renegotiated, or terminated, or allowed to drag on?

One problem is that of the "ratchet effect"—the ease with which new agreements can be made, and the immediate short-term benefits they yield, as against the difficulty of funding and maintaining all of these commitments, plus the diplomatic awkwardness that results from their termination.

In this connection, the report of the Inspector General [116] noted the problem of "short institutional memory" attributable to SCI as an agency with considerable personnel mobility. Under these conditions, it would seem important that the learning process in experiments in scientific diplomacy be thoroughly documented as they proceed, to inform later generations of diplomats and administrators. In fact, emphasis on documentation of all parts of the science and technology function in the Department of State would seem essential.

Tangible Returns From Cooperative Bilateral Research and Development

A survey of benefits of cooperative science programs was summarized in a short public release by the Department of State in March 1974. Information supplied by the various participating agencies of the U.S. Government turned up "almost 200" specific cases in which international scientific cooperation had produced "tangible benefits for this country." Excerpts from this summary report follow:

Our wide-ranging and highly successful cooperative programs with Japan furnish a good example of cost savings. American researchers had concluded that manganese oxides might be useful agents for absorbing sulfur dioxide fumes released into the atmosphere when coal is burned. A research project to determine their absorptive qualities was planned. But American scientists, attending a joint meeting in Japan, as part of the U.S.-Japan Natural Resources Program learned that the studies the United States was about to undertake had already been made in Japan. The U.S. project was dropped, and we were saved an estimated $100,000 to $150,000—as against the $2,500 in air fare for the American scientists attending the Japan meeting.

A visit by U.S. Bureau of Mines researchers to the United Kindgom's National Coal Board laboratories saved as much as $1 million in unnecessary research and development tasks. For example, we would have needed at least $250,000 to develop independently information acquired from the British about coal gasification an important area of research in dealing with the energy shortage.

Our government also has saved about $8 million each year through the data received from other countries participating in the Worldwide Cooperative Network of Solar Activity. This information has made a vital contribution to the safety of our space program. Without the international data collection network, we would have had to obtain the data by using our own resources.

The United States and the Federal Republic of Germany have agreed to share the costs of HELIOS, a major, highly sophisticated program for gathering information about the Sun. In 1974 and 1975, the United States will launch toward the Sun two German built and financed satellites incorporating both American and German experiments. The Germans will pay for over half the cost of the program, expected to total more than $135 million.

A major example of cost sharing is the decision of nine European governments to design, develop, and build the first Space Lab module which will become an integral part of the U.S. Space Shuttle system. The cost of this European contribution will be about $300–$350 million. Agreements on this cooperation were concluded in September 1973, and work on the module is now underway.

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[116] See page 1372.

A new type of cost-sharing arrangement—the binational science foundation—may be used more and more to finance cooperative research programs. The first institution of this kind, a United States-Israel Binational Science Foundation, was established in the fall of 1972. Both countries are contributing the equivalent of $30 million in Israeli pounds for the foundation's endowment; Israel will pay interest on the endowment to provide the foundation its basic operating income. The foundation will sponsor research on problems of interest to the two nations.

The U.S. Bureau of Mines and the National Coal Board of the United Kingdom cooperated on a study of fluidized bed techniques to burn coal. (This is a process in which coal is burned more efficiently and so has economic and environmental advantages.) Having agreed on a division of labor the Bureau of Mines saved about $300,000 during a 2-year period alone by not having to perform research tasks carried out by the British.

Foreign scientists supported by their own countries have performed 89 investigations of the soil and rock samples the Apollo spacecraft brought from the Moon. Since the American scientists receive an average of $60,000 per investigation, the participation of foreign scientists and laboratories has saved American taxpayers more than $5 million.

Glomar Challenger, a vessel supported by the National Science Foundation, collects core samples from the ocean floor. Teams of scientists serving 2-month tours on the vessel, analyze the cores initially and produce information of great geological value. To date, about 100 foreign scientists, supported by their own governments or laboratories, have taken part in the program. They have made up about one-third of the total membership of these scientific teams.

The Soviet Union agreed to contribute the equivalent of $1 million annually to the deep sea drilling program, and contributions from other nations are anticipated.

American researchers, studying the behavior of materials at high temperatures, have used the solar furnace at Odeillo, in the French Pyrenees. This solar furnace, the largest in the world, uses a series of large mirrors and lenses to focus on the Sun's rays to produce intense heat levels for experimental purposes. We are using the French facility on a reimbursable basis.

The French have placed at our disposal two unique wind tunnels and a large rotating table. The table is used for studying tidal effects. In this fashion we have been invited to use facilities which would have cost millions of dollars to duplicate.

The National Aeronautics and Space Administration's (NASA) use of the Italian-built San Marco platform off the east coast of Africa is another illustration of savings through facilities sharing. From Cape Canaveral an expensive fuel consuming "dog-leg" maneuver is required to launch a satellite into equatorial orbit, but a smaller, less costly launcher can put payloads of comparable weight directly into equatorial orbit from the San Marco platform. NASA has used the platform on a cost reimbursable basis for this purpose, thus achieving substantial savings.

Foreign germ plasms raised crop yields by millions of dollars in the United States. A variety of Argentine peanut introduced in the United States about a decade ago increased yields by about $9 million annually. The Argentine germ plasm was later used to breed new peanut varieties of even greater yield. Today about 85 percent of the peanuts grown in the United States are types either developed abroad or types with foreign germ plasm in their pedigrees.

A Turkish variety of hard red wheat was used for breeding purposes in the United States because of its resistance to various forms of stem rust and bunt disease. In Montana alone the Turkish germ plasm has prevented wheat crop losses of $2 to $3 million annually.

Agriculture Department researchers have developed an experimental vaccine against [hoof-and-mouth] disease. Initial field tests carried out by U.S. and Latin American scientists at an international laboratory in Brazil showed the vaccine was promising. It is now undergoing additional field tests to confirm its worth and to establish how often cattle must be inoculated. Because hoof-and-mouth disease does not exist in the United States, field tests on this scale could not be performed here. So we arranged to conduct the tests in Argentina and Brazil, where the disease is prevalent. If the vaccine proves successful, these two nations will have made an indispensable contribution. No longer would hoof-and-mouth disease threaten U.S. cattle raisers with possible losses amounting to billions of dollars over the years.

Polish and Yugoslav scientists cooperating with our Agriculture Department and supported with the equivalent of about $80,000 in U.S.-owned foreign currencies have made important contributions to our understanding of how to cope with the cereal leaf beetle. Yugoslavia is now the main source of the control parasites being introduced into the United States. Agriculture Department researchers believe the parasites will end the cereal leaf beetle problem in 3 to 5 years. It has been estimated that without the parasite American farmers eventually might have had to spend $60–$100 million annually on pesticides to keep the beetle in check.

An agreement expected to be signed before the end of 1973 by the Department of Transportation and the Ministry of Transport of Italy is expected to produce this kind of indirect economic benefit. Under the agreement the Italians will give us data from their ongoing SLIM project—a program of research and development on a single-sided linear induction motor. This extremely advanced experimental motor has the theoretical potential to propel tracked air-cushioned trains or magnetically levitated trains at 300 to 400 miles an hour. In return for access to Italian work on this motor we will make available to Italian researchers the facilities of our High Speed Ground Test Center at Pueblo, Colorado. It will enable them to develop experimental data which cannot be secured through their own facility. The United States had been planning to start a research program on this type of motor in about 2 years. The agreement with Italy will save us at least 2 years in developing essential data on the possibilities of this type of motor. Equally important, the data secured should help us aim our research in the most promising directions.

About 1 million Americans suffer from Parkinson's Disease, a potentially disabling neurological disorder. Its treatment was largely ineffective until 1967, when the combined efforts of Austrian, Canadian, Chilean, Swedish, Swiss, and American scientists created L–DOPA, a drug permitting the first effective treatment of this malady. About three-quarters of those Americans afflicted with Parkinson's Disease can now look forward to fully productive lives under continuing L–DOPA therapy.

The treatment of amputees constitutes a little-known example of how Americans have benefited from cooperative international medical research. Fitting prosthetic devices has always been a long, painful process. But Polish researchers supported by our Department of Health, Education and Welfare developed new procedures to permit fitting immediately after surgery. The result: amputees return to productive pursuits an average of 8 months sooner. More than 75,000 Americans have already been helped by this dramatic advance in physical rehabilitation techniques.

As part of its program to reduce traffic fatalities, our government has entered into agreements with the Federal Republic of Germany, Italy, the United Kingdom, France, Sweden, and Japan to exchange information on the design, construction, and evaluation of experimental safety vehicles (ESV). These cars range in size and weight from small economy models to full-size sedans. Four vehicles already have been built abroad under this program, and another four are being developed. An ESV built by Fiat was recently sent to our Department of Transportation for testing. It is expected that other vehicles will be made available to us. Meanwhile, we receive the data produced by the development and testing of these foreign-built vehicles, just as the other nations receive information relating to the ESV's built for the U.S. Government by American auto makers. The Department of Transportation estimates that the foreign countries participating in the ESV program have already invested more than $100 million.

The difference between what happened when a hurricane struck Corpus Christi, Texas, in 1919 and the hurricane which hit the city in 1970 dramatically illustrates the importance of early warning. The 1919 storm struck with almost no advance warning, killing 284 persons. Corpus Christi at that time had a population of 11,000. In 1970 there was considerable advance warning before Hurricane Celia struck, and only 13 persons died, even though the city's population has increased tenfold. It is conservatively estimated that the early warning system resulting from cooperation between our weather service and those of Latin American and Caribbean countries saved about 2,000 lives during Celia.[117]

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[117] U.S. Department of State, Bureau of International Scientific and Technological Affairs, *International Scientific Cooperation—A Summary of Tangible Benefits*, General Foreign Policy Series, no. 285, Publication no. 8760, March 1974, pp. 3–6, 8–12.

Proliferation of Bilateral Programs

The numerous bilateral science and technology arrangements to which the United States is a party pose substantial problems of administrative coordination. Undoubtedly, a well planned and stoutly implemented cooperative science program yields both technical and diplomatic benefits to the participants. However, as bilateral commitments increase in numbers, with more and more U.S. agencies called upon to participate, many problems arise; e.g., coordinating all these diffused activities, funding conferences and travel, detailing personnel to plan and staff a myriad of operations here and abroad, and relating each separate set of bilateral programs to the particular (and shared) diplomatic and technical purposes for which it is intended.

A number of "bilateral science and technology agreements" are managed by the National Science Foundation. (See Table 4.) Other less formal relationships also exist at varying levels of intensity with Bulgaria, Czechoslovakia, Colombia, Costa Rica, Venezuela, and Guatemala. NSF also funds international activities of the National Academy of Sciences.[118]

THE JOINT COMMISSIONS

More recently, further cooperative devices called "joint commissions" have come into play. A letter from the Department of State to Congressman Lee H. Hamilton, December 31, 1974, listed six "bilateral commissions" as having been organized or agreed to in 1974. These were "at the cabinet level," and were with Saudi Arabia, Egypt, Jordan, Israel, India, and Iran. Other proposed commissions are currently under study. The letter describes the commissions as "diverse in character and . . . tailored to the particular interests and requirements of each partner." A general intent common to all agreements is "a mutual desire to develop a special relationship which goes beyond normal diplomatic discourse."

> With certain of these countries, we have long enjoyed close and friendly ties; we want to strengthen them. With other countries, we want to move to a new relationship of greater amity and greater maturity. We intend under these commissions to encourage connections between all elements of our society and theirs, while broadening cooperation in such fields as cultural exchange, economic and social development, and science and technology.[119]

The letter transmitted a "summary of Joint Commission Activities During 1974," indicating that some of these Commissions were still in the process of development. Excerpts from the summary follow:

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[118] National Science Foundation, *Annual Report for Fiscal Year 1974*.

The objectives of these programs, as described by NSF, are:

To improve coordination among Federal and private scientific and technical information services;

To conduct an annual assessment of the health of the scientific and technical information enterprise in the United States;

To arrange for the dissemination of the results of research supported by the Science Information Activities program;

To increase benefits from United States participation in international science information activities.

While administratively complex, the NSF-managed agreements do not entail very heavy management costs. The 1976 budget authorization recommendation for this activity was $8 million mainly for "cooperative research projects, seminars, and exchanges of scientists with 19 countries." (These included the 14 bilaterals managed by NSF, cooperative activities with 5 other countries, and support for the NAS international program.) (Source: U.S. Congress, House, Committee on Science and Technology, *Authorizing Appropriations to the National Science Foundation*, House Report No. 94-66, 94th Cong., 1st sess., March 14, 1975, pp. 121-123.)

[119] U.S. Congress, House, *Congressional Record*, 94th Cong., 1st sess., 1975, 6, p. E148.

Saudi Arabia

The joint statement of June 8, 1974 establishing two bilateral commissions discusses the aims of the two governments. Under the Joint Commission on Economic Cooperation several dozen technical experts have gone to Saudi Arabia to assess the situation, investigate areas in which economic cooperation would be useful, and discuss possible programs with the Saudi Government. The joint working groups established under the commission have all met at least once to examine the same questions on a broad basis. Both governments are now reviewing the experience gained during the past 6 months and digesting the reports of individual experts and teams. A preparatory meeting will take place January 5-6, 1975, in Riyadh to review developments jointly, and lay the groundwork for the first meeting of the Joint Commission in February. It is expected that technical advice provided by the U.S. Government to the Saudi Arabian Government will be on a fully reimbursable basis.

Egypt

The texts of the joint communiques of June 14 and August 19, 1974, discuss in considerable detail the work program of the Joint Commission and the aims of the two governments. The results of the Joint Commission meetings held in June and August were reviewed in these communiques. Passage of the Foreign Assistance Act in December 1974 provides the basis for funding a number of the activities planned the auspices of the Joint Commission.

Jordan

The Joint Commission has formalized and consolidated the close cooperation which has characterized U.S.-Jordanian relations. Both security and economic considerations fall within the scope of the Joint Commission's responsibilities. We do not expect the Joint Commission to change the character of our relations, but it will strengthen them along the existing lines.

Israel

The subcommission formed under the auspices of the Joint Commission all have an economic orientation, and have each met once or twice during the past few months. The work of the subcommission shares a common aim; to broaden to the private sector already close U.S.-Israel economic relations. The first meeting of the Joint Commission is scheduled to be held January 27-28, 1975, in Washington.

India

The text of the October 28, 1974, agreement establishing the U.S.-India Joint Commission discusses the purposes of the two governments. Meetings are expected to be held as follows:

January 20–21, Washington: Economic and Commercial Subcommission.
January 27–29, Washington: Scientific and Technological Subcommission.
February 3–5, New Delhi: Educational and Cultural Subcommission.
March, Washington: Joint Commission meeting.

Iran

Through the Joint Commission we seek to enter into a partnership of equals across a broad spectrum of activities. It is expected that technical assistance provided by the United States Government to Iran under the auspices of the Joint Commission will be on a fully reimbursable basis. The five or more committees formed under the Joint Commission are expected to hold their first meetings during January and February, looking toward a meeting of the Joint Commission in March.[120]

Efforts To Coordinate Bilateral Science Agreements

Under the guidance of the Bureau of Science and Technology, Department of State, an effort was made in 1972 to rationalize and systematize the management and operation of the various bilaterals. At that time (Jan. 27, 1972) "Guidelines for Executive and Participating Agencies in Bilateral Agreements for S&T Cooperation"

[120] Ibid.

were promulgated by the International Committee of the Federal Council for Science and Technology. The following provisions were set forth in the guidelines:

RESPONSIBILITIES OF THE EXECUTIVE AGENCY

1. The Executive Agency participates with the Department of State in the negotiation of the agreement and provides the technical and program guidance in its drafting and execution.

2. In conjunction with other interested agencies and organizations the Executive Agency plans U.S. participation and activities in implementation of the agreement.

3. The Executive Agency provides broad coordination of the activities of participating agencies and other organizations so that agency program objectives and priorities will be consistent with the terms of the agreement.

4. The Executive Agency serves as the focal point for communication with its foreign Executive Agency counterpart, and helps facilitate counterpart agency approval of program activities undertaken by participating agencies and other organizations.

5. The Executive Agency makes a reasonable attempt to arrange financial support required for an appropriate level of U.S. participation and will, insofar as possible, seek funds to provide core support for the program. When necessary, the Executive Agency will, insofar as possible, provide "seed money" for the planning and initiation of participating agency activities.

6. With the cooperation of the participating agencies and other organizations, the Executive Agency submits an annual report to the Department of State on activities carried out under the agreement, and periodically evaluates these activities and the agreement. The Department of State will consult with the Executive Agency on courses of action to be taken, including recommending termination or continuation of the agreement.

RESPONSIBILITIES OF THE PARTICIPATING AGENCIES

1. Participating agencies will develop and provide to the Executive Agency in a timely manner program plans for participation in the agreement within the scope of their mission responsibilities.

2. Coordinating with the Executive Agency, participating agencies will develop and implement agreement activities with counterpart organizations. They wil, keep the Executive Agency regularly informed about the status of such activitiesl and will furnish the Executive Agency with such information as it may require for the purpose of preparing reports and making evaluations.

3. Participating agencies will, where possible, provide the financial support and staff needed to inaugurate their activities under the agreement. Subsequently they will budget for continued participation in the agreement.

TABLE 4.—BILATERAL SCIENCE AND TECHNOLOGY AGREEMENTS MANAGED BY NSF

[Number of approved activities fiscal year 1974]

Country	Visiting scientists		Seminars	Cooperative research projects
	United States	Foreign		
Argentina	2			
Australia	5		7	1
Brazil	7		1	9
Republic of China	12		4	6
France	16	13		1
Hungary	6	2	1	5
India	14	18		
Italy	8		4	24
Japan	8		28	29
Mexico	9			7
New Zealand				
Romania	13	17	2	13
Spain			5	18
United Soviet Socialist Republic			2	65
Total	100	50	54	178

Source: National Science Foundation, "24th Annual Report for Fiscal Year 1974" (January 1975), p. 62.

THE NEED FOR FURTHER RATIONALIZATION AND COORDINATION OF BILATERALS

So numerous have these agreements become, and so diffused the responsibilities for cooperative overseas programs of U.S. agencies, that the time seems appropriate for a general review of the mechanism of bilateral science and technology cooperation. Agreements are easy to make, costly and time-consuming to implement, difficult to keep track of, duplicative in effects, and painful to terminate. Federal agencies find themselves committed to programs abroad for which no funds can be obtained for support. Expectations are likely to run ahead of performance. In some cases, of course, there are tangible economic benefits in terms of dollar saving from joint or collaborative researches, valuable results, and shared facilities. But only by a vigorous and competent management, supplied on an overall basis by the executive branch, can these agreements ultimately be assured of yielding more good than harm. Only if programs are carefully planned, on a joint basis, toward explicit and useful tasks, with assured leadership, personnel, and funding, can the product justify the effort. It is understood that a review of this general problem was underway in the Executive Office of the President, under the general supervision of the Under Secretaries Committee of the National Security Council, early in 1975. It is possible that further congressional attention to this matter might also be appropriate.

VII. Science, Technology, and the Foreign-Policy-Making Process

Up to this point in the study the emphasis has been on the operational aspects of science and technology in the Department of State. The purpose of this chapter is to explore a few of the many problems of policy planning and decisionmaking, as these relate to the subject of the study. To lay the groundwork for the discussion, a brief digression into the mechanisms of international policymaking may be helpful.

Inherent Incompleteness of State Department Mission

As the late Dean Acheson pointed out, the Supreme Court has ruled, and the Senate Committee on Foreign Relations in 1800 reported: The President alone has the power to represent the Nation, to negotiate treaties, and to decide when to do so and upon what subjects. Accordingly, "neither the Constitution nor the law binds the President to monogamous cohabitation with the Secretary and Department of State in the conduct of foreign affairs." [121] Acheson traced the influence of the Department through the 19th Century ("not much to do"), through the period of the 1920s when the Secretary was given a "free hand" ("not * * * much improvement"), neglect during the Roosevelt years ("horse and buggy"), a brief period of effectiveness under Secretary Marshall ("sound enough to provide policy through the next administration and beyond"), "purges" under Secretary Dulles (leaving "more form than substance"), neglect again under President Kennedy ("no professional departmental staff could be trusted"). The substance of the recital is that the role of the Secretary and the Department of State are determined by the interests and style of the President, and the nature of the international problems that confront him. Also, the distinction between "an adviser at the elbow" of the President and a "minister of foreign affairs" means that they can seldom be one and the same person.[122]

MINORITY PARTNER IN OVERSEAS OPERATIONS

The other gap in the mission of the Secretary of State is the incompleteness of his jurisdiction over U.S. foreign operations and contacts. As one analyst has observed: "when the main ingredients of an agenda [in diplomatic negotiations] are military, economic, financial, technological, or legal, the harassed generalists of the Department can usually contribute so little in the way of substance that they are hopelessly dependent on the experts of other departments." However, the principal limitation is the Department's "lack of control over the overseas programs and activities that are now the real instruments of policy execution." In fact:

> Since the end of World War II, the deployment overseas of large United States land, sea, and air forces has been both a major instrument of policy implementation and a source of involvement in foreign international affairs. Our military and economic assistance programs—now chiefly centered in the less developed

[121] Dean Acheson, "Eclipse of the State Department," *Foreign Affairs* 49, no. 4 (July 1971), pp. 593–594.
[122] Ibid., pp. 597–604.

countries—are also important arms of policy and sources of overseas involvement . . . . At least two other agencies—Defense and CIA—are fully the equals of State in power and influence, not only within the Executive Branch but on Capitol Hill; while AID, USIA, and the Disarmament Agency, although nominally part of State, are in fact semi-autonomous organizations, with separate budgets, personnel hierarchies, and top-level management by energetic, independently-minded political appointees.

And, concludes the analyst: "The truth is that the growing complexity of the international environment renders not only the State Department but every other single agency of government incapable of coping with the full range of international problems."[123]

Policy Planning Organization and Reorganization

Considerable effort has been expended since 1950 to strengthen the resources and influence of the Department of State in diplomatic policy planning, decisionmaking, and policy implementation. One of the most successful of these, in the opinion of Dean Acheson, was the postwar reorganization by General Marshall: "Lines of command were clarified and the Under Secretary made chief of staff; line duties separated from staff duties; supervision was made effective through the Central Secretariat; planning—looking around, ahead, and behind—confided to a competent staff; research and intelligence centralized."[124]

During the administrations of President Eisenhower, John Foster Dulles as Secretary of State made a determined effort to free himself from the details of management and to free his Department from the obligations of operational functions. At the same time an elaborate policy structure was erected within the National Security Council to massage as thoroughly as possible the issues that were to go to the President. As President Kennedy prepared to take office, an extended study was underway by the Subcommittee on National Policy Machinery of the Committee on Government Operations under the chairmanship of Senator Henry M. Jackson. Under the general heading of "Organizing for National Security," the subcommittee issued a series of reports that repeatedly called for a strengthening of the policy planning resources of the Department of State.[125] In his final state-

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[123] Charles Maechling, Jr., "Our Foreign Affairs Establishment: The Need for Reform," *The Virginia Quarterly Review* 45, no. 2 (Spring 1969), pp. 200-202.

[124] Acheson, "Eclipse of the State Department," *Foreign Affairs*, p. 601.

[125] For example, in the Committee Print, U.S. Congress, Senate, Committee on Government Operations, *The National Security Council*, 86th Cong., 2nd sess., November 12, 1960, p. 9:

> The Secretary of State is crucial to the successful operation of the Council. Other officials, particularly the Secretary of Defense, play important parts. But the President must rely mainly upon the Secretary of State for the initial synthesis of the political, military, economic, and other elements which go into the making of a coherent national strategy. He must also be mainly responsible for bringing to the President proposals for major new departures in national policy.

And in a second staff study, U.S. Congress, Senate, Committee on Government Operations, *Super-Cabinet Officers and Superstaffs*, 86th Cong., 2nd sess., November 16, 1960, p. 9:

> If the President is to ask more, and to get more, from the Secretary of State, the Secretary must be better staffed to offer policy guidance and initiatives across the whole span of national security problems. This does not mean a larger Department of State; it may well mean a smaller one. But it does mean a Department competently staffed with generalists, economists, and military and scientific experts to support the Secretary in understanding and following all fields falling within his broad concern.

Again, in a third staff study, U.S. Congress, Senate, Committee on Government Operations, *The Secretary of State and the National Security Policy Process*, 87th Cong., 1st sess., January 28, 1961, p. 8:

> State does not require large staffs of "house technicians" in every narrow specialty bearing upon foreign policy. But the Secretary does need, in his own family, more first rate experts in economics, science and technology, intelligence, and military matters who can interpret their specialities in terms of his needs. . . .
>
> State's need for broadened staff competence is perhaps most acute in the area of military and scientific-technical problems. . . .
>
> If competently manned to take into account the entire range of the problems of our foreign relations, the Planning Staff can give the Secretary continuing counsel on basic strategic policy not likely to be provided by other parts of the department.

ment, Senator Jackson declared that "No task is more urgent than improving the effectiveness of the Department of State."

In our system, there can be no satisfactory substitute for a Secretary of State willing and able to exercise his leadership across the full range of national security matters, as they relate to foreign policy. The Secretary, assisted by his Department, must bear the chief responsibility for bringing new policy initiatives to the President's desk, and for overseeing and coordinating our manifold foreign policy activities on the President's behalf.

State is not doing enough in asserting its leadership across the whole front of foreign policy. Neither is it doing enough in staffing itself for such leadership.

State needs more respect for comprehensive forward planning. The Department as a whole attaches too little importance to looking ahead in foreign policy, and is too wedded to a philosophy of reacting to problems as they arise. The Policy Planning Council is not now in the mainstream of policymaking.

State needs more officials who are good executive managers—and who are broadly experienced in dealing with the full range of national security problems which now engage the Department. The administration of foreign policy has become "big business." This places a high premium on the ability to manage large scale enterprises—to make decisions promptly and decisively, to delegate, and to monitor.

This need for "take charge" men is particularly urgent down through the Assistant Secretary level and at our large missions abroad. Round pegs in square holes are a luxury we cannot afford.[126]

An appeal for a more active role in the strategic diplomatic use of science and technology was voiced in 1965 by Dr. Killian in an address to the first science seminar held by the Foreign Service Institute. He said:

All of us—whether we be in the scientific, academic, or government communities in this country and abroad—are still in the kindergarten stage in really understanding how to use science and technology in foreign affairs. There is the diplomatic opportunity to grasp a powerful new lever to advance our national interest in the world arena. The United States has exceptional technical resources that are understood all over the world, both by advanced peoples and by less-advanced peoples. This scientific and technological strength is among the most conspicuous, most admired, and most persuasive features of the American landscape—more so, to other peoples, than even our cherished democratic system. In this striking fact, in the worldwide appreciation of the quality of our science and technology and the education which supports it, lies a unique diplomatic opportunity, if we can but cultivate the complicated skills and understanding required to exploit it, and create the conditions where these skills are really utilized in agencies concerned with affairs abroad. The power of our science and technology to serve national goals also presents to the State Department a compelling reason to pursue policies designed to maintain and augment this quality.[127]

However, by 1969, a critic observed from a review of contemporary literature that: "As President Kennedy became disenchanted with the State Department, he relied increasingly on his own staff for coordination in selected policy areas." According to this source:

The Kennedy regime overloaded the small White House staff, drawing both President and staff into detailed and distracting administration, without compensating progress in the establishment of guidelines for lower-echelon action. Agency resources were ignored or underutilized. Crisis management was impaired as the Kennedy system experienced difficulty in responding to more than one sensitive area at a time, a problem that became acute under the Johnson Administration as the Vietnam War grew progressively intractable.[128]

Reorganization of the Foreign Service to meet the demands of modern diplomacy has been a favorite sport for a long time. There

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[126] U.S. Congress, Senate, Committee on Government Operations, *Organizing for National Security: Final Statement of Senator Henry M. Jackson, Chairman*, 87th Cong., 1st sess., November 15, 1961, p. 4. (Committee print.)

[127] J. R. Killian, Jr., "Science in the State Department: A Practical Imperative," *Bulletin of the Atomic Scientists* 21, no. 5 (May 1965), p. 13.

[128] Edward A. Kolodziej, "The National Security Council: Innovations and Implications," *Public Administration Review* 29, no. 6 (November/December 1969), p. 578.

have been about 12 such actions since World War II.[129] The problem is a doubly intractable one: with the support of his staff the Secretary of State must somehow deliver credible advice to the President on high policy under the scrutiny of the Secretary of Defense and his staff, the other members of the National Security Council, and the President's own White House staff; he must also exercise policy coordination of the overseas activities of nearly 20 departments and agencies. The literature is replete with criticisms of the performance of the Department of State in both directions, and with suggestions for further reorganization to set things right. Much of the attention is directed toward the Policy Planning Staff.

Writing in 1964, Roger Hilsman was critical of the track record of the Policy Planning Staff.

> New and better knowledge is needed, but how can it be developed? Certainly the attempts to institutionalize the effort within government have not been very fruitful. It was this need for knowledge and foresight, according to Dean Acheson, that led General Marshall when he was Secretary of State to establish in 1947 the Policy Planning Staff, a group of about a dozen top-level specialists under an assistant secretary. But in practice, the Policy Planning Staff did not work out to be the panacea some had hoped for. It proved to be a useful pool of talent that could be tapped in time of crisis. . . . Its members have also contributed "thinkpiece" memoranda, which have been neither better nor worse, on the average, than similar thoughtful memoranda written in the action bureaus, in the intelligence agencies or by outside scholars and writers. But none of this, no matter how well done, fulfills the concept of a "planning" staff, and yet beyond this the Policy Planning Staff has done very little.

To Hilsman, "long range planning in foreign affairs" was not drawing blueprints for future operations but "analyzing the nature of the problem and making broad strategic choices for dealing with it." It was distinguished from short-range planning—"working out the moves and countermoves in the midst of an ongoing situation." Both of these, he said, "are at the political heart of policymaking." Moreover, for good and sufficient reasons policy is the product of a political process rather than one of pure *logic* in a vacuum. Accordingly, attempts at institutionalizing the complete process are likely to fail. "New and better knowledge" can have many sources but the process of applying it to foreign policymaking is a "groping effort at understanding the nature of the evolving world around us."

> But important though the results of these kinds of effort might be in the long run, the immediate results would not be any very dramatic improvement in United States foreign policy. The making of foreign policy is a groping effort at understanding the nature of the evolving world around us. It is a painful sorting out of our own goals and purposes. It is a tentative, incremental experimentation with various means for achieving these purposes. It is an unremitting argument and debate among various constituencies about all of these questions and an attempt to build a consensus on how the United States as the United States should decide on these questions and what action it should take. And none of these several activities is the kind that will yield to organizational or institutional gimmicks.[130]

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[129] Ibid., p. 601.

[130] Roger Hilsman, *To Move a Nation: The Politics of Foreign Policy in the Administration of John F. Kennedy* (New York: Dell Publishing Co., A Delta Book, 1964), pp. 566–568. However Hilsman also observes (p. 18):

> So whether one thinks a certain organizational arrangement is "good" or "bad" depends on what one thinks of the kind of policy it facilitates. And this, too, has its repercussions. We have said that policy-making is essentially a political process, by which the multiplicity of goals and values in a free and diverse society are reconciled and the debate over means and ends is distilled into a politically viable consensus on a workable policy. But if some organizational arrangements facilitate certain kinds of policy and other arrangements facilitate other kinds, then organization is also politics in still another guise—which accounts for the passion that men so often bring to procedural and organizational matters.

The problem with foreign policy is like Mark Twain's remark about the dictionary—"interesting reading but kind of various." All kinds of missions interact. Policy merges with operations. Short-range policies tend to shape and prejudge long-range policies. Long-range studies have important bearing on short-range policy decisions. Political questions merge with economics—and equally with technology.

> Effective foreign policy depends on the capacity to predict events in the social affairs of men, and a better capacity to predict would mean better and more effective foreign policy. But more is required than simple factual information.[131]

It would seem that forecasting the future diplomatic environment and its problems is vastly more than political divination: the arcane art of sorting out human motivations is often furthered by asking the economic question—who benefits? Another area with great predictive power is technology, which determines what is or is becoming technically practicable. A policy planning staff needs to be able to combine expertise in these three areas of politics, economics, and technology. Most problems of foreign policy involve all three.

The Nature of the Foreign Policy Planning Process

Taken as a whole, long-range policy planning appears to consist of an iterative set of steps leading to decisionmaking on specific issues to achieve progress toward national goals in the face of the prevailing circumstances and within the limits of available resources. The process is iterative because some information is needed to identify the issues to be analyzed, and the analysis of issues requires further information. However, in general the information needs consist of at least the following:

—An understanding of the total decisionmaking process involved;

—A formulation of relevant national goals;

—A characterization of present and probable future prevailing circumstances;

—The relation of the issue in question to all of these; and

—An elaboration of the factors that define the changing nature of the issue.

The decision process itself seems to involve—apart from the continuing review of the information inputs:

—Selection of a salient issue for analysis on the basis of general criteria of importance and probable future urgency;

—Integration of the parts of the information available bearing on the issue and the search for further information;

—Analysis of the information to identify the decisive elements;

—Formulation of alternative possible courses of action;

—The ordering of the information in relation to the alternatives;

—Evaluation and comparison of alternatives as to probable costs and benefits, technical feasibility, and political acceptability; and

—Selection of one or more preferred alternatives for further analysis and presentation to the ultimate decisionmaker.

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[131] Ibid., p. 565.

To conduct the strategic planning to design the future diplomatic posture of the United States in the face of the numerous challenges of global technology[132] would seem to require a staff capability in either the White House, or the Office of the Secretary of State, or both, with the following characteristics:

1. Knowledge about technological trends to obtain early knowledge of what is likely to be technically feasible and also diplomatically important.
2. Enough technical sophistication to identify aspects of an ongoing development (i.e., the diplomatic counterpart of "technology assessment") to determine what might be done to enhance beneficial diplomatic consequences or minimize adverse diplomatic consequences.
3. An early understanding of specific items of new technology (wherever developed) that has a probability of perturbing the international balance of power, destabilizing local societies, or introducing significant economic developments.
4. An appreciation of the possibilities of beneficially reacting to foreseen technological developments by diplomatic means.

Clearly, policy planning requires a wide variety of information flows, and the skills of a well-informed generalist, and the immediate availability of a technically competent interpreter of the scientific or technological content of the information.

Ever since World War II technology has been of increasing importance for U.S. diplomacy. How important is it today for the future diplomatic posture of the United States?

Importance of Science and Technology for Foreign Policy Planning

What proportion of the really important diplomatic issues that have arisen since 1945 have a significant technological content? Actually, it is not easy to find very many that are not somehow involved with technology—issues that come to mind might include:

Nuclear weapons control, tests and nuclear power development;
Military hardware and its deployment;
Space, tracking, communications, observation, and sharing;
Foreign aid and technical assistance;
Technology transfer;
Food;
Pollution and environmental issues;
Antarctic exploration;
World health and disease control; and
International air transport.

A panel of the United Nations Association of the United States of America,[133] in 1973, identified "10 basic issues of a global character

[132] The historical diplomatic importance of technology was explored in an earlier study in the series. See: U.S. Congress, House, Committee on Foreign Affairs, *The Evolution of International Technology*, in the series, Science, Technology, and American Diplomacy, prepared for the Subcommittee on National Security Policy and Scientific Developments by Dr. Franklin P. Huddle, Senior Specialist in Science and Technology, Science Policy Division, Congressional Research Service, Library of Congress, 1970. See vol. II, pp. 607–680.

[133] The Panel was chaired by Howard C. Petersen, Chairman of the Board, The Fidelity Bank, Philadelphia, and its 21 members included: David E. Bell, Executive Vice President, The Ford Foundation; Richard Newell Cooper, Provost, Yale University, and Frank Altschul, Professor of International Economics, Formerly, Deputy Assistant Secretary of State for International Monetary Affairs; Thomas L. Hughes, President, Carnegie Endowment for International Peace, Formerly, Assistant Secretary of State; George B. Kistiakowsky, Professor Emeritus, Harvard University, Formerly, Special Assistant to the President for Science and Technology, and Member, President's Science Advisory Committee; Francis O. Wilcox, Dean, School of Advanced International Studies, Johns Hopkins University, Formerly, Assistant Secretary of State for International Organization Affairs; Adam Yarmolinsky, Ralph Waldo Emerson University Professor, University of Massachusetts, Formerly Deputy Assistant Secretary of Defense for International Security Affairs. The report of the panel was titled *Foreign Policy Decision Making: The New Dimensions* (New York: U.N. Association of the U.S.A., May 1973), 108 pp.

which the Panel considers of central importance." All but item 6 were directly technological in character, and the exception had numerous technological implications. The 10 items were:

1. The depletion of and the need to conserve critical natural resources—including the question of future sources of energy.
2. The developing competition for the resources of the oceans and the type of international regulation of access and competition which will be required.
3. The possibilities of weather modification and inadvertent climate modification as these bear on the ecological system, including agricultural production and human settlements
4. The implications of world population growth—from 1.6 billion in 1900 to an anticipated 6.5 billion by the year 2000.
5. The widening economic gap between the developed and the less developed countries—under the impact of a science and technology centered principally in the industrial areas
6. The unresolved trade, tariff, and balance of payments questions, and the urgency of creating an improved international monetary system.
7. The implications for the international community—both the developed and the less developed countries—of the growth of multinational corporations, and the need for the development of international guidelines.
8. The impact of instant international communications and the international implications of direct broadcasting from satellites into home receivers.
9. The need for strategic and conventional arms agreements as a basis for bringing escalating national defense budgets under some form of control and reducing the dangers of nuclear and non-nuclear war.
10. The urgent need to build into the proliferating international institutional structure new measures for the settlement of disputes and conflicts which are likely to arise over the type of issues outlined above—as a means of moving toward a more stable international system.[134]

It is hard to know how literally to read the various statements by a succession of Secretaries of State and their subordinates when they periodically assert the importance of science and technology for diplomacy. The roster of problems, issues, and instances that can be collected from such statements is impressive. But the effort to marshal the Department's resources to deal with this array of business does not seem commensurate with the demand.

Proposals to strengthen the policy planning resources of the Department are numerous. Some students propose to place the science and technology part of the policy planning function in the science office. Skolnikoff, for one, urges this, although he also suggests at one point that the function would be "possibly working in conjunction with the Policy Planning Council, which would be the logical first recipient for the information." [135]

Writing in 1969, Edward J. Kolodziej saw the position of the Secretary of State as weakened by the reactivation of the National Security Council (NSC) by President Nixon. At the same time the enlargement of the planning staff (or as it was then called, the "Planning and Coordination Staff") might buttress the Department but complicate the Secretary's relations with the Under Secretary. As he said:

While the institutional position of the Secretary of State appears to be decreasing, that of the Under Secretary of State may be increasing. The recent reorganization of the State Department Policy Planning Council [in July 1969], renamed the Planning and Coordination Staff, and its expansion from approximately 15 to 20 members suggests this possible development. The staff will be loosely divided into two groups for planning and operations, roughly reflecting the distinction

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[134] United Nations Association of the United States of America, National Policy Panel, *Foreign Policy Decision Making: The New Dimensions* (New York: U.N. Association of the U.S.A., May 1973), pp. 15–16.
[135] Skolnikoff, op. cit., pp. 273–281, and especially p. 275.

already institutionalized in the NSC system. While the new organ will report directly to the Secretary of State, the largest beneficiary is the Under Secretary, who is afforded increased staff assistance to oversee State Department operations and to keep pace with matters coming before the Review Group and the Under Secretaries Committee. The Planning and Coordination Staff is to serve the Seventh Floor of the Department of State. Its participation in foreign and security policy can be expected, correspondingly, to be initially shaped and guided by State Department, rather than by NSC system pressures. Its work has already been placed under tighter State Department control. The access of the NCS staff and the President's Special Assistant to the papers of the Planning and Coordination Staff formally passes through the State Department. The more direct access characterizing the initial practices of the NSC system has now been curtailed to some degree. These changes tend to reinforce the autonomy of the State Department although how much they will buttress its apparently sagging institutional position in the NSC system is difficult to predict at the moment.[136]

Other students have suggested reducing the size of the planning staff and bringing it into closer association with the Secretary, or transferring the function to an interdepartmental or White House Policy Council. All these suggestions, and the periodic changes in the planning staff itself, suggest that the Department and its friends have not yet reached a consensus on how the planning staff should be organized, where its product should be directed, or what its product should be. In view of the growing volume of scientific and technological issues in the portfolio of diplomatic business, resolution of the matter of a well conceived and accepted policy planning staff has bearing on the subject of this study.

Policy Planning Staff, Departmental "Think Tank"

When it was first created in 1947, by Secretary Marshall, the Policy Planning Staff was assigned five functions:

1. Formulating and developing, for the consideration and approval of appropriate officials of the department, long-term programs for the achievement of U.S. foreign policy objectives.
2. Anticipating problems which the department may encounter in the discharge of its mission.
3. Undertaking studies and preparing reports on broad political-military problems.
4. Examining problems and developments affecting U.S. foreign policy in order to evaluate the adequacy of current policy and making advisory recommendations on them.
5. Coordinating planning activities within the Department of State.

By 1960 the policy planning institution was 13 years old. At this time an assessment by a group at the Brookings Institution was critical of the planning apparatus that had evolved over these years. Too many people wanted to influence the planning. Planners were discouraged from challenging prevailing doctrine. Speech writing and the NSC paper mill consumed time and energy. The Brookings study, performed at the request of the Senate Committee on Foreign Relations, saw the policy planning task as one of "looking ahead to identify major problems, to appraise alternative approaches, and to recommend preferred courses of action." The rapidity of change in the world environment made the task more difficult. The concept had always

[136] Kolodziej, "The National Security Council," *Public Administration Review*, p. 580.

been that of a small, highly qualified staff of advisers to the Secretary. However, their very quality occasioned diffusion of their resources:

While the performance and influence of the staff have varied considerably, certain difficulties have plagued it through most of its existence. As a small group of able officers, its members are frequently drafted for operational duties, such as writing speeches and current policy statements. Such activities can be useful in keeping the staff in touch with current affairs, but they have considerably reduced the time available for thoughtful consideration of longer range problems, as have the burdens involved in servicing the Department of State's participation in the National Security Council.

Thus the Policy Planning Staff devotes only a limited portion of its limited resources to the task of long-term, broadly focused consideration of major foreign policy problems. Yet it continues to be, on the whole, a competent group of officials respected within the Department. Its papers do not usually have wide circulation in the Department, but there are established contacts with the various regional and other bureaus. It has a good working relationship with the Department's Bureau of Intelligence and Research. There are also continuing, informal contacts with the Joint Staff and the Office of International Security Affairs in the Department of Defense. . . .

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Clearly, many officials involved in the foreign policy process already engage in considerable long-range thinking. Much of it is unsystematic and unsustained; nevertheless, intelligent policymaking in the present obviously rests on assumptions, whether implicit or explicit, about the future. The question now being asked is whether this kind of analysis can and should be improved in both quality and quantity. Many policymakers, and many outside the policy process, feel that the fairly general projections that they make into the future represent about as much as can usefully be done. They point out that some modest contingency planning has already been done. But they feel that the scope, dynamism, and complexity of the factors that comprise international affairs are so great that it is difficult to look very far ahead with any useful degree of precision.[137]

During the Kennedy years, the Policy Planning Staff was changed to a Council and its functions were prescribed as follows (paraphrase):

> To advise and assist the Secretary and other senior officials in evaluating current foreign policy, in the formulation of long-range policies, and in the coordination of planning activities of the Department with other interested departments and agencies.[138]

A rather critical account of the planning staff's operations in the 1960s complained that "concern for current events was virtually exclusive."

Excerpts:

It always worked on the most important problems of the moment, but planning, prediction, and a true concern for the significance of long-range developments were honored rhetorically and ignored in practice. (p. 459)

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Dean Rusk, either because of his low regard for the staff or because of traditional views about how the Department should function, turned only to his geographical and functional bureaus for policy advice. (p. 459)

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As timed passed, however, it gradually lost its direct relationship with the Secretary of State, and came into increasing conflict with the operating bureaus of the Department. The reputation and influence of the Staff, especially under its last two directors in the 1960s, gradually sank, and its disappearance in 1969 was

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[137] H. Field Haviland, Jr., with the collaboration of 11 others, *The Formulation and Administration of United States Foreign Policy*, a report for the Senate Committee on Foreign Relations (Washington, D.C.: The Brookings Institution, 1960), pp. 97–98, 100.

[138] U.S. Department of State, *U.S. Department of State Organizational Manual* (also known as *Foreign Affairs Manual*), March 14, 1967, p. FAM 210, item 1.

scarcely noticed. (p. 459) (It was incorporated at that time as a planning and coordinating staff in the Office of the Secretary)

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The impact of long-range planning staff, in the short run, must come from questions about the ideas and assumptions that guide the policymaker; and in the long run, from its ability to discuss probable boundaries of the emerging international system, as well as the possible consequences of short-run actions. (p. 462)

The conclusion of this analysis is not sanguine about the future of foreign policy planning. It is unlikely to succeed because those in power do not believe in it. Thus:

We must be pessimistic about the possibility of change. . . . The creation of a long-range planning staff committed to taking the future seriously could be an important innovation. It would add new and different voices to a political process that has lost direction, self-confidence, and, most critically, its sense of legitimacy. Nevertheless, even if this planning staff was created, it would be naive to assume that it, or any other institution, which is merely added to the old political system, could have a fundamental impact on how we conduct our political affairs. Institutional reform is not by itself sufficient to create basic change unless it is accompanied by changes in professional belief systems. New institutions must be staffed by men who understand and believe in their purposes. For that to happen, we must change the minds of practitioners who believe that planning is a waste of time and of theorists who believe that involvement in practical affairs is sinful.[139]

A more optimistic view is that human performance and human relations are always more important than organizational boxes and flow charts. Planning is likely to continue, whether or not there is a congestion of other duties, or explicitly assigned functions. The problem is to assure that broad-gauge thinking and its product are reasonably concentrated and that decision makers give them access. It is also important that the policy planners have time to think, that they are in good communication with specialists whose expertise is pertinent, and that they do not ignore the intellectual explorations of the academic community.

Present Organization and Functions of the Policy Planning Staff

The frequently voiced criticism that the Department of State was excluded from the main stream of foreign policy and national security policy during the early 1960s was answered—at least on paper—by the President's action, September 22, 1973, appointing Dr. Henry Kissinger Secretary of the Department while retaining the title of Assistant to the President for National Security Affairs. Assignment as Secretary gave him the resources of a large field staff, regional and functional bureaus, and the Policy Planning Staff; he could take the experience and special knowledge of a large team of Assistant Secretaries, the most recently created being the head of the Bureau of Oceans and International Environmental and Scientific Affairs. As Presidential assistant he had direct contact with the Chief Executive and other members of his advisory staff in the White House as well as lateral assistance from the several White House Councils, and was himself the Director of the National Security Council staff numbering about 70. (See Table 5.) As either Secretary or Assistant to the President, he had access to the resources of the Central Intelligence Agency and other elements of the intelligence community.

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[139] Robert L. Rothstein, "Planning in Foreign Affairs," *Policy Sciences* 4 (1973), p. 464.

TABLE 5.—NATIONAL SECURITY COUNCIL STAFF POSITIONS

	1974 actual	1975 estimate	1976 estimate
GS-18	4	4	4
GS-17	4	7	7
GS-16	3	1	1
GS-15	8	6	6
GS-14	9	5	5
GS-13	4	2	2
GS-12	4	4	4
GS-11	6	3	3
GS-10	4	5	5
GS-9	12	16	16
GS-8	9	6	6
GS-7	4	7	7
GS-6	5	3	4
GS-5	3	3	2
Total permanent positions	79	72	72
Unfilled positions, June 30	−10	−2	−2
Total permanent employment, end of year	69	70	70

Source: The budget of the U.S. Government fiscal year 1976, appendix.

The contacts between the White House system and the Department of State have been further strengthened by the composition, formal assignments, and informal contacts linking the Policy Planning Staff with the National Security Council. Thus, Wreatham E. Gathright of the Staff is staff director of the Under Secretaries Committee of NSC. Winston Lord, director of the Policy Planning Staff, chairs the NSC Contingency Planning Working Group. And in general, all members of the staff relate closely to the NSC staff and contribute to its operational programs. Lord and one of his two deputies (Samuel W. Lewis) served under Secretary Kissinger on the NSC staff, and the other deputy (Reginald Bartholomew), was director of policy plans and NSC affairs in the Department of Defense.

The Policy Planning Staff, currently numbering about 30, finds itself involved in an extensive array of scientific and technological problems, issues, and fields of concern. The principal member of the staff for scientific and technological affairs is Mr. Gathright, but at least eight other staff members have technical assignments as a part of their work (see Table 6).

TABLE 6.—*Members of the Policy Planning Staff Concerned With "Science and Technology Related" Problems* [1]

Michael H. Armacost—Japan.
Harry C. Blaney—Law of the Sea, environment, population, energy.
Luigi Einaudi—Latin America.
Charles R. Frank—economic problems of Less Developed Countries.
Wreatham E. Gathright—general overview; technology policy; outer space; environmental modification; U.S.-Soviet agreements; nuclear tests; arms control.
Jerome H. Kahan and Jan Kalicki—nuclear energy, non-proliferation.
C. William Kontos—development, Joint Cooperation Commissions (Middle East/South Asia), U.N.
Robert H. Morris—food, energy, raw materials.
Charles Zemach—SALT, arms control.

[1] Source: Department of State.

An enthusiastic endorsement of the "new" Policy Planning Staff is offered by James Reston in the *New York Times*. His column, re-

produced in the Congressional Record, February 19, 1975, at the request of Senator Ribicoff, concludes as follows:

This is a quite different Policy Planning Staff from the days of George Kennan. Like everything else now, it is much bigger—around thirty members as compared with Kennan's eight or ten—and dealing with many more things.

It has experts on air power (Lt. Col. B. Conn Anderson, Jr., West Point, age 41, professor at the Air Force Academy and the National War College); advisors on science (Harry C. Blaney, age 36, Allegheny College, London School of Economics, former assistant to Pat Moynihan in the White House); information officers (Douglas Pike, age 50, California, former P.R. officer in Vietnam).

You name it and Policy Planning now has it, and it's so large that Mr. Kissinger, who hates big meetings, seldom meets with it. But he has changed in the last few months. He now has breakfast at the State Department at 7:30 in the morning, and has a staff meeting once or twice a week, when he's around, with his Under Secretaries and Assistant Secretaries, and Winston Lord, his Policy Planning Director.

The talent has been here at State for more than a generation, unused and uninspired. Mr. Kissinger has been very tough on it, but he has nourished it and brought it alive again, and in the end, this may be one of his most important achievements.[140]

Relations Between OES and Policy Planning Staff

The new Assistant Secretary heading the Bureau of Oceans and International Environmental and Scientific Affairs moved into an office in the Department of State in February 1975 while this study was in preparation. She was altogether too recently in the assignment to have plotted a course or made the many administrative decisions as to staff, program emphasis, appropriate role for the scientific attaché system, and the like. It was evident from a discussion with her that she expected to play a strong positive role in shaping the new bureau and melding together its previously separate elements like oceans and fisheries, population, and environment with atomic energy (nonmilitary aspects) and science and technology. She is confident of a participatory share in departmental policymaking, along with the other Assistant Secretaries heading the geographic and functional bureaus, as first-line advisers to the Secretary. Her jurisdiction would be science and technology and related matters.[141]

It will be important for the effectiveness of planning of the Department's scientific and technological affairs that the new Bureau establish a good working relationship with the Policy Planning Staff, and that both units not become enmeshed in operational details and short-term problems. With particular reference to the Planning Staff, much of the criticim over the years has addressed the dilemma presented by competitive uses of the staff to plan ahead and to deal with immediate crises. Conceived as a small group of highly qualified foreign policy analysts to do unstructured thinking ahead, the staff also constituted an invaluable and rare resource to be tapped in current emergencies. Since emergencies were not postponable, and usually landed on the President's desk, the request for diversion of staff attention from longer range to immediate problem was likely to be irresistible. As a general proposition, operational problems take precedence over planning.

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[140] James Reston, "The Policy Planners," *New York Times*, February 19, 1975, p. 35. (Reprinted in U.S. Congress, Senate, *Congressional Record*, 94th Cong., 1st sess., 1975, 121, p. 2126. (Daily edition))

[141] Conversation with Dr. Dixy Lee Ray, February 7, 1975.

Similarly with the science office in State: the problem of keeping track of 28 bilateral science programs, supporting the science aspects of an uncountable variety of multilateral science activities, assisting in further negotiations, coordinating and backstopping 30 scientific attachés or deputies in 23 countries or missions, and supporting or analyzing the budgets of various departments and agencies engaged in overseas scientific and technological activities, leaves little time for meditative planning and analysis. It is possible that for precisely the same reason that the Policy Planning Staff was conceived as an insulated group of knowledgeable and intelligent planners, a small insulated planning group in OES might serve as a source of fact, analysis, trends, and technology forecasts to support the work of the Policy Planning Staff. Broad experience, high intellectual quality, diplomatic training, and extensive relationships with the U.S. scientific and technological communities would appear to be minimum requirements for such a staff.

Future Policy Impacts of Science and Technology

To what extent are future problems and opportunities of U.S. diplomacy likely to involve science and technology? A recent study by a policy panel of the United Nations Association of the United States[142] called attention to the radical alteration in "traditional patterns of international relations" brought about by developments in the application of science and technology. In particular:

> Developments in science and technology have become in many cases the basis of political power struggles. National power is constantly being deployed to achieve larger shares of the benefits of such new technologies as remote sensing of the earth's resources and recovery of mineral wealth from the world's seabeds. Where the use of internationally traded resources is at stake, some industrial states are seeking new technologies that will permit self-sufficiency, while many countries hope to use boycotts and cartels as a form of coercion for both economic and political ends. And, scientific research and development for military purposes continue to be a high priority for many nations. According to one estimate, military efforts account currently for about 40 percent of total world research and development expenditures, or nearly $25 billion, which might otherwise be available for non-military purposes.
>
> While advances in science and technology obviously have contributed both directly and indirectly to the world's problems, on balance they have made—and will continue to make—major contributions to the resolution of those problems. Alleviation of the world food problem depends importantly on scientific and technical advances which will make possible greater agricultural productivity in the developing world. The development of new types of energy sources is an essential element in relieving the problems resulting from geographically concentrated and ultimately finite supplies of petroleum. It is important that the capabilities—as well as the consequences—of science and technology be examined more carefully than they have been in the past, and in the broadest possible framework, if science and technology are to be applied effectively to benefit mankind as a whole.[143]

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[142] The panel on *Science and Technology in an Age of Interdependence*, was chaired by Franklin A. Lindsay, president of Itek Corporation. Among its 23 members were: William O. Baker, President, Bell Telephone Laboratories, Inc.; Harvey Brooks, Dean of Engineering and Applied Physics, Harvard University; Dr. Harold Brown, President, California Institute of Technology; John H. Knowles, M.D., President, The Rockefeller Foundation; Eugene B. Skolnikoff, Professor of Political Science, Director, Center, for International Studies, Massachusetts Institute of Technology; Carroll L. Wilson, Mitsui Professor in Problems of Contemporary Technology, Sloan School of Management, Massachusetts Institute of Technology. As cited in United Nations Association of the United States of America, National Policy Panel, *Science and Technology in an Era of Interdependence* (New York: U.N. Association of the U.S.A., January 1975), pp. 2-3.

[143] Ibid., p. 18.

There have been numerous evidences in recent years that the White House and the Secretary of State appreciate the need for injecting technical expertise into the foreign policy process. The report of the President to the Congress, May 3, 1973, identified a number of "global challenges of peace." Foremost were problems relating "the Oceans" not only to questions of historic freedom of the seas and rights of passage but also to such technologically connected matters as depletion of fish, oceanic pollution, and seabed mineral resource development. Problems of outer space, "economic and scientific interdependence," various kinds of technology-related terrorism, drug control, population growth, energy, environmental protection, and impact of domestic environmental controls on international trade were also cited.[144]

In a series of speeches and statements, Secretary Kissinger has underscored the future importance of science and technology for diplomacy. In his first speech as Secretary, he told the United Nations General Assembly, September 24, 1973, that the world had been drawn together by "modern science, technology, and new forms of communication into a proximity for which we are still unprepared."

> Technology [said the Secretary] daily outstrips the ability of our institutions to cope with its fruits. Our political imagination must catch up with out scientific vision.

At the Washington Energy Conference, February 11, 1974, the Secretary attached importance to science and technology as one of seven areas of international cooperation to assure "abundant energy at reasonable cost to meet the entire world's requirement for economic growth and human need." Said Dr. Kissinger:

> New technologies, and not only new explorations, can provide us with new sources of energy. Many of our countries are launching large new programs. [U.S. plans called for $11 billion in public and $12.5 billion in private outlays for this purpose.] But we have no monopoly on the most advanced and promising approaches. It is to our mutual benefit to coordinate and combine our efforts. Thus, the United States is prepared to make a major contribution of its most advanced energy research and development to a broad program of international cooperation in energy.

Before the Sixth Special Session of the U.N. General Assembly in New York, April 15, 1974, the Secretary proposed a "global agenda," made possible by technology, to—

—Achieve an expanding supply of energy;

—Enable an escape from the "cycle of raw material surplus and shortage";

—Balance food and population;

—Buoy the poorest nations;

—Exploit fully "our most precious resource" of science and technology to overcome "a global economy of scarcity"; and

—Sustain industrial civilization and growth by a workable trade, monetary, and investment system.

With particular reference to science and technology, he said: "No human activity is less national in character than the field of science." (And also) "No development effort offers more hope than joint technical and scientific cooperation."

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[144] Richard Nixon, *U.S. Foreign Policy for the 1970's: Shaping a Durable Peace*, a report to the Congress by the President of the United States, May, 3, 1973, pp. 216–229.

Man's technical genius [he continued] has given us labor-saving technology, healthier populations, and the green revolution. But it has also produced a technology that consumes resources at an ever-expanding rate; a population explosion which presses against the earth's finite living space; and an agriculture increasingly dependent on the products of industry.

Let us now apply science to the problems which science has helped to create.

On April 20, the Secretary told the General Assembly of the Organization of American States (OAS) in Atlanta, Georgia, that the United States was "prepared to link its technology with the resources and capital of the hemisphere's oil producers to help them expand their production and diversify their economies." The United States, he went on, "will give high priority to linking our technological skills with the raw materials and capital of oil producing countries to encourage the development of new fertilizer capacity." A program to increase hemispheric food production, he proposed, "should encompass research, the application of science and technology, and the intensified application of foreign and domestic resources." He also favored the "transfer of science and technology" by both private and public means.

An article in *Science* quoted R. Mark Palmer, identified as "Kissinger speechwriter," to the effect that the Secretary "thinks that Americans' ability to contribute money and run the world in the old-fashioned way of the 1950s and 1960s is now over. What we can contribute—and what the world wants—is our technological capabilities." "Kissinger aides" were reported as stressing that the proposals in the April 15 speech would be implemented; and Palmer again: "The Secretary took the speech very seriously and he hopes the scientific community will take it seriously." The article continued:

Before leaving on his latest trip to the Middle East, Kissinger directed Winston Lord, director of the State Department planning and coordination staff [i.e., Policy Planning Staff] and one of his few close associates, to develop a strategy for following up on the initiatives proposed in the speech, including those related to science and technology.

Lord declines to say what actions are envisaged, and it is too early to say whether there will be major budget or program changes.

According to the *Science* article, the ideas for initiatives were gathered by the speechwriter not from (the then) SCI, but "from within and outside the State Department." And—"Kissinger's interest in science and technology lies chiefly in its effects on diplomacy and is shaped by the study of nuclear weapons problems on which he spent much of his academic career." [145]

Some Concluding Observations on Policy

During at least the next 2 years, the organizational framework for policy in the interaction of diplomacy with science and technology appears to be established, assuming present incumbencies continue. The President, as always, has constitutional jurisdiction over all negotiations. He has the support of a Special Assistant for National Security Affairs who is also Secretary of State. The National Security Council supports the Special Assistant and the State Department supports the Secretary. Senior planning people in the Department interact functionally with the NSC committees and staff. A new

[145] Nicholas Wade, "Kissinger on Science: Making the Linkage with Diplomacy," *Science*, May 17, 1974, pp. 780–781.

Bureau of Oceans and International Environmental and Scientific Affairs has been created, headed by an Assistant Secretary, supported by a substantial staff (larger than NSC's) in Washington and in a coordinate relationship with 30 scientific attachés and deputies in 23 countries or missions.

How well the Secretary/Special Assistant will be able to orchestrate this team remains to be seen. Another imponderable is the direction to be selected and the receptivity to be achieved by the new Assistant Secretary.

The scientific and technological roles of other organizational elements of the Department, next to be discussed, also relate to the policy role of the Secretary. Particular question is raised with respect to the Bureau of International Organizations (IO) and the Bureau of Intelligence and Research (INR), as well as the Foreign Service Institute.

Relationships of all these elements not only to each other but also to the policy groups of other departments with international missions (such as the Departments of Treasury, Commerce, Agriculture, Interior, HEW, HUD, Transportation, Labor, and most of all Defense) and agencies (chiefly CIA, NSF, NASA, the Council of Environmental Quality, and the new Energy Agency) have largely been established but every new tension abroad is likely to heighten the tensions among these agencies at home. In virtually every case, science and technology are likely to be an important ingredient in the foreign policy issues that are the substance of these interactions.

Finally, the relationship of the foreign policy apparatus to the committees of Congress, and particularly those with both diplomatic and scientific/technological interests needs to be explored. In the last analysis, this relationship and the problems and opportunities it implies for the congressional policymaking and oversight responsibilities, may well turn out to be a major consideration under the heading of Science, Technology, and American Diplomacy.

VIII. Opportunities for Expanded Technical Expertise in State

Science and technology are ingredients of the State Department's business at many other points besides the science office, the policy staff, and the scientific attaché system. A brief survey of these other elements is offered here. The sparcity of the literature and the indications from conversations with departmental personnel suggest that in these other parts of the Department a relatively low priority of attention is assigned by them to science and technology. For example, little effort is made to recruit physical scientists into the Foreign Service. The principal fields of expertise are political and economic. A "sample" U.S. overseas mission, in 1969, contained no persons explicitly charged with scientific liaison or technological trend analysis. (See Table 7). The Inspector General's report on SCI (see pp. 48–51) made reference to the general departmental want of confidence in its science office, the poor liaison between technical and diplomatic personnel, and the general neglect of science and technology throughout the Department. (See also footnote 57, page 34.)

Table 7.—*Composition of a sample U.S. Mission* [1]

Executive Section:
- Chief of Mission
- Deputy Chief of Mission
- Executive Assistant

Political Section:
- Counselor for Political Affairs
- 5 Political Officers
- Labor Attaché

Economic Section:
- Counselor for Economic Affairs
- 4 Economic Officers
- Commercial Attaché
- 2 Commercial Officers
- Petroleum Attaché
- Financial Attaché
- Transportation & Communications Officer

Consular Section:
- Consul General
- 5 Consular Officers
- Visa Assistant
- Consular Assistant

Administrative Section:
- Counselor for Administration
- Administrative Officer
- General Services Assistants
- Personnel Officer
- Budget & Fiscal Officer
- Disbursing Officer
- Communications and Records Supervisor
- Communications and Records Clerk
- Telecommunications Specialist
- Security Officer

Service Attachés:
- Defense Attaché (and Army Attaché)
- Assistant Army Attaché
- Naval Attaché
- Assistant Naval Attaché
- Air Attaché
- Assistant Air Attaché

Foreign Agricultural Service (FAS):
- Agricultural Attaché
- Assistant Agricultural Attaché

United States Information Service (USIS):
- Counselor for Public Affairs
- Executive Officer
- Information Officer
- Assistant Information Officer
- Assistant Information Officer (Labor)
- Cultural Affairs Officer
- 3 Assistant Cultural Affairs Officers
- Public Affairs Trainee
- Director, Binational Center
- Director of Courses, Binational Center

Agency for International Development (AID):
- AID Representative
- Controller
- Program Officer
- Programs Analysis Officer
- Development Officer
- Manpower Adviser
- Agricultural Credit Adviser

See footnote at end of table.

TABLE 7.—*Composition of a sample U.S. Mission*[1]—Continued

Agency for International Development (AID)—Continued
- Industrial Officer
- Sociologist
- Public Affairs Adviser
- Chief Public Safety Adviser
- Deputy Chief Public Safety Adviser
- 6 Public Safety Advisers
- General Engineer
- Auditor

Peace Corps:
- Peace Corps Representative
- Deputy Peace Corps Representative
- 8 Associate Representatives
- 3 Physicians

Military Assistance Advisory Group (MAAG):
- Commander of Group
- Chief Administrative Officer
- Chief, Joint Plans and Operations
- 3 Officer Advisers
- Chief, Army Section
- 12 Officer Advisers
- Chief, Navy Section
- 8 Officer Advisers
- Chief, Air Force Section
- 6 Officer Advisers
- Chief, National Guard Adviser
- 3 Officer Advisers

[1] Source: W. Wendell Blancke, *The Foreign Service of the United States* (Washington: Frederick Praeger, Publishers, 1969), pp. 93-94.

Need for an Inventory of Opportunities

In an address to the scientific attachés, meeting in Washington for their annual briefing on domestic trends and international developments, Secretary Rogers, January 29, 1970, said:

> It would be foolhardy in this day and age to set political objectives without an accounting of the technical realities—or to approach technological problems without regard to their political and social implications. [And in particular:] The conduct of our foreign affairs—the formulation of our policies and goals—must reflect the sometimes complex, sometimes subtle, but persistent influence and interaction of science and technology on the affairs of man.

The Secretary suggested that in view of these interrelations, ". . . in forging the capability of the State Department to deal with the problems of the 1970s, the professional corps of the Foreign Service and the Department must develop the capacity to keep abreast of these developments and the skills necessary to cope with them." [146] Where might this "capacity" be appropriate?

THE REGIONAL BUREAUS

The scope of responsibility of the regional bureaus [147] is generally to provide assistance in the direction, coordination, and supervision of State Department and interdepartmental activities in the designated region, and for the general conduct of U.S. foreign relations with countries in the region. It backstops the U.S. Embassies in the region and directs their management and administration. Generally, such bureaus have special advisers on public affairs, labor, economics, political-military, regional planning, and U.N. affairs. There do not, however, appear to be any special advisers on science and technology, a circumstance that might warrant consideration, especially in view of the elevated status of the Bureau of Oceans and Environmental and Scientific Affairs.

The special activities, needs, and relationships with the United States in science and technology tend to differ radically from region to region. For example, the highly developed science and technology of

[146] Remarks by the Secretary of State on the occasion of meeting with the Scientific Attachés, January 20, 1970, p. 5. (Copy of the address supplied by the Department of State.)

[147] These are the Bureaus of African Affairs, European Affairs, East Asian and Pacific Affairs, Inter-American Affairs, and Near Eastern and South Asian Affairs.

the nations in the region for which the Bureau of European Affairs (EUR) has jurisdiction involves not only more concentrated but also more sophisticated technical matters than does the Bureau of African Affairs. The former has a share of responsibility for NATO and OECD matters and also educational and cultural exchanges with the U.S.S.R. Shared interests of EUR with OES would appear to be extensive and functional. Secretary Kissinger's pledge of mutual science and technology programs with other hemispheric nations would also seem to imply an enlargement in the planning and operational concerns of the Bureau of Inter-American Affairs on technical matters.

However, as a practical matter, every region in the Department's organizational scheme has substantial concern with science and technology at some level of sophistication and development. The less-developed nations seek help in organizing institutions and in planning programs; the more-developed nations are more interested in exchanges of information and personnel. Both situations imply activity and the rising rate of technological change since World War II implies an increase in the technological ingredient of regional diplomacy.

SPECIAL CASE OF BUREAU OF INTERNATIONAL ORGANIZATION AFFAIRS

The Bureau of International Organization Affairs (IO) appears to have some of the characteristics of both the regional and the functional bureaus.[148] It is in general the channel between the U.S. Government and international organizations and conferences. These include the United Nations and the associated organizations within the U.N. family—UNESCO, World Health Organization, and others. However, with respect to the fields of science and technology its role appears to be primarily organizational and administrative more than substantive. That is, IO recruits U.S. personnel to staff U.N. agencies, coordinates U.S. participation in international conferences, defends and administers appropriations for U.N. activities (scientific or other), and "formulates and coordinates United States foreign policies on . . . scientific . . . matters under consideration by the U.N., other international organizations and affiliates thereof not specifically assigned to other areas of the Department." [149]

There is in IO a small science and technology unit, designated as IO/SCT, consisting of three professional officers. These perform the IO functions in relation to the International Atomic Energy Agency, the U.N. Science Office, the U.N. Environmental Program, and the World Meteorological Organization; other elements in IO are concerned with health (World Health Organization), transport and communications, and UNESCO affairs.

On this point Herman Pollack comments:

> In my view the existing arrangement for relationships between the United States and the UN technical agencies is fundamentally sound. Under it the basic responsibility for the technical relationship lies with the mission agency while the political, parliamentarian and administrative relationship is with the Department of State. It is in the area of coordination as among UN technical programs and in oversight that United States performance is weak. Improvement will

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[148] As one interested party observed: "The Bureau of International Organization has [some] functions analogous to those of the geographic bureaus and others analogous to those of the functional bureaus." Source: John Keppel, "Undersecretary for Functional Affairs," *Foreign Service Journal* 46 (March 1969), p. 51.

[149] U.S. Department of State, *U.S. Department of State Organizational Manual*, 1967, p. FAM 340.

require that this weakness be recognized and that manpower in numbers and quality sufficient for an adequate response be provided. At the present time I believe there are 2½ manyears of officer personnel available in the Department of State to work on UN science and technology programs. This is supplemented by several officers detailed to the State Department by the mission agencies. The manpower available is entirely insufficient to get on top of the problem.[150]

It is possible that the coordination of both bilateral and multilateral science and technology relationships in the Department of State suffers from being separately managed in two different bureaus, and further subdivided within each bureau. It would, of course, be unreasonable to expect the Department to build its organizational structure around one function or set of functions like those of science and technology. But the present diffusion and division of responsibility seems to invite review.

Science and Technology in the Functional Bureaus

As distinguished from the regional bureaus of the Department of State there are eight or more bureaus which have missions to perform, rather than geographic areas to serve. These functional bureaus [151] to greater or less degree have responsibilities or functions in science and technology. Thus, the Bureau of Educational and Cultural Affairs (CU) has an interest in international exchanges of persons and information, the "Brain Drain," [152] educational assistance, and conferences on these and related subjects. The Bureau of Politico-Military Affairs is concerned with arms transactions, arms control, and other international security matters. The Bureau of Public Affairs is responsible for telling the story of the Department, including its concerns with science and technology.[153] However, in two of the functional bureaus the relationship to scientific and technological matters would seem to be extensive and important. These are the Bureau of Economic and Business Affairs (EB) and the Bureau of Intelligence and Research (INR).

SCIENTIFIC AND TECHNOLOGICAL POTENTIAL OF THE BUREAU OF ECONOMIC AND BUSINESS AFFAIRS

Under the rubric of "economic and business affairs" in the Department of State are gathered a great many of the functional responsibilities of international relations that closely involve science and especially technology. The "job description" of the Assistant Secretary who directs this Bureau emphasizes his role in trade and commercial

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[150] Pollack to Huddle, March 25, 1975.

[151] These are: the Bureaus of Politico-Military Affairs, Congressional Relations, the already discussed OES and IO, Intelligence and Research, Economic and Business Affairs, Public Affairs, and Educational and Cultural Affairs, as well as several administrative and services bureaus.

[152] See: U.S. Congress, House, Committee on Foreign Affairs, *Brain Drain; A Study of the Persistent Issue of International Scientific Mobility*, in the series Science, Technology, and American Diplomacy, prepared for the Subcommittee on National Security Policy and Scientific Developments by Dr. Joseph G. Whelan, Senior Specialist in International Affairs, Foreign Affairs Division, Congressional Research Service, Library of Congress, 1974. See vol. II, pp. 1037–1318.

[153] For example, the historical account of the science office and Scientific Attaché program, *Science Adviser of the Department of State*, op. cit., was prepared with the assistance of this Bureau.

negotiations, extension of credit, and the flow to the United States of information on multilateral economic and commercial matters.[154]

The Assistant Secretary has five deputies, charged respectively with international trade policy, transportation and communications, international finance and development, international resources and food policy, and commercial affairs and business activities. Under one or another of the offices of these Deputy Assistant Secretaries are such technical functions as—

East-West Trade (including "Battle Act")
Aviation Negotiations
Aviation Programs and Policy
International Communications Policy
Maritime Affairs
Tropical Products
Industrial and Strategic Materials
Fibers and Textiles
Food Policy and Programs
Food for Freedom
Fuels and Energy

While there are obvious economic implications in all these functions, there are also many scientific and technological aspects. A substantial technical input would certainly be essential in the development of "policy recommendations" and "approved policy programs" for which these organizational elements are responsible.

There are, of course, several ways of ensuring such technical input: by including in the staffs of these organizations persons with technical as well as economic expertise, by close liaison with OES, by calling upon other Federal agencies for assistance to supplement in-house expertise, and by enlisting consultants and advisers from outside the Government on an ad hoc basis. All these expedients are appropriate even if the mission is limited to reactive responses to new developments. But if creativity in policy is to be achieved, a strong technical capability is needed on a continuing basis, closely integrated with the political and economic expertise for negotiation, assessment, and trade analysis. Forecasts of technological change, for example, are likely to be more reliable in the short run (2 to 5 years) than economic forecasts, simply because the conversion of a new industrial technology into practice takes time and thus gives advance signals. (For a concrete illustration, the 1975 application of British and French airlines for approval of Concorde landings at J. F. Kennedy and Dulles airports could have been forecast in 1968.)

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[154] The text of this section in the *Foreign Affairs Manual* reads as follows (FAM 310):

Formulates and implements policy regarding foreign economic matters and trade promotion and business services of an interregional nature and, in this connection, negotiates agreements; serves as Deputy Administrator for the Mutual Defense Assistance Control Act (Battle Act); participates in the selection of officers to senior economic and commercial positions abroad; is responsible for Departmental guidance and representation with respect to U.S. and other public international lending institutions; is responsible for all Departmental activities necessary to advise and assist the Office of the Special Representative for Trade Negotiations in carrying out the trade agreements program under the Trade Expansion Act of 1962; and insures, in coordination with the assistant secretaries of the regional bureaus, the provision of an adequate, regular flow of information concerning the U.S. Government's multilateral economic and commercial policies, policy deliberations, legislative developments, and diplomatic exchanges, especially on matters that may result in negotiations and representations abroad. (Sept. 4, 1974.)

IMPORTANCE OF THE RELATIONSHIP OF TECHNOLOGY WITH ECONOMICS

Considerations germane to the Bureau of Economic and Business Affairs (EB) would seem to include such matters as the multinational corporation and technology transfer, materials shortages and negotiations to ease them, cooperation in international fuel and energy programs, the use of the technological base to characterize national economies, and economic-technological initiatives on a multilateral basis.

The importance of science and technology in the economic affairs of State was highlighted in 1973 by William J. Casey, Under Secretary of State for Economic Affairs.[155] While granting the importance of productivity, quality, price, exchange rates, and trade barriers, he said, "today we consider none of these more important than supporting science to nourish technology and enlisting our technology to pay our way in the world and to meet the world's development and environmental needs."

As examples, he cited a $2.8 billion net surplus in royalty and fee earnings from foreign subsidiaries and licensees. The United States, he said, has an "enormous economic stake in science and technology."

> As we look ahead we can see that the outflow of dollars necessary to bring in from abroad the fuel and the raw materials needed to keep our plants and households going and to maintain our living standards will grow sharply.

Under Secretary Casey foresaw "forces and programs which will put still heavier responsibilities on our high technology industries and our engineering and managerial skills." He went on—

> We find our chief competitors, Japan and the European Community, with more or less conscious plans to shift labor intensive, energy intensive and fuel intensive industries beyond their boundaries—to Taiwan, Korea, Southeast Asia, Latin America and Africa. At the same time, we see them developing policies to subsidize and otherwise promote the development of high technology industries at home—aircraft, computers, nuclear power, communications equipment and so on.
>
> Many of our own corporations find it necessary to shift labor intensive industries to Latin America and Asia in order to meet world competition. At the same time, the Soviet Union and the oil rich Persian Gulf States are seeking to attract industries which find a significant economic advantage in cheap hydro-electric power and proximity to raw materials which they have to import in order to manufacture in the United States. These are fundamental economic forces which are loose in the world. We will have to adjust to them, and we will have to look to science and technology to fill the gap in our employment and national earning power which seems likely to arise from these forces.
>
> As this implies, our position in the world economy hinges on:
>
> —the export of products incorporating advanced technology;
>
> —the international diffusion of advanced technology; and
>
> —the introduction within the U.S. of technological advances whose effects will reach beyond the domestic economy.

However, the main thrust of Mr. Casey's address concerned the transfer of U.S. technology to foreign countries or foreign industry. A case in point was the increased activity in the U.S.S.R. to encourage the importation of U.S. technology. His Department's concern was that this transfer be in "conformance with U.S. national interests." He did not elaborate very far on what these interests were, and explained that:

> One of the difficulties we face in the broad area of attitudes and policies regarding the international transfer of technology is specifying the national interests

[155] William J. Casey, Under Secretary of State for Economic Affairs, "Science, Technology and World Economics Affairs," an address before the Industrial Research Institute, Chicago, October 17, 1973.

involved—which are frequently conflicting—and establishing their appropriate priorities. We must, of course, protect our national security. Where our proper course lies as regards our industrial competitiveness in the world market has been widely debated. We do not believe in protectionism as the basis for continued U.S. leadership in advanced technology. You know, better than most, that continued technological leadership in a dynamic economy rests on our own innovative capabilities and not on attempts to weaken or limit the technological enterprise of other nations. When the benefits of our own enterprise are made available to others, we do ask that the quid pro quo include an appropriate financial recompense for the R&D investments, public and private, which we have made. This is essential to our continued innovative efforts.[156]

Historically, the Department of State has not been especially alert to the opportunities for technological diplomacy. As Dean Acheson pointed out, one of the most coherent programs of postwar diplomacy since 1950 was initiated outside of the Department and accepted only reluctantly within it. Wrote Acheson:

The State Department was slow in realizing the importance of Point Four and in getting a program in motion. Technological help for developing countries had for some time been a feature of the good-neighbor policy in the western hemisphere. The idea of expounding it on a worldwide basis originated with Clark Clifford, then Counsel to the President, who included it in a draft of the inaugural address sent to Acting Secretary [of State] Robert Lovett and Paul Nitze of the Policy Planning Staff. They were neither enthusiastic nor impressed with its utility. Nevertheless, it went into the inaugural address and became much talked about. [And, he remarked later] Although the program continued to do a creditable job, it remained the Cinderella of the foreign aid family.[157]

In their joint examination of "Science Advice in the White House," Eugene B. Skolnikoff and Harvey Brooks called attention to the need for a stronger scientific unit in the Department of State and a stronger scientific advisory mechanism in the White House, to construct a forward-looking international policy for science and technology.

When one looks at the entire federal R&D budget [they wrote], a curious fact emerges. A substantial portion of that budget, well more than half, is committed to missions which have strong foreign policy motivations and repercussions: primarily the Department of Defense, some of the AEC, and some of NASA. A good portion of the rest goes for work in subjects that will affect foreign policy quite directly: agriculture, energy, oceanography, foreign trade, and population to mention just a few.

However, given this strong foreign policy motivation for federal R&D, the Department of State, the one department of government most concerned with foreign policy below the President, has essentially no voice in the allocation of those R&D resources. Instead, other departments and agencies rely on their own interpretation of what serves foreign policy goals in setting their R&D objectives. The President and Executive Office agencies (NSC and OMB) oversee the process, but only in the most general terms. The Department of State merely has to cope with the consequences.[158]

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[156] This issue of U.S. national interests in U.S.-U.S.S.R. trade was examined in some depth by Dr. John Hardt in a study for this series. See: U.S. Congress, Committee on Foreign Affairs, *U.S.-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer, and Diplomacy*, in the series, Science, Technology, and American Diplomacy, prepared for the Subcommittee on National Security Policy and Scientific Developments, by John P. Hardt and George D. Holliday, Congressional Research Service, Library of Congress, 1973. See vol. I, pp. 525–606.

[157] Dean Acheson, *Present at the Creation, My Years in the State Department* (New York: W. W. Norton and Company, 1969), pp. 265–266. For an extended discussion of the Point IV Program see: U.S. Congress, Committee on Science and Astronautics, *Technical Information for Congress*, prepared by the Science Policy Research Division, Congressional Research Service, Library of Congress, April 15, 1971. (Committee print.) See especially p. 75: "To begin with the program was not recognized as involving scientific problems at all. Much of the deliberation centered on political, economic, and military considerations such as the need to contain communism, the need to expand U.S. markets, and the development of secure sources of strategic materials." (Capital for investment rather than technology was the main item of export considered.)

[158] Eugene B. Skolnikoff and Harvey Brooks, "Science Advice in the White House?—Continuation of a Debate," *Science*, January 10, 1975, p. 40.

Writing in 1970, Robert Gilpin, professor of politics and international affairs at the Princeton University Center of International Studies, called attention to the "major transformation" that the world economy had undergone. Of primary importance were the "effects of the contemporary technological revolution upon economic and commercial activities. . . ." Most noteworthy in their economic effects were advances in air and sea transportation, electronic communications, the emergence of a global market, and—"most significant of all, the unprecedented innovation of new products and cost-reducing industrial processes, which has profoundly altered the relationship between technology and economics."

Three major interrelated economic consequences have flowed from these developments. The first, . . . is the increased interdependence among national economies and the consequent greater sensitivity of foreign trade to changes in economic conditions. The second is the enhanced role of technological innovation in economic growth and competition. The third is the rapid expansion abroad of the corporations, primarily American, that are best equipped to take advantage of the new conditions of the world economy. These developments have in turn produced in all major industrial nations a concern that they will be left behind and they must formulate appropriate strategies to adapt their economies to the imperatives of economic growth and competition.[159]

The author went on to describe three national strategies of technology for economic objectives, and then concluded: " . . . To a degree perhaps unparalleled in the past, economic and technological considerations will shape the ways in which political interests and conflicts seek their expression and work themselves out."

In a world where nuclear weaponry has inhibited the use of military power and where social and economic demands play an inordinate role in political life, the choice, success, or failure of a nation's technological strategy will influence in large measure its place in the international pecking order and its capacity to solve its domestic problems.[160]

The necessity for combining expertise in technology analysis with skill in economic analysis appears to be especially strong in the field of foreign relations. An increasingly popular view is that the "technology tail is already wagging the policy dog." More explicitly:

In the coming decade the new technology and how it is used will affect the distribution of power among nations.

In developing his analysis from this theme, Victor Basiuk identified consequences of the foreseen "rapid, accelerating technological change" as being large benefits and political power to leading innovators among nations, and increased impacts and "social discontinuities." He called for "a timely appreciation of the emerging problems and a conscious effort to plan ahead and frame policies to deal with them." [161]

An effort to approach quantitatively and explicitly the kind of forecasting effort urged by Basiuk was demonstrated by the National Science Board in its report for 1973. Among the economic-technological findings of that report, in a section on "indicator highlights" for the "international position of U.S. science and technology," the Board found that:

The proportion of the gross national product (GNP) spent for research and development (R&D) between 1963–71 declined in the United States, France,

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[159] Robert Gilpin, "Technological Strategies and National Purposes," *Science*, July 31, 1970, p. 441.
[160] Ibid., p. 448.
[161] Victor Basiuk, "Perils of the New Technology," *Foreign Policy* 2 (Spring 1971), pp. 51–53.

and the United Kingdom but increased in the Union of Soviet Socialist Republics (U.S.S.R.), Japan, and West Germany. By 1971, U.S. expenditures for R&D were 2.6 percent of GNP, as compared with an estimated 3.0 percent for the U.S.S.R. approximately 2.0 percent for the United Kingdom and West Germany, and 1.8 percent for both Japan and France.

The United States had a favorable but declining "patent balance" (patents of United States versus foreign origin awarded in each country) between 1966 and 1970; the decline was due to a reduced number of patents of U.S. origin in France, West Germany, and the United Kingdom, combined with increased U.S. patents of Japanese origin.

Starting from a higher base, increases in labor productivity in U.S. manufacturing industries between 1960–71 were the lowest of all countries—39 percent—compared with 210 percent for Japan, 86 percent for West Germany, 81 percent for France, and 50 percent for the United Kingdom. Productivity gains in the United States offset increased labor costs until the mid-1960s but rose less rapidly than such costs during the 1966–71 period.

The United States had an increasingly favorable position in the sale of "technical know-how"—patents, techniques, formulas, franchises, and manufacturing rights—during 1960–71; Japan was the major purchaser of U.S. "know-how," surpassing all of Western Europe after 1967.

The favorable U.S. balance of trade in technology-intensive products grew throughout 1960–71, but was increasingly negative in nontechnology-intensive areas.

Within the technology-intensive areas, products with the fastest rising trade surplus are aircraft, computers, and plastics. Product areas in which the growth of imports exceeds exports include office machinery, chemical elements and compounds, medicinal products, and telecommunication apparatus.

The favorable trade balance of the United States in high technology products rested primarily on purchases by developing nations (55 percent in 1971) and countries of Western Europe. A deficit balance with Japan, developed in the mid-1960s and continuing to grow through 1971, exists in electrical machinery, scientific and professional instruments, and nonelectrical machinery.[162]

One broad technological trend adversely affecting the U.S. position in international trade was identified in 1971 by Peter G. Peterson, while Assistant to the President for International Economic Affairs. He pointed out that the United States is "tending to become an increasingly service-oriented economy." While fears of a decline in U.S. manufacturing were "highly exaggerated," nevertheless, "the kinds of services which make up the bulk of the service sector are certainly less 'tradeable' than new manufactured goods and raw materials . . . ." And between 1950 and 1971 the national output in services had risen from 30 to 42 percent. Meanwhile "our exports have become inadequate to pay for our imports." It should be noted that this observation was made before the oil embargo of 1974 and the subsequent sharp increase in the price of imported petroleum. Even then,

> Our imports have been rising not only in response to our consumer appetites, but because our industry buys an increasing share of its raw materials abroad. Our imports of crude oil, iron ore and copper are growing and we import most or all of our natural rubber, tin, nickel and chrome. Long-range projections indicate that by the year 2000 we will import 30% to 50% of our mineral requirements, including oil. In doing so, we will be competing in world markets with other industralized nations, such as Japan, which are even more dependent on imported raw materials than we are.[163]

The scope of the technology-economics interface has been suggested by Dr. Leo S. Packer, director of the office of technology policy and

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[162] National Science Foundation, National Science Board, *Science Indicators 1972* (Washington, D.C.: U.S. Government Printing Office, 1973), pp. 2-3.

[163] Peter G. Peterson, *A Foreign Economic Perspective*, vol. 1 of *The United States in the Changing World Economy* (Washington, D.C.: U.S. Government Printing Office, 1971), p. 11.

space affairs in OES. In many important areas, he said, such as "space, defense, energy, environment, health, industrial development, trade, food, and so on," most of the action related to technology. "That is where the sticky problems are." The United States was still the most affluent country in the world, with the "largest reservoir of technology" but this position was eroding, and the trend called for "a more realistic understanding of our national interest." And then he asked: "Who defines our national interest, how is it defined, and in what time scale are we operating?" Among the questions that followed from this basic inquiry were, according to Packer:

> For example, how do you balance short-term economic gains against long-term competitive risks? How do you weigh the anger and possible retaliation of a foreign country? How do you account for intense competition for the business by foreign industries? How do you consider the capacity of the overseas customer to assimilate the technology transfer to our later disadvantage? How do you deal with foreign customers who want an independent R&D capability rather than products? How should government provide useful guidance and help to U.S. industry? How do you measure the existing technology gap in a specific technology area? What are the probable rates of progress in the U.S. and overseas and what will the future trend be in the technology gap? What should our attitude be toward exporting management and systems integration skills? How can we encourage the import of certain commercially valuable technologies developed in Japan, USSR, Europe and elsewhere? What are the risks of technology diversion to undesired military use or to third parties? What are the comparative risks of transferring various embodiments of technology by different modes of transfer? To what extent does U.S. government action actually control the diffusion of technology and what is the likely impact of possible actions? [164]

These were only a few of the important questions (clearly both economic and technological) that needed to be asked and answered. But, he added: "I cannot, unfortunately, assure you that these and other questions are now being asked and answered in a comprehensive, systematic, and objective manner."

While the predictive power of technology analysis warrants attention in the area of international economics, the utility of such analysis should not be regarded as solely for long-range forecasting of future developments. Indeed, it is possible that technological events are moving so rapidly that only short-range forecasting is practicable on this basis. Fifteen years ago, George Kistiakowsky warned that "What is new today is the rapidity with which the developments of science are altering the human condition, the rapidity with which policy, particularly foreign policy, must adjust to the changes being wrought by the pace of scientific advance." [165] Similar observations have been repeatedly offered in more recent years by Secretaries of State, the Director of SCI, and others. The thrust of this point is that a close interaction would be appropriate in the Department of State between officials engaged in economic analysis, those concerned with technological trends, and those conducting policy analysis and planning.

The Foreign Information Function and Technological Change

In the Department of State a counterpart to the military function of general staff intelligence ("G–2") was established by General Marshall

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[164] Leo S. Packer, "Technology Export and Foreign Affairs," a talk delivered at the banquet of the 1974 Tactical Missiles Conference, sponsored jointly by the American Institute of Astronautics and Aeronautics and The American Defense Preparedness Association, May 1, 1974, pp. 5–6. (Furnished by the Office of Technology Policy and Space Affairs, Bureau of Oceans and International Environmental and Scientific Affairs, U.S. Department of State.)

[165] G. B. Kistiakowsky, "Science and Foreign Affairs," *Science*, April 8, 1960, p. 1020.

during his term as Secretary. This was the Bureau of Intelligence and Research (INR). In the U.S. Government Manual, the function of this unit is described as follows:

> The Bureau of Intelligence and Research coordinates programs of intelligence, research, and analysis for the Department and for other Federal agencies, and produces intelligence studies and current intelligence analyses essential to foreign policy determination and execution. In addition, the Bureau, through its Office of External Research, maintains liaison with cultural and educational institutions and with other Federal agencies on a wide range of matters relating to government contractual and private foreign affairs research.[166]

The history of INR appears to have followed a somewhat similar course to that of SCI: initial growth, sharp cutback at the end of the 1950s, then growth again. However, during the past decade (1965–75) the office has declined slightly in numbers from 370 to about 330.

An account of INRs functions and products, in 1965, distinguished between its management of information and that of the "policy" bureaus of the Department. Said the article:

> . . . The authorities have ever since World War II felt the need for a specialized center which should devote itself exclusively to the internal and external implications of the Department's enormous appetite for sound, pertinent, and absorbable information. This center is the Bureau of Intelligence and Research (INR).[167]

It has essentially three functions: (1) to handle the "whole mass of incoming information from all parts of the world, . . . systematically in selecting and analyzing the material which can be of use"; (2) to provide a parallel source of information "conditioned by the particular qualities of research work" as distinguished from information supplied by bureaus "whose central focus is formulation of policy"; and (3) to concentrate "in a coherent group of experts' hands the staff work necessary to assist the Secretary of State in his relations with the Government's intelligence network and all its complex technological and operational processes." In sum:

> Thus INR is the organization specially assigned within the Department to supply information of particular kinds tailored for specific needs, to provide a professional researcher's view of events abroad, and to insure that the Department both benefits fully by and does its duty toward the intelligence community. The outer limits of the Bureau's activity are marked in one direction by the tradition that it does not itself form foreign policy in the way that policy bureaus invent and plan courses of action for the United States. On the other hand, it differs from other components of the intelligence community in having no field force, in relying for collection on Foreign Service reporting and on the work of its fellow intelligence agencies.[168]

The staff of INR is about evenly divided between FSO's and Civil Service personnel. From time to time, persons are taken onto the staff with physical science, engineering, and other technical backgrounds, but no systematic effort has been made to accumulate or concentrate a "science and technology" capability as such.

Around 1970, apparently, some consideration was given to the creation of a science and technology office in INR, and the idea got

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[166] Office of the Federal Register, National Archives and Records Service, General Services Administration, *United States Government Manual* (Washington, D.C.: U.S. Government Printing Office, July 1974), p. 351.

[167] Allan Evans, "Research in Action: The Department of State's Bureau of Intelligence and Research," *Department of State Bulletin*, August 30, 1965, p. 359.

[168] Ibid., pp. 360-361.

as far as to be incorporated in the *Foreign Affairs Manual* of the Department, with the following "job descriptions":

DEPUTY DIRECTOR FOR FUNCTIONAL RESEARCH (INR/DFR)

a. Directs a program for the production of intelligence and research reports and estimates on functional subjects pertinent to the formulation and execution of foreign policy.

b. Supervises the work of the offices within the Bureau dealing with strategic, political-military, and specialized interregional political affairs; economic affairs; science affairs; and geographic affairs.

ASSISTANT DEPUTY DIRECTOR FOR SCIENCE AFFAIRS (INR/DFR/SA)

a. Maintains liaison with other agencies on research dealing with the impact on foreign policy of both substantive and institutional developments in non-military science and technology, including environmental affairs; and prepares studies and reports on these subjects.

b. Advises the Director and other senior officials on new analytical methods, particularly quantitative techniques, applicable to research in international relations.

c. Participates in the preparation of reports and estimates on special topics concerned with foreign affairs.[169]

However, the science element was never staffed and the parent office was abolished in 1974 as a part of a reorganization of INR that was still in progress in early 1975.

INR ORGANIZATIONAL UNCERTAINTIES

Several uncertainties persist in this question of the role of INR in science, technology, and intelligence generally. As the State Department element of the intelligence community, INR would seem to be confronted by the complications of the dual role of Mr. Kissinger as both Secretary of State and Director of the NSC staff—in this latter capacity the official to which the Central Intelligence Agency reports. However, INR could still serve usefully as the bridge between CIA and policy elements of State.

Another question is whether INR ought to involve itself more extensively in substantive matters of science and technology, perhaps including augmentation of staff and establishment of a technological data base, analytical capability, and organizational point of contact.[170] Can information about science and technology be compartmented within the already existing OES, or is it so pervasively and intimately a part of the Department's business—and so significant an influence upon the diplomatic environment—that it needs attention in both areas? During the past 15 years the State Department's science office was competing for resources with the well-established regional and functional bureaus. It always needed more "job slots" than the Department was prepared to allocate to it. However, the elevation by Congress of the office to full bureau status under a statutory Assistant Secretary provides an occasion for a reassessment of the

[169] U.S. Department of State, *Foreign Affairs Manual*, October 5, 1972, FAM 333 and 333.1.

[170] However, on this point Professor Rusk writes:

> I do not believe that INR should try to staff itself for a comprehensive effort in the fields of science and technology. I have long felt that the U.S. Government as a whole should be better organized to collect and evaluate information in these fields. The sheer scale of the effort required calls for a government-wide plan. INR should be a part, but only a part, of that total effort.

(Rusk to Huddle, March 18, 1975.)

relationship between OES, as the departmental center for science and technology, and the regional and functional bureaus. The question is whether there are functions of these latter bureaus that warrant in-bureau staffing to give express attention to the scientific and technological content of developments abroad.

In the particular case of the Bureau of Intelligence and Research (INR) a useful purpose might be served by reconsidering a decision made over the past several years to minimize the organizational emphasis on functional elements and to concentrate more emphasis on regional or geographic elements. The role of OES is centered on policy formulation; that of INR could be on data review and analysis; that of IO and CU could address multilateral coordination with the support of other mission agencies; and that of the regional bureaus could include coordination of bilateral and other regional science and technology arrangements—supported by OES and appropriate mission agencies. Science and technology have so profound an impact on present diplomacy, and prospectively on future diplomatic problems and opportunities, that what is needed is not only a central point for science and technology in the Department of State but also a general and widespread competence to deal with scientific and technological issues and impacts. The diplomat, as several Secretaries of State have pointed out, must today be technically "literate." The technically-oriented people in OES need to be in close contact with technically-oriented people in the other functional and policymaking elements of the Department. Herman Pollack has given considerable thought to this issue and offers the following commentary:

I believe that any officer dealing with foreign policy—or for that matter with any significant aspect of public policy generally—should be "technically literate". At the very minimum, he must have enough grasp of the technical implications of a subject to be aware of when he needs professional technical support. Preferably, he should have sufficiently strong technical comprehension to be able to follow and understand a professional discussion of the technical aspects of a problem. Just as a Secretary of State cannot perform effectively without understanding international economics, so today he cannot be fully effective if he is technically innocent. This is perhaps most obvious in nuclear and space matters because of their security significance, but it is just as pertinent in energy, food, industrial policy and other areas.

A concentration of expertise in a functional office is not alone a sufficient answer. That must be blended with widespread sophistication in science and technology among the policy officers of the Department of State. That sophistication does not exist today. I hold the institutions of higher learning principally responsible. Their programs of instruction do not reflect the scientific revolution that we all assert is taking place in our presence. The computer, electronic, nuclear and space ages, to mention a few of the key ones, do not yet show up in the typical liberal arts program. Therefore the new classes of Foreign Service officers arrive technically unsophisticated and the burden of training is transferred to the State Department.

The Department's response cannot by any standards be considered successful. Foreign Service Institute courses, college assignments, exchange programs with technical agencies, Secretary's Science Luncheons, Secretary's Science Lectures, Foreign Service recruiting in technical faculties have all been tried, but never on a scale or with the priority necessary to produce a marked impact.

It may take another Sputnik to shock the U.S. into effective action. There has to be developed, it seems to me, a national will to move forward to the scientific and technological realities of the 1970s. This would lead to a fundamental change in the educational curriculum and to high priorities within the State Department to programs designed to equip its officers to deal with those realities.[171]

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[171] Pollack to Huddle, March 25, 1975.

Technical Literacy in the Foreign Service; the Institute

At least two different levels of technical knowledge have been proposed for incorporation in the Foreign Service. One level, of which much was made in the Berkner Report, and strongly endorsed a decade later by Dr. Rollefson as director of the science office of the State Department,[172] is that of an outstanding, or at least highly qualified, scientist. The other level is that described by Secretary Rusk:

> . . . The Foreign Service officer should be familiar with the ways, the concepts, and the purposes of science. He should understand the sources of our technological civilization.
>
> He should be able to grasp the social and economic implications of current scientific discoveries and engineering accomplishments.[173]

Specifications for the two degrees of technical literacy that ought to be found in the Foreign Service were suggested in 1960 by Dr. George B. Kistiakowsky, Special Assistant to President Eisenhower for Science and Technology. He urged the recruitment, first, of scientists "continually aware that the scientific community must accept its appropriate share of the responsibility for the intelligent and successful resolution of the challenges facing the world." However—

> Another kind of individual must be recruited, too—an individual with training in science in addition to the usual disciplines of the foreign service. [Merely to obtain technical advice for policymaking] does not fill today's requirements for a continuing and intimate involvement in the policymaking process of competent people who understand science and its significance to policy, and who could therefore work effectively with the practicing scientists supplying the specialized *ad hoc* studies.

The purpose in combining these two kinds of scientific sophistication, he explained, was that "to integrate the scientific with the political, economic, military, and other factors that make up foreign policy operations requires, above all, competent people who understand the relationship of science to these other factors." Dr. Kistiakowsky had two solutions to this problem. First, more science and engineering graduates might be attracted "for regular careers in the Foreign Service and in our other overseas programs." But, in addition:

> I believe we must also provide a better scientific background for nonscientists in the international affairs field, and that this, perhaps, is the most important measure of all. Essential to these efforts is the development of an academic field of teaching and research in the interrelationship of science and foreign affairs, in order to provide education in and better understanding of the underlying significance and opportunities of this relationship.[174]

Five years after Dr. Kistiakowsky's article appeared, a survey by the Carnegie Endowment for International Peace showed that the number of FSOs with advanced training in the physical, biological, and other sciences was still minuscule. Those with training in history (705), political science (571), international relations (543), and economics (383) constituted 60 percent (2,202 of 3,670) of the Foreign Service officer personnel. Physical scientists numbered 52 or 1.4 percent. Those with training in biological sciences, mathematics, and medicine were grouped in a category of "miscellaneous." (See Table 8.)

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[172] Daniel S. Greenberg, "Science and Foreign Affairs: New Effort Under Way to Enlarge Role of Scientists in Policy Planning," *Science*, October 12, 1962, p. 124.

[173] Dean Rusk, Keynote Address, 8th Annual Meeting of the Panel on Science and Technology, of the House Committee on Science and Astronautics, January 24, 1967.

[174] George B. Kistiakowsky, "Science and Foreign Affairs," *Science*, April 8, 1960, p. 1023.

At the level of the masters degree the percentage in the four main categories of training rose to 75 percent. And of the 193 FSOs with the doctorate, 147 (76.2 percent) were in the four main categories, with only one FSO holding the doctorate in each of the fields of agriculture and biological sciences, and two in the physical sciences.[175]

TABLE 8.—FSOs BY EDUCATIONAL MAJOR [1]

Educational major	Number	Percent
Accounting	128	3.5
Business administration	148	4.0
Economics	383	10.4
Education	48	1.3
Engineering	65	1.8
English	155	4.3
History	705	19.2
Humanities	174	4.7
International relations	543	14.8
Language	149	4.1
Law	124	3.4
Physical sciences	52	1.4
Political science	571	15.6
Public administration	38	1.0
Social sciences	83	2.3
Miscellaneous [2]	266	7.2
Not designated	38	1.0
Total	3,670	100.0

[1] Source: John E. Harr, "The Anatomy of the Foreign Service: A Statistical Profile," Foreign Affairs Personnel Study No. 4 (Carnegie Endowment for International Peace, 1965), p. 14.
[2] Includes advertising, agriculture, biological sciences, geography, home economics, industrial relations/labor, international trade, mathematics, medicine, liberal arts.

THE SPECIALIST-GENERALIST ISSUE

Related to this subject is an issue that has perennially troubled the Foreign Service. It is the question of specialist versus generalist. The traditional attitude of the Foreign Service toward the specialist is illustrated by the testimony of George F. Kennan, former Director of the Policy Planning Staff and U.S. Ambassador to the U.S.S.R., in 1964. He said: "I think the Service should not include people who, while they may be technical experts in some specific field, lack the broader background of education and character necessary for foreign service work generally." [176]

Mr. Kennan's view appears to be reflected in the career histories of FSOs generally. A 1965 study of this subject found that specialists in the Service rose in rank more slowly than did generalists; according to this study:

TABLE 9.—AVERAGE AGE BY GRADE OF SPECIALISTS AND GENERALISTS, JUNE 30, 1962

	1	2	3	4	5	6	7	8	Total
Generalists	50.4	47.5	44.4	41.3	41.9	38.5			44.2
Specialists	51.0	49.4	47.0	45.1	45.8	46.3			46.6

"Those who enter [the Foreign Service] by the examination route, become generalists, and ultimately link political work with an area

[175] John E. Harr, *The Anatomy of the Foreign Service—A Statistical Profile*, Foreign Affairs Personnel Study No. 4 (New York: Carnegie Endowment for International Peace, 1965), pp. 14-16.
[176] U.S. Congress, Senate, Committee on Government Operations, National Policy Machinery Subcommittee, *Organizing for National Security*, vol. 1, Hearings, 87th Cong., 1st sess., 1961, p. 805.

specialty have the greatest possibility of achieving high rank at a relatively young age." Functional specialists may be promoted but "they must wait longer." [177]

One solution to the specialist-generalist issue in the Foreign Service was offered in a 1960 study by the Brookings Institution.[178] It proposed a more flexible, mixed strategy in recognition that the generalist was the "backbone" of the Service while specialists were needed in varying numbers for different fields of concentration. The plan had six elements:

(1) There should be continuing review of present and future requirements, and of methods to meet those needs.

(2) Foreign Service examinations should be designed so that potential generalists will not be penalized, but with an opportunity for a limited number of specialists to be selected each year through similar but somewhat differently organized examinations. If the Foreign Service is to staff a wide range of operational and specialized program posts in the future, it cannot hope to select talented young blood to fill these positions by a single examination.

(3) Specialists should be developed within the Foreign Service wherever possible, and inservice training should be provided to retool and maintain expertise during a specialist's career.

(4) Personnel assigned to specialist positions should be given longer tours of duty where this seems necessary and feasible.

(5) Opportunities for service at the rank of Career Minister should be available in many special fields with no prejudice against promotion of specialists to this rank.

(6) Lateral entry into the Foreign Service or appointments in the Foreign Service Reserve should be made as necessary, but should not be regarded as the major means of acquiring specialists. Requirements for such lateral entry should be flexible and realistic, free of unnecessary limitations.

The point of the foregoing is that entrants to the Foreign Service tend to be selected for nontechnical qualifications, and rewarded for avoiding specialization. Expertise in scientific and technological subjects does not appear to be perceived as beneficial, and these subjects do not appear to have attracted interest.

One call for an increased injection of specialized expertise into the U.S. diplomatic apparatus has come from the Foreign Service community itself. In an "Open Letter to the Director General of the Foreign Service," in 1969, Lannon Walker, chairman of the board of the American Foreign Service Association called attention to the increasing complexity of the diplomatic process resulting from technology. He noted that the solution had been to summon experts and create new agencies, which had resulted in fragmentation of knowledge and responsibility. Said Walker:

As the United States has moved from consultation on major problems of traditional diplomacy to a foreign policy which now includes internal financial policies, military technology, the ocean beds, and the movement of agricultural commodities through novel mechanism—and will soon include supersonic "booms," the multinational corporation, and growing uses of atomic energy—our response has been to call in the experts, and to create new agencies to meet new problems. The result has been a fragmentation of knowledge and responsibility which has clogged our own governmental processes and confused our friends abroad.

His solution was to preserve within the Foreign Service a strong cadre of generalists. However, he said: "The association believes that

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[177] John E. Harr, *The Development of Careers in the Foreign Service*, Foreign Affairs Personnel Study No. 3 (New York: Carnegie Endowment for International Peace, 1965), pp. 71–73.

[178] H. Field Haviland, Jr., *The Formulation and Administration of United States Foreign Policy*, a report on Foreign Relations of the United States Senate (Washington, D.C.: The Brookings Institution, 1960), p. 131.

increasingly the successful generalists will be officers who have acquired wider scope after having mastered a specialty." [179]

EFFORTS TO INCREASE TECHNICAL INTEREST IN STATE

During the years 1965–1967 a variety of efforts were made to increase the level of attention to science and technology in the Foreign Service. The emphasis, of course, was on the importance of technological development for foreign policy. A series of courses in science and science policy were initiated by the Foreign Service Institute, with the assistance of SCI. A program to exchange State personnel for training purposes with personnel from the Department of Commerce, the Atomic Energy Commission, NSF, and NASA was initiated in 1966. A series of "Secretary's Science Luncheons" were held during these years, and in 1966 a series of four "Secretary's Science Briefings" were scheduled.[180]

This range of expedients had a variety of purposes. It was intended to increase the visibility and perceived importance of science and technology for the Foreign Service. There were educational benefits in that a few technologies with significant impacts on U.S. foreign relations were exposed to diplomatic scrutiny. Exchanges of personnel would improve State's relations with the technical agencies as well as improving State's understanding of the international problems of these agencies. It was also possible that an increased awareness of the scientific and technical content of modern diplomacy would percolate throughout the diplomatic corps. However, a more systematic educational effort toward some of these purposes had a mixed success. This was the attempt to introduce a scientific and technological content into the curriculum of the Foreign Service Institute (FSI).

ORIGINS AND PURPOSES OF THE FOREIGN SERVICE INSTITUTE

Authorization for FSI was provided in the Foreign Service Act of 1946 to furnish "training and instruction to officers and employees of the Service and of the Department and to other officers and employees of the Government for whom training and instruction in the field of foreign relations is necessary, and in order to promote and foster programs of study incidental to such training. . . ." [181]

The Foreign Service Institute is explicitly to provide inhouse training to State Department personnel to enable them to carry out their duties. Thus, training is provided in 46 languages, in orientation for new employees, consular training, upgrading courses for executive, administrative, and clerical personnel, and preparatory training for Foreign Service families going overseas. Attention is also given to communication skills. A senior seminar in foreign policy runs from

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[179] Lannon Walker, "Toward A Modern Personnel System," *Foreign Service Journal* 46 (August 1969), p. 48.

[180] Of the "science luncheons," Professor Dean Rusk of the School of Law, University of Georgia, recalls:

> During my period as Secretary of State, I held a number of luncheons for 15 or so senior officers of the Department of State at which one or another top scientist would talk to us about the "cutting edges" of his own science, where he and his colleagues were going, and what problems we could expect in terms of our foreign relations. I found these meetings of very great interest.

(Rusk to Huddle, March 18, 1975.)

[181] United States Code, Title 22, sec. 1041 (Washington, D.C.: Government Printing Office, 1971), prepared by the Committee on the Judiciary of the House of Representatives.

September to June, and six foreign affairs executive seminars are held annually, running 6 weeks each.

For purposes of the present study the interest is particularly in the courses of "economic and commercial training" and "political training." Most of the scientific and technological education provided by FSI is under these two headings. For example, the subject of technology transfer by multinational corporations might be taken up in a "workshop on international business/commercial activities." The relationship of technology to U.S. exports could be a subject of the senior trade expansion seminar. However, in general, the scientific content of economics courses is muted.

In the category of political training are a number of other courses, all 1-week, with scientific content:

Science, technology, and foreign affairs
Psychological dimensions of diplomacy
Computers and foreign affairs
World resources

Of these, the course most directly on the topic is Science, Technology, and Foreign Affairs. This course has had an interesting history that may be instructive as to the problem of injecting scientific and technological content into the FSI curriculum. The course was first developed as a 4-week seminar, January 11 to February 5, in 1965. In transmitting a report on this seminar to the Secretary, June 1, 1965, George A. Morgan, director of FSI, described the "months of planning" for the seminar, the "gratifying" attendance, the "impressive array of speakers," the funding support by the Ford Foundation, and the leadership in assembling the program.[182] This, he said, was a "pioneering effort to explore how science and technology contribute to the development and execution of our foreign policy." Director Morgan expressed the hope that this effort—

> . . . will help to create within government, the scientific community, universities and industry an interest in considering more broadly and in greater depth the interactions between science and technology and foreign policy. In particular we hope that our experiment will prove useful to academic institutions in developing instruction and research in this uncharted interdisciplinary area linking the physical and social sciences and foreign affairs. For this reason this report has been prepared for general distribution.[183]

The seminar itself was a substantial effort, attended by 22 participants (including 13 from State and related agencies), with 37 prepared papers by such leading science statesmen as Dr. Killian, Dr. Hornig, Chairman George Miller of the House Science and Astronautics Committee, and President Seitz and Foreign Secretary Brown of the National Academy of Sciences. (See the accompanying course syllabus for an outline of the course.) A large bibliography was published for the seminar, and—according to the report—the "reference material and assigned readings were considered too extensive to study during the progress of the course." Clearly, there was much more material than could be crammed into a 4-week period. (See table 10.) The participants recognized the problem of a tradeoff between length of

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[182] Those thus cited were: Dr. E. M. J. Kretzman, formerly Acting Director of the Office of International Scientific Affairs of the Department of State, and his staff; Dr. Irwin Tobin of the Office of Science and Technology; Professor Carroll Wilson and Mr. Eugene B. Skolnikoff of M.I.T.; and Mr. Christopher Wright, Executive Director of the Council for Atomic Age Studies at Columbia University.

[183] U.S. Department of State, Foreign Service Institute, *Science, Technology, and Foreign Affairs*, report on seminar held from January 11 to February 5, 1965 at the Foreign Service Institute, prepared by L. F. Audrieth, and H. I. Chinn, letter of transmittal from George A. Morgan, Director FSI, to Secretary of State Dean Rusk, June 1, 1965.

time that senior officers could be spared from their regular duties to take the course and the time required to deliver to the participants a useful amount of information service.

TABLE 10.—*Foreign Service Institute Course Syllabus: Science, Technology and Foreign Affairs* [1]

(Idealized Syllabus)

A. INTRODUCTORY PRESENTATIONS

1. Seminar objectives.
2. Principles and concepts relating to the effect of science and technology upon national and foreign policy; background literature and reference sources.
3. Scientific discoveries and technological innovations and their effect upon the social, economic and political development of nations; historical approach.
4. Science and technology as factors in the development of national policies in the Western world, the Iron Curtain countries, and the emerging or developing areas of the world; science and technology as related to U.S. national and foreign policies.
5. Foreign policy issues classified on the basis of their scientific and technical inputs; policies for the advancement of science; science and technology as political parameters; the "case" approach.

B. THE SCIENTIST AND THE SCIENTIFIC METHOD: DEFINITIONS

Attitudes and characteristics of scientists and the scientific community; science and society; the scientist in politics; the scientist and national policy-making.

C. SCIENCE AND TECHNOLOGY IN THE UNITED STATES

1. Organization of U.S. science and technology; international operations and interests of various departments, agencies and organizations within the Government and outside of Government:
   a. Federal government—Presidential offices; congressional committees; departmental in-house and extramural activities; independent agencies.
   b. Quasi-governmental organizations.
   c. Industry.
   d. Miscellaneous—professional societies; foundations; academic institutions.
2. Science in the Department of State; activities and functions of SCI and other bureaus and offices with scientific and/or technological interests.

D. SCIENCE AND TECHNOLOGY ON THE INTERNATIONAL LEVEL—OBJECTIVES, RESPONSIBILITIES AND PROBLEMS (WITH SPECIAL EMPHASIS ON U.S. INTERESTS)

1. Intergovernmental—international; regional.
2. Nongovernmental scientific organizations.

E. INTERNATIONAL SCIENTIFIC PROJECTS—U.S. PARTICIPATION

1. IGY, Antarctica, Space, Atomic Energy, etc.
2. Research areas and disciplines of worldwide interest and/or those necessitating international cooperation to assure scientific progress; for example, oceanography, hydrology, biology, meteorology, fall-out, air pollution, water pollution (detergents), saline water conversion, arid zone projects, food, health, medicine, pharmacology, etc.

F. GROUP PROJECTS AND CASE STUDIES

(Assigned to working groups of two to five seminar participants, constituting position papers for presentation and discussion during the closing days of the seminar).

1. UN Conference.
2. US/USSR Space Cooperation.
3. Scientific Choice.
4. Exploitation of Mineral Resources Under the Seas.
5. Deterioration of Peanut Crops Resulting in Growth of Carcinogenic Fungi Dangerous to Man.
6. UN Environmental Pollution Control.
7. The Brain Drain.

See footnote at end of table.

TABLE 10.—*Science, Technology and Foreign Affairs*[1]—Continued

G. FIELD TRIPS AND VISITS

1. National Institutes of Health.
2. E. I. DuPont de Nemours and Company, Wilmington, Delaware.
3. Agricultural Research Center, Beltsville, Maryland.
4. Goddard Space Flight Center.

H. ADVANCES IN SCIENCE AND TECHNOLOGY

1. See Item G.
2. General lectures.

[1] L. F. Audrieth and H. T. Chinn, *Science, Technology and Foreign Affairs*, report on the seminar held at the Foreign Service Institute, January 11 to February 5, 1965, pp. 21–22.

The following year, the course was substantially reduced in scope, duration, and attendance. It went from 4 to 2 weeks, and eventually became a 1-week course given once yearly. The course was scheduled to be given the first week in December 1974, but when only two applications were received from candidate students the course was cancelled. Apparently there was thereafter some question as to whether the course should be dropped for want of interest.

OPTIONS FOR INCREASING THE TECHNICAL CONTENT OF THE FSI CURRICULUM

The purpose of the Institute is to enlarge the professional skills of diplomatic personnel. There appears to be a consensus that one of the requisite skills has to do with technical or scientific "literacy." Broadly defined, this skill implies a familiarity with science, its institutions and practitioners, and technological applications important for U.S. foreign relations.

The evidence is that a major attempt was made in 1965 to present a training program in FSI to meet this need, but that the level of effort declined, the response of candidate students diminished, and the substantive content of the training fell away. This decline in emphasis and effectiveness occurred at a time when the impact and pace of technological change were both accelerating and the need for scientific and technological literacy among the FSOs was increasing.

There appear to be four problems that remain unsolved in this matter: (1) The defining of what precisely is needed by the FSO in the way of scientific and technological familiarity for diplomatic service; (2) the development of curricula, course work, and training materials to meet the FSOs need; (3) the convincing of the FSOs and their superiors of the need for them to spare adequate time and effort to acquire the needed training; and (4) the maintenance of an up-to-date program of high utility, attractiveness, and acceptability to sustain it over the future.

Possible solutions to this set of problems, could include the following:

—Development of a set of simulated but realistic, technical-diplomatic problems to be undertaken by a seminar study team;

—Establishment of a relationship between the FSI and the Policy Planning Staff to enrich the curriculum;

—Contracting with a qualified research institution to define the FSO need for technical information and to design ways of meeting the need;

—Stronger support by higher level officers of the Department;

—Increased emphasis on general technical knowledge in initial qualifying examinations for admission to the Foreign Service;

—A series of assessments of the comparative predictive power of economic statistics and technological trend analysis, for use in regional studies;

—Increased use of technological inputs by INR, and OES, to the work of the functional bureaus and the Policy Planning Staff; and

—Arrangements for the continuing education of students, after taking an FSI science policy course, through continued mailings of reports on science and technology trends of significance for diplomacy.

Dean Harvey Brooks of the Department of Applied Physics, Harvard University, would stress the problem-solving approach suggested in some of these options. He writes:

Insofar as an attempt is made to impart technical literacy to FSOs, it should be issue-oriented rather than discipline oriented. But I think that State needs both specialists and technically literate generalist FSOs who can communicate with the specialists and feel comfortable in making use of the technical expertise of others.[184]

Similarly, David Beckler, long associated with the Office of Science and Technology (OST) and earlier with the Department of State, suggests that "science literacy" should be a logical outcome of practical issue-oriented study courses in FSI:

In-house policy training at the Foreign Service Institute.—I am not an enthusiast for special lectures or courses aimed at developing scientific and technical "literacy" on the part of the Foreign Service officers. On the other hand, many, if not all, of the matters of direct concern to them at the Institute have a scientific or technological dimension. This dimension needs to be developed and elaborated in the context of the overall issues whether they be foreign trade, relationships between the U.S. and developing countries, environment, population, energy, etc. It is important to weave this perspective into the Foreign Service Institute program. Special study materials should be developed for this purpose. In this way, the Foreign Service officers can become interested in and familiar with the nature and implications of science and technology for their future work.[185]

There are, however, inherent limitations on what the FSI can do to inculcate scientific and technological expertise in the FS. In particular, the individual officer must somehow be motivated to absorb what the FSI has to offer, to combine it with knowledge from other sources, and to apply it within his terms of reference. A recent article by James N. Cortada, dean of the FSI School of Professional Studies and consultant A. Guy Hope of the Maxwell Graduate School, Syracuse University, describes this problem thus:

It is the philosophy of the Institute that, regardless of how carefully developed training programs may be, they must complement, not substitute for, professional experience under competent and conscientious superiors. Only to the extent that

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[184] Brooks to Huddle, February 10, 1975.

[185] Beckler to Huddle, March 5, 1975. Mr. Beckler is now serving as Assistant to the President, National Academy of Sciences.

supervisors in the Foreign Service, in the Department of State, and in related foreign affairs agencies are conscious of their responsibilities for personnel development can short- or long-term training succeed. Programs with a formal training content can only act as catalytic agents to assist officers who are motivated to improve their skills and understanding of the complex tasks of a modern foreign policy establishment. The developmental job is up to the people who are doing the work and to those who supervise their activities and careers.[186]

One thing seems evident. Unless Foreign Service officers clearly identify "technical expertise" as an essential item in the diplomatic tool kit, and a faculty associated with promotion to senior policy-making status, this quality is unlikely to be vigorously sought. Only when language facility became a defined requirement for advancement in the Foreign Service was it a major element of in-house training.

One interesting suggestion was advanced by Under Secretary Nicholas deB. Katzenbach, in 1967. To meet the need for FSOs "not just versed in foreign affairs but versed as well in the intricacies of American government and political life," he proposed that FS personnel be afforded an opportunity "to work in and with other governmental and private agencies concerned with the foreign and domestic problems of the United States." Examples were: a congressional committee staff, another executive agency, in journalism, with a foundation, school, or private business, but returning thereafter to the Department of State. Such an arrangement, he said, would—

. . . Provide a cross-fertilization of views and ideas. It would introduce into the Service a greater variety of specialized professional skills and talents. And it would increase the independence of Foreign Service officers. With a widened professional experience, they would be able to move out of or stay in the service as they see fit.[187]

Another possibility is the use of postdoctoral interns from the university community to serve in OES, and in the functional and regional bureaus. Such interns could perhaps retain their academic affiliations during such service. In the Department they could provide a source of technical expertise, and upon their return to academic careers they could increase the awareness there of the diplomatic aspects of technical matters. Construction of "bridges" between the diplomatic and technical academic community is desirable, as well as the enhancement of technical expertise in the diplomatic community.

Some Possible Purposes of Expanded Departmental Attention to Science and Technology

The essence of the foregoing chapter of this study is not that the Department of State has failed to recognize its responsibilities for relating science and technology to diplomacy. The attempt was made, but circumstances and competing demands on departmental resources stood in the way. Some specific projects and programs did peter out, others never got off the ground. Thus the need for a scientific and technological competence, spread throughout the Department of State, is great and increasing; what appears to be required is not some vast shake-up but a carefully managed, gradual, but steady growth in technical sophistication, a heightened visibility of technological

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[186] James N. Cortada and A. Guy Hope, "The Foreign Service Institute: Patterns of Professional Development," *Department of State Bulletin*, February 6, 1967, p. 223.

[187] Nicholas deB. Katzenbach, "Administration of Foreign Policy," *Department of State News Letter*, No. 79 (November 1967), p. 5.

content of diplomacy throughout. This appreciation should encompass both the positive and negative impacts of technology on diplomacy, and be perceived in both the regional and functional bureaus. There needs to be a deeper appreciation of the relationship between U.S. technological developments and the U.S. international posture, and of the potential contributions to U.S. diplomacy of foreseeable future technological developments.

The heart of science and technology is invention and change. The problem is to relate this force for change to diplomacy. It implies for the diplomatic process the encouragement of creativeness and increased receptivity toward innovation.

More particularly, the rate of technological change and its impacts on the diplomatic environment call for a strengthened ability of the functional bureaus to perceive and interpret these changes and impacts, around the world, and for an increased alertness to the predictive power of technology analysis and forecasting.

IX. Congressional Concern With Science in the Department of State

One student has observed: "Significantly, it was Congress and not the State Department or the White House that first saw the broad implications of science's penetration into all segments of foreign policy.[188] This awareness took the form of a study planned by the staff of the Senate Committee on Foreign Relations in 1958 and commissioned from Stanford Research Institute (SRI) January 24, 1959. It was scheduled for delivery in 6 months and called for ". . . an imaginative but scientifically sound examination of possible scientific developments during the next decade, with an estimate of the impact of such developments on foreign relations."

Congressional Contract To Study Science Impacts on Foreign Policy

The contractor was asked to identify possible favorable and unfavorable impacts of scientific developments on U.S. foreign policy and to forecast future foreign policy problems resulting from such developments. Among the examples suggested were nuclear modification of geography, weather modification, increased pollution, population control, new food and energy sources, exploitation of seabed minerals, uses of outer space, and communication technologies.

The SRI report[189] offered three main conclusions:

1. Scientific developments in the next decade will give rise to or intensify many problems that must engage the attention of foreign policy planners. Scientific developments will also help solve foreign policy problems. But the outlook is that the progress of science and technology will do more to create or intensify than to ameliorate such problems, unless deliberate policy measures are taken.
2. The national interest requires a more conscious direction of scientific activity in ways likely to assist in the achievement of America's international goals. The security and well-being of the United States call for a reappraisal of present allocations of scientific and technological effort with a view to directing more effort toward nonmilitary foreign policy challenges.
3. Foreign policy planning of the broadest kind, making use of the best scientific assistance, will be a critical requirement in the years ahead. This planning should include continual review of prospective scientific developments and their significance for international relations.

Science, said the report, had produced a global environment of political and economic interdependence, shifts in national power-relationships and the relative importance of geographic areas (e.g. petroleum-bearing areas of the Middle East). "Scientific progress itself has become a matter of concern to foreign policymakers, because of its important relation to military power, to economic relationships, and to a nation's prestige." And, finally, it had affected the instruments and methods of foreign policy through rapid travel and instant communications. "By far the most important channel through

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[188] Donald W. Cox, *America's New Policy Makers: The Scientists' Rise to Power* (New York: Chilton Company, Chilton Books, 1964), p. 83.

[189] Stanford Research Institute, *Possible Nonmilitary Scientific Developments and Their Potential Impact, on Foreign Policy Problems of the United States* (July 1959), printed in: U.S. Congress, Senate, Committee on Foreign Relations, *United States Foreign Policy: Compilation of Studies Nos. 1–8*, 86th Cong., 2nd sess., September 1960, pp. 99–198. (Committee print.)

which science has influenced the problems of foreign policy is technology." The report continued: Science was not to be confounded with technology; the time lags in converting scientific discoveries into widely applied technologies had been greatly reduced; accordingly, there was a need to reduce the time lag between the diplomatic impact of a new technology and the diplomatic response to that impact.

While the report dealt mainly with the diplomatic problems created by present and future science and technology, it also suggested the possibility that technical initiatives could advance U.S. diplomatic goals. Some efforts were assertedly already underway.

> But on the whole [said the Report] the extent to which science is consciously being called upon to improve the formulation or execution of our foreign policy is quite small compared with the conscious use of science in connection with military, industrial, agricultural, and medical problems, particularly small when one considers the urgent need to find new approaches to foreign policy problems.[190]

The Report suggested that the committee review this situation. It also proposed three steps (paraphrase):

1. Identification of, and action on, foreign policy problems that research and development initiatives could alleviate;
2. Stepped-up effort in basic research judged beneficial to U.S. foreign policy formulation and execution; and
3. New steps devised and taken to exploit the "bridge" effect of science, that links scientists across national boundaries.[191]

A number of examples were suggested in each of these areas, some of which have since been initiated (e.g., World Weather Watch and International Biological Program). Others still invite attention (e.g., "an international translation and information retrieval center").

FOREIGN RELATIONS COMMITTEE HEARING ON SCIENTIFIC DIPLOMACY

Following receipt of the SRI study on "Possible Nonmilitary Scientific Developments and Their Potential Impact on Foreign Policy Problems of the United States," the Senate Committee on Foreign Relations held open hearings on the report, January 28, 1960. However, these hearings added little to the information before the committee. Speaking for the Institute, President E. Finley Carter urged more science initiatives for social purposes on a global basis, expanded research in policy sciences in the Department of State, more science in foreign assistance programs, and more support for U.S. participation in international meetings and conferences. There was, he said a role for the Congress here:

> . . . If science is to contribute, there must be hard, realistic thinking, by both scientists and Government people, and there must be money and leadership available. As members of Government, concerned with the overall directions of the United States in foreign affairs, we look to you in the Congress, and to the executive branch, to provide the leadership and the support necessary to encourage more effective application of science to the problems of human welfare and human understanding.[192]

Carter was followed as a witness by Dr. Wallace R. Brode, science adviser, Department of State, who agreed that "It is impossible to dissociate those developments in science and technology which affect

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[190] Stanford Research Institute, *Possible Nonmilitary Scientific Developments*, op. cit., p. 183.
[191] Ibid., p. 184.
[192] U.S. Congress, Senate, Committee on Foreign Relations, *United States Foreign Policy*, Hearings, Part I, 86th Cong., 2d sess., January 28, 1960, pp. 2–7.

our national policy from those which form our foreign policy." He quoted from an earlier address he had made as president of the American Association for the Advancement of Science: "A national science policy is needed for a wise and rational distribution of scientific activities, so that space, defense, education, atomic energy, oceanography, and medical research are not bidding against each other for limited available support." However, he took exception to Dr. Carter's expressed concern that the Department of State was not a "major recipient" of research funds, because in his view the Department was "not an operating agency in science, but rather a coordinating and assessing agency." He said:

> Our modest program in science coverage in the Department of State is directed primarily toward the policy influence of scientific developments. We expect the major needs of American industry and applied governmental agencies to be met by specialists from these areas, or supported by these areas and coordinated through the science attaché of the Embassy in accordance with the coordinating function which the President has directed to be exercised by our Ambassadors. The coordination authority which the Department has in respect to foreign science programs of U.S. agencies abroad can provide a useful means of directing such activities in the support of our foreign policy and the flow of scientific information.

Dr. Brode asserted that "It must be obvious that there is an important place for science in our foreign policy planning." Nevertheless his view of the requirements of the Department to provide this function was not expansive: "Relatively speaking, our needs are modest and our entire program for a number of years to come would not envisage, with our present responsibilities, more than 25 scientists. As science grows in importance it may well follow that our science program in the Department may expand in area and subjectwise." [193]

Although the importance for American diplomacy of science and technology was abundantly documented by the SRI study and confirmed by Dr. Brode's testimony, no congressional action was taken in view of the Department's apparent satisfaction with the *status quo*.

EARLY CONGRESSIONAL LOOK AT ORGANIZATION FOR INTERNATIONAL SCIENCE POLICY COORDINATION

An expression of interest came November 9, 1962, from the House Committee on Science and Astronautics (changed to Science and Technology, effective January 1975). The committee reviewed, in a very brief (6 page) staff study, the need for "coordination of foreign scientific policy," traced the evolution of the scientific attaché program and SCI, and proposed that the committee "within the limits of its jurisdiction, periodically review the coordination of national scientific and technological policies and programs with respect not only to such matters as effectiveness, adequacy, and cost," but to such questions as the following:

> How can the United States best incorporate scientific and technological factors in making its national decisions, including foreign policy?
>
> Under what circumstances does international scientific and technological cooperation serve the national interest?

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[193] Ibid., pp. 7-14.

What factors favor international cooperation in science and technology?
What factors hinder such cooperation?
How can the United States best use its scientific and technological resources in support of its national decisions, including its foreign policy? [194]

The congressional interest in the broad subject of science and technology aspects of foreign policy thereafter appears to have followed, in approximate order of emphasis, four sets of considerations, as follows:

1. The strengthening of the science office and other elements in the Department of State to deal with all these matters.
2. Broad reviews of global trends in social, economic, military, and technical development as background for more specific legislative initiatives;
3. National science and technology policy, with international aspects as an essential element; and
4. Specific international issues with substantial scientific or technological content.

In the discussion that follows, these will be taken up in order, with the last of the four items considered in a later chapter.

Congressional Actions To Strengthen Diplomatic Resources in Science

The many reorganizations of the Department of State following World War II, and the many reports and studies of ways to improve the Department's organization have, of course, been subjected to congressional scrutiny in funding authorization and appropriations hearings. In general, however, the Congress has elected not to prescribe organizational forms or adjustments, but has relied on the Department to maintain the modernity of its structure.

One notable exception to this principle was the action in 1973 (see page 45) to create a new Assistant Secretary of State and a new consolidated Bureau of Oceans and International Environmental and Scientific Affairs. This action apparently had the threefold purpose of (a) requiring intensified attention to the diplomatic importance of the oceans and the environment in a technological setting, (b) consolidating in one organization a number of diplomatic functions with a substantial technical content, and (c) providing statutory emphasis to the State Department science office as a legitimate copartner with the ranking regional and functional Assistant Secretaries in the policy-making hierarchy of the Department. In its new form, OES today presents one organization that covers oceans, environment, nonmilitary atomic energy, population matters, bilateral science agreements, technology, and basic science generally. Welding these elements into a coherent pattern seems to present a formidable as well as important task. It is likely to be one that will take time and effort.

In the meantime, the roles of other elements of the Department in science and technology may also warrant congressional consideration. Such considerations as the following might come under review:

1. Technical and policy aspects, as opposed to funding, of U.S. participation in international scientific and technological agency activities. (How might U.S. expertise be mobilized to enhance the total effectiveness of U.N. associated agencies concerned with

[194] U.S. Congress, House, Committee on Science and Astronautics, *Coordination of Foreign Scientific Policy*, Staff study, 87th Cong., 2d sess., November 9, 1962, p. 6. (Committee print.)

medicine and health, atomic energy, natural resources, the world environment, economic and industrial development, population problems, food and agriculture, communications, technology transfer, scientific information management, and other international concerns? Here the coordinating responsibility is shared between OES and a small scientific unit in the Bureau of International Organizations Affairs.)

2. The close interactions between technology and economics, as these affect the foreign economic policy of the United States. (How can the predictive power of technology analysis be applied to the making of global economic forecasts? What beneficial effects on U.S. international trade does technology offer, and how can these be secured? What is the role of the multinational corporation in effecting international transfers of technology, and what policy controls and guidances should be involved to constrain or direct this growing presence? What are the economic consequences of mineral shortages and possible cartel actions; and what U.S. policies could be devised to cope with these?)

3. The pervasive importance of the information function in the design and execution of U.S. foreign policy. (How can the enormous number of bits of seemingly unrelated information about scientific discoveries, new applications of scientific principles, and the myriad of industrial and commercial ventures to exploit technology in foreign countries be assembled and analyzed, and translated into comprehensive statements of national and global trends? Is there a role here for the Bureau of Intelligence and Research?)

4. The need for an enhanced awareness of Foreign Service personnel as to the growing importance of the scientific and technological element of the totality of factors which comprise diplomacy. (How is the Foreign Service motivated to acquire these skills? Where in the regional bureau structure would they be most useful? What kind of inhouse arrangement would best provide training in them? How can "science in diplomacy" be exploited throughout U.S. foreign relations management, as contrasted with "diplomacy in science"? What role might the Foreign Service Institute play in this situation?)

5. The scientific and technological personnel in world deployment as an element of the total foreign policy establishment. (In what countries should there be scientific and technological offices? How much emphasis should there be on science and how much on technology? What would be the ideal composition of the office of a foreign attaché? Should these offices be replaced or supplemented by regional science offices? Is there a need for science officers of the Foreign Service in embassies without a full-time scientific attaché?)

Congressional Reviews of Trends in International Science and Technology

Two broad approaches appear to characterize congressional attention to the interaction of science and technology with American diplomacy. One of these has stressed the role of science and technology; the other, the diplomatic consequences. Thus, Congressman Emilio Q. Daddario, addressing a Panel on Science and Technology convened

by the House Committee on Science and Astronautics in 1967, spoke of a "new determination on the part of the Congress of the United States to take part in the international interchange of science and technology, and to help shape its influence on world affairs." [195] At a hearing before a subcommittee of the House Foreign Affairs Committee in 1969, the subcommittee chairman, Clement J. Zablocki, stressed the other side of the relationship: "If the quality of our strategic thought and the effectiveness of our strategic policies are to remain high, their constant review is necessary in the light of strides in science and technology." It was therefore necessary for Members of Congress to have "a deeper appreciation of the ways in which scientific progress may shape strategic thinking and foreign policy in the days to come." [196]

It is beyond the scope of this study to trace all the different staff studies and reports, hearings and individual commentaries on broad scientific and technological trends affecting the sweep of U.S. foreign policy. However, two examples are offered to approaches by congressional committees to assess (a) the present and future diplomatic environment largely created by modern technology, or (b) the present and prospective trends in science and technology that produce profound impacts on the diplomatic environment.

INVESTIGATION OF CHANGES IN THE DIPLOMATIC ENVIRONMENT

In 1969 an investigation was begun by the Subcommittee on National Security Policy and Scientific Developments of the House Committee on Foreign Affairs into the relationships between national strategy and science, broadly defined. The emphasis of this first investigation was heavily on the technology of weaponry and its diplomatic consequences. However, late in the hearing the concluding witness, the Under Secretary of State for Political Affairs, U. Alexis Johnson, broadened the scope of the discussion when he said:

> Another set of questions relevant to national security concerns the role technological change plays in the relationship between ourselves and others. How do technological developments help to strengthen the ties with others in the free world? How do these developments divide? [197]

A further set of hearings in 1972, carefully structured, addressed the broader scope of "National Security Policy and the Changing World Power Alignment." These hearings explored:

—Strategic and General Considerations;
—National Security Policy: the Exercise of Military Power;
—The Economics of National Security;
—Third World Development: Tribulations, Challenges, and Prospects;
—Domestic Requirements of a Successful National Security Policy;
—The Tasks—and the Alternatives—in Preventing World War III; and
—The View from the State Department.

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[195] U.S. Congress, House, Committee on Science and Astronautics, *Government, Science, and International Policy*, proceedings before the Committee of the Panel on Science and Technology, Eighth Meeting, January 24–26, 1967, p. 16.

[196] U.S. Congress, House, Committee on Foreign Affairs, National Security Policy and Scientific Developments Subcommittee, *Strategy and Science: Toward a National Security Policy for the 1970s*, Hearings 91st Cong., 1st sess., March 1969, p. 2.

[197] Ibid., p. 237.

The theme of technological impacts was never far from center stage in these hearings, which ranged widely over the military, economic, foreign aid, and even sociological considerations. Among the questions posed in the outline of the hearings [198] were the following:

> [How can national strategy be designed so as to avoid] overwhelming technological influences in an increasingly complex world?
> How to control and direct technology and who controls the controllers?
> Will [the United States] be able to continue to export technology . . . ?

Issues raised by participants included the "growing worldwide concern with the allocation of the planet's resources" (p. 7), the rise of the multinational corporation (p. 18), the general movement toward a global economy of interdependence with respect to both resource depletion and environmental protection (pp. 31, 34), and the "single community" of Western science and technology (p. 45). In this hearing again, Secretary Johnson was the concluding witness. He spoke of the "economic side of diplomacy" as presenting "the most intractable problems for the future":

> I expect [said the Secretary] that economic considerations may dominate foreign policy over the next two decades, as security concerns have dominated the last two. Technology is hurrying us into the future at a rate that neither our understanding nor our institutions, including our diplomatic ones, seem able to comprehend or cope with.[199]

The impressive scope of this hearing was reflected in a subcommittee report containing an "agenda for congressional consideration and action" which appeared October 25, 1972. After reviewing the findings of the Hearing-Symposium, it proposed

> . . . that the House Committee on Foreign Affairs, the Senate Foreign Relations Committee, and other appropriate committees of the Congress should:
> (1) Hold annual hearings on the foreign policy reports to the Congress of the President and the Secretary of State as well as on the foreign policy implications of the economic report to the President and the President's message on the state of the world.
> (2) Establish machinery and procedures for systematically and periodically assessing the long-term foreign policy goals and programs of the United States; for example, by the creation of a high-level advisory panel composed of public officials and private persons, and/or by systematic and periodic review through congressional hearings.
> (3) Hold hearings and/or establish advisory panels which would:
> (a) develop criteria to determine more clearly what constitute the vital security interests of the United States;
> (b) establish guidelines to determine what commitments must be based on treaties and what role executive agreements can and should play;
> (c) set criteria to guide the conduct of foreign policy in such traditional fields as the protection of American citizens, property, and investment abroad; freedom of the seas, and access to markets and sources of raw materials;
> (d) examine the decision-making process in foreign affairs, particularly the roles of the Secretary of State and the National Security Council as well as the potential roles of the Cabinet and other executive agencies concerned with domestic affairs;
> (e) examine the extent to which social science research can be more effectively utilized in guiding the formulation and execution of U.S. policy toward the other nations and cultures of the world;

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[198] U.S. Congress, House, Committee on Foreign Affairs, National Security Policy and Scientific Developments Subcommittee, *National Security Policy and the Changing World Power Alignment*, Hearing-Symposium, 92d Cong., 2d sess., May 24, 1972, p. 1.
[199] *Ibid.*, August 8, 1972, p. 368.

(f) conduct periodic reviews of the security, political, and economic implications of U.S. foreign bases, including the sharing of bases and costs with our allies.

(4) Request the Office of Management and Budget to prepare foreign expenditure budgets in terms of balance of payment implications.

(5) Enact legislation to require the Central Intelligence Agency and the intelligence staffs of other executive departments and agencies to report their relevant studies and intelligence assessments to appropriate congressional committees in executive session and to qualified staff members.

(6) Hold hearings on the various efforts of all government agencies and departments involved in the development of programs dealing with the protection of the international environment and natural resources.

(7) Encourage by every means possible public discussion of foreign policy questions.[200]

As extensive as these recommendations were, an observation by one of the first witnesses in the hearing, Professor Robert A. Scalapino of University of California at Berkeley, suggested the need for still further congressional inquiry and action. He said in his prepared statement:

No current body, however, exists which by virtue of its structure and personnel can address itself systematically and regularly to the most fundamental issues concerning foreign policy objectives and strategy in such a fashion as to involve the Congress and the public as well as the national administration. In my opinion, it is time to give this matter the most serious consideration.[201]

DIPLOMATIC USES AND EFFECTS OF SCIENCE AND TECHNOLOGY

A 10-year sequence of studies of the components and consequences of science and technology policy culminated in 1975 in the offering of a legislative proposal for a national policy and implementing institutions in this area. Explicit attention was given to the diplomatic aspects of this policy. The investigation was conducted by the House Committee on Science and Astronautics, and began with two contract studies by the National Academy of Sciences into *Basic Research and National Goals* (contracted for in 1963 and reported in March 1965) and *Applied Science and Technological Progress* (reported in May 1967). The first of these studies led to the adoption of its theme for the seventh annual meeting of the committee's Advisory Panel on Science and Technology.[202] The keynote address at this 3-day seminar, by Vice President Hubert H. Humphrey, strongly accented the international aspects of science and technology, as did the prepared remarks of Lord Snow of the United Kingdom Ministry of Technology, Dr. Roger Revelle, director of the Harvard University Center of Population Studies, and others.

The following year (January 24–26, 1967) the Panel took up the topic of "Government, Science, and International Policy." Dean Rusk, Secretary of State, in his keynote address described in detail the attention being given in his Department to science policy and declared:

The political significance of strong national programs in science and technology expands steadily. Political-scientific areas such as disarmament, nuclear safe-

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[200] U.S. Congress, House, Committee on Foreign Affairs, National Security Policy and Scientific Development Subcommittee, *National Security Policy and the Changing World Power Alignment*, Report, 92d Cong., 2d sess., October 25, 1972, p. 20. (Committee print.)

[201] Hearing-Symposium, House Foreign Affairs Committee, *National Security Policy*, May 24, 1972, p. 22.

[202] U.S. Congress, House, Committee on Science and Astronautics, *Government, Science, and Public Policy*, proceedings before the Committee of the Panel on Science and Technology, Seventh Meeting, January 25–27, 1966, 198 p.

guards, ocean exploitation, space technology and communications, and water management are areas in which the natural and social sciences meet, and they offer major opportunities for international programs. Wider use of forums, such as this today, to bring the international problems of science and technology before learned men from both broad areas can assist in finding the solutions.

As to our approach to this kind of international cooperation, my points were three. We can make better use of new techniques for technological forecasting as an input to foreign policy judgments. New understandings and mutual respect between the physical sciences and the social sciences are prerequisites if the gap between them is to be completely closed. We must have programs of international scientific and technical cooperation on two levels: with the advanced nations in understanding and controlling the total environment; and with those nations in assisting the material progress of the developing nations.

Our future no longer stands in the wings. Man's needs and his competence have both reached dimensions which can no longer be ignored. The scientific revolution has arrived—live, and in color. We cannot clearly foresee the advances, discoveries and innovations which lie ahead, but the uses to which we put the new knowledge in our human relationships may well be critical.[203]

A feature of this conference was the presence of six foreign guest panelists who described science organization and issues in their countries (Brazil, Switzerland, Netherlands, Japan, Norway, and India).

Again in 1968 the theme of the Panel was international—*Applied Science and the World Economy*—with four papers by foreign guest speakers;[204] the keynote address was delivered by George D. Woods, president of the International Bank for Reconstruction and Development. The thrust of this meeting was the strengthening of the world economy. As Barbara Ward summed up the problem:

We shall not reverse this trend by inaction. On the contrary, drift is carrying us on towards the rapids. Our need is rather, as Mr. George Woods has proposed, to call on the best expert advice to advise our governments and help them work out the implications of the world's dilemmas, to assess the scale of necessary action, weed out the failures, underline the successes and devise a joint strategy for the future modernization and progress of our interdependent world. Only if we are ready for something like the sustained practice of welfare and justice we accept inside our domestic economy, are we likely to make much progress in the larger task of modernizing and domesticating the whole planet. Yet if we cannot do so, we must face the fact that the technology, which might have united and enriched our world, is much more likely to blow it up.[205]

The Committee's Subcommittee on Science, Research, and Development in 1970 next addressed the question of *National Science Policy* in an extensive set of hearings.[206] While the main attention of witnesses was addressed to the funding of U.S. science, the reduction in military expenditures for basic research, and support for science education, a number of statements by witnesses called attention to the international aspects of U.S. science policy.[207] The strongest statement on this subject was in a letter received by Chairman Daddario of the subcommittee from Charles A. Lindbergh, who wrote in part:

. . . I think that the survival or the breakdown of our western civilization is likely to depend on how intelligently we apply its science and technology to

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[203] Panel on Science and Technology, Eighth Meeting, *Government, Science, and International Policy*, p. 7.

[204] These were: Dr. Alexander King, Director for Scientific Affairs, Organization for Economic Cooperation and Development, France; Dr. Jorge A. Sabato, Technology Manager, National Commission for Atomic Energy, Argentina; Lady Jackson (Barbara Ward), Foreign Affairs Editor, "The Economist," England; Dr. O. M. Solandt, Chairman, Science Council of Canada.

[205] U.S. Congress, House, Committee on Science and Astronautics, *Applied Science and World Economy*, a compilation of papers prepared for the Panel on Science and Technology, Ninth Meeting, February 1968, p. 19. (Committee print.)

[206] U.S. Congress, House, Committee on Science and Astronautics, Science, Research, and Development Subcommittee, *National Science Policy*, Hearings, 91st Cong., 2nd sess., July 7, 8, 21, 22, 23, 28, 29; August 4, 5, 11, 12, 13; September 15–17, 1970, 963 p.

[207] Among these were President Ruben F. Mettler of TRW, Inc., p. 539; Professor W. Albert Noyes of the University of Texas at Austin, p. 623; and Professor Eugene B. Skolnikoff of M.I.T., p. 683.

our human environment within the next decade. If we can cope with the problems our unprecedented knowledge has created, we can do so only by properly using the tools of that knowledge. No previous civilization has had either our knowlege or our tools. It seems to me that in this fact we have remaining some hope that we can avoid following the path of breakdown that history suggests is inevitable for every civilization.[208]

The final panel meeting on the subject—*International Science Policy*—was held January 26–28, 1971.[209] The keynote address was was delivered by William P. Rogers, Secretary of State who said:

Our basic goal is to put science and technology at the service of human—and humane—ends.

In our foreign policy we are taking three major steps to achieve this goal:

1. We are increasing our emphasis on science and technology in our aid to developing countries.
2. We are encouraging an international effort to preserve the quality of the world's environment, and
3. We are seeking greater international cooperation to enhance the benefits of technology and to curb its danger.[210]

At this conference Franklin A. Long, director of the Cornell University program on Science, Technology, and Society, proposed the creation of a congressional joint committee which would be the counterpart of the National Security Council, with similar scope. "I would hope," said Long, "that the interpretation of national security by the new committee would be broad enough to include a study of nonmilitary alternatives as well as of military programs and to include a study of the impact of internal U.S. programs as well as of international needs and goals." [211]

One of the participants in the conference was Emilio Q. Daddario, who had left the Congress and was senior vice president of Gulf and Western Precision Engineering Company. He called attention to the coherence of the successive panels. The "central question" was "how science can best be employed for the benefit of all mankind." New approaches and mechanisms were needed for broader international scientific and political cooperation. And it was necessary "to integrate more completely our own national science activities with those of other nations." [212] One such mechanism, he suggested, might be a series of regional "international science policy committees" to "develop more fully the multilateral approach to scientific cooperation."

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[208] Hearings, House Committee on Science and Astronautics, *National Science Policy*, p. 4. (The complete letter appears in the Appendix, p. 929.)

[209] Guest panelists included:

Dr. Viktor A. Ambartsumian (U.S.S.R.), President, International Council of Scientific Unions, Rome, Italy, and President, Academy of Sciences of the Armenian SSR, Yerevan, U.S.S.R.

Hon. Staffan Burenstam Linder (Sweden), Member of Parliament, Stockholm, Sweden.

Capt. Jacques Yves Cousteau (France), Centre d'Etudes Marines Avancees, Marseilles, France.

Hon. Emilio Q. Daddario, Senior Vice President, Gulf & Western Precision Engineering Company, Manchester, Conn.

Hon. Allister Grosart (Canada), Special Committee on Science Policy, The Senate of Canada, Ottawa, Canada.

Dr. Franklin A. Long, Director, Program on Science, Technology, and Society, Cornell University, Ithaca, N.Y.

Prof. Thomas Odhiambo (Kenya), Director, The International Centre of Insect Physiology and Ecology, Nairobi, Kenya.

Mr. Herman Pollack, Director, Bureau of International Scientific and Technological Affairs, Department of State, Washington, D.C.

Dr. Walter Orr Roberts, President, University Corporation for Atmospheric Research, Boulder, Colo.

Prof. Abdus Salam (Pakistan), Director, International Centre of Theoretical Physics, Trieste, Italy.

Dr. James D. Watson, Professor of Biochemistry, Harvard University, Cambridge, Mass.

Mr. James E. Webb, Treasurer, National Academy of Public Administration, Washington, D.C.

(As cited in, U.S. Congress, House, Committee on Science and Astronautics, *International Science Policy*, proceedings before the Committee of the Panel on Science and Technology, Twelfth Meeting, January 26–28, 1971. p. iv.)

[210] Proceedings, Panel on Science and Technology, Twelfth Meeting, *International Science Policy* p. 4.

[211] Ibid., p. 71.

[212] Ibid., pp. 165–172.

However, a necessary first step was the formulation of national science policy.

Another speaker, James E. Webb, formerly Administrator of NASA, called attention to the fact that "others are at work in these fields." He cited the initial report of the present series, *Toward a New Diplomacy in a Scientific Age*, quoted its thesis,[213] and observed:

> Now, Mr. Moderator, I refer to this report by this sister committee as only one indication, which I am sure is welcome to the chairman of this committee, that just as this committee is reaching out for a better understanding of the international opportunities inherent in science, so is the Committee on Foreign Affairs reaching out to better understand the implications of science for diplomacy.
>
> Now, perhaps the identification of international science policy and practical ways to make it effective might be pursued further and then maybe some form of joint effort of these two committees might be worth consideration. In any event, this action by the Foreign Affairs Committee shows the growing recognition in Congress, and elsewhere, that no area of international concern can be oblivious to the need for a further strengthening of the scientific underpinning on which so much of modern life rests; and it seems to me that one essential ingredient of an international science policy is how we can learn from our experience to enable leaders of many nations to work within their own nations to improve their own scientific competence and relate it to engineering development that follows it, relate it to public policy, project approval, allocation of resources.[214]

The most recent development in the sequence followed by what is now the Science and Technology Committee [215] was a series of hearings in 1973 and 1974 on Federal Policy, Plans, and Organization for Science and Technology, leading to introduction of a national science policy bill [216] March 6, 1975. In the hearings, a number of witnesses took positions on the need for an international science and technology policy. For example, Elmer Staats, Comptroller General of the United States, saw a large component of "international relations" in science policy at the Presidential level of decisionmaking. He said, in his prepared statement:

> There seems to be little doubt that the all pervasive impact of science and technology on national security, quality of life, the economy, and international relations is so important that Presidential decisions regarding national policy, strategy, and tactics must have the benefit of the best advice available. The National Academy Committee base their recommendations on this fact. In matters such as arms control and international safeguards; national security and defense posture; foreign relations and sharing of technological resources with other nations; potential critical shortages of energy, materials, and food; environmental protection, the economy, objective, thoughtful and imaginative advice from the science community is absolutely vital.[217]

Dr. Patrick E. Haggerty, chairman of the board of Texas Instruments, Inc., proposed as one element of a "national development act of 1976" the statement of an explicit objective: "To seek improvement in the standard of living (with full implications of quality of life) of the world's peoples by joining in cooperative agreement and efforts

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[213] Ibid., pp. 179–180. The quotation was:

> Science and technology have effected changes in the substantive tasks of foreign policy, in the methodology of diplomacy, in the management of information on which diplomacy is based, in the intellectual training of diplomats, in the range of present options of negotiations, and in the prospects of future evolution of diplomacy, foreign policy objectives, and the international political system.

[214] Ibid., p. 180.

[215] The name of the Committee was changed from Science and Astronautics effective with the beginning of the 94th Congress.

[216] H.R. 4461, "National Science Policy and Organization Act of 1975," introduced by Chairman Olin E. Teague, of the Committee, and co-sponsored by Charles A. Mosher, Ranking Minority Member.

[217] U.S. Congress, House, Committee on Science and Astronautics, *Federal Policy, Plans, and Organization for Science and Technology, Part II.* Hearings, 93d Cong., 2d sess., June 20, 25–27; July 9–11 16, 18, 1974, pp. 140–141.

with other nations, especially those whose political and economic philosophies are compatible, which will advance the policies expressed in this Act throughout the world." Purposes to be served would include the enhancement of free trade, travel and commerce, assurance of sound international currencies, minimization of environmental pollution, improvement of the health and protection of the safety of all peoples, fullest utilization and conservation of the resources of all nations, and encouragement of competitive enterprise (including multinational corporations) to fulfill needs for goods and services.[218]

Dr. Roger Revelle, as president of the American Association for the Advancement of Science, urged that "scientific and technical information must be one component in the broader context of policymaking in the field of international affairs." He continued:

> The feasibility and time horizon of developments in industrial technology, communications, agriculture, satellite reconnaissance, detection of nuclear explosions, ocean petroleum and minerals production, new weapons systems, etc. must be taken into account in foreign policy. Similarly, the quality and quantity of fuel and metal reserves in different countries and regions, the land, water and energy resources available for agricultural production, the potential yields of the ocean fisheries, and estimates of national technological capabilities are important considerations in international policymaking.
>
> One aim of a National policy for Science and Technology should be to ensure that the best scientific and technical information is fully utilized in making and implementing the nation's foreign policies.
>
> The nation's unique scientific and technical capabilities should be an instrument and an object of foreign policy. Attention should be paid to means of increasing imports and exports of technology, and to the "balance of trade" in technical exchange with other countries. International cooperation and cost-sharing in scientific research and technical development should be encouraged and technology transfer as a major element of assistance programs for less developed countries should be facilitated. International constraints on oceanic, atmospheric and space research should be avoided.[219]

DRAFT SCIENCE POLICY BILL

The bill H.R. 4461 presented a plan for an Advisory Council in the Executive Office of the President, and a Department of Research and Technology Operations, charged with furthering a science policy delineated in title I of the bill. This title contained (section 101(a)(1)) the finding of Congress that "the general welfare, the economic growth and stability of the Nation, its security, the efficient utilization and conservation of the Nation's resources, and the promotion of the progress of science and the useful arts, upon which the very functioning of government and society depend, require the vigorous and perceptive employment of national science and technology." Goals of the policy included (section 101(b)(1)) "demonstrating world leadership by enlarging the contributions of American science and technology to the knowledge of man and his universe." Two of the five policy principles in the bill, items 3 and 5 of section 102(a), had explicit foreign policy implications:

> Item (3): The mobilization of science and technology to further United States diplomatic objectives and assure the adequacy and effective global allocation of

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[218] Ibid., p. 256.

[219] Ibid., p. 413. In his retiring presidential address delivered at the AAAS meeting in New York City on January 29, 1975, Dr. Revelle said "Science unifies men." One aim of a "National Science Policy for Science and Technology," in his opinion, "should be that the best scientific and technical information is fully utilized in making and implementing the nation's foreign policy, and that our unique scientific and technical capabilities are both an instrument and an object of foreign policy." (Roger Revelle, "The Scientist and the Politician," *Science*, March 21, 1975, p. 1105.)

raw materials, food, and energy, while maintaining a proper balance, in the development and export of technology, between aid to lagging foreign economies and maintenance of an equitable balance in world trade;

and

Item (5): The encouragement of person-to-person and other interchange of scientific information in the national and the world scientific communities.

In introducing the measure, Representative Teague described it as "a product of the most thorough congressional scrutiny yet accorded to the focused issue of policy and planning by the Federal Government as to its own role in handling science and technology." Even so, it was not "cast in concrete" but was "offered for discussion and critique." He expected, he said, the measure to be the subject of further hearings during the 94th Congress.[220] The bill was referred jointly to the Committees on Science and Technology and Government Operations.

Broad Congressional Interest in Science, Technology, and American Diplomacy[221]

An interest in both international affairs and science and technology—approached from differing vantage points—is evidenced by both the Committee on International Relations (formerly Foreign Affairs) [222] and the Committee on Science and Technology (formerly Science and Astronautics), as well as by the Senate Committee on Foreign Relations. Both House and Senate Committees on Appropriations, both Armed Services Committees, and the Senate Committee on Aeronautical and Space Sciences, also are concerned with these combined topics. Other committees with at least some actual or potential interest in these matters might include: the Senate Committees on Banking, Commerce, Finance, Government Operations, and Judiciary; the House Committees on Banking, Government Operations, Judiciary, Merchant Marine and Fisheries, and Ways and Means.

Other committees might also conceivably develop interests that relate to these combined fields of interest. More to the point, the basic structure of the U.S. resources, economy, educational systems, culture, and society are all germane to the U.S. diplomatic posture. U.S. science and technology have bearing on the strength of this basic structure. Just as the Department of State has a legitimate interest in domestic science and technology as the basis of U.S. world influence, so also do committees of Congress with diplomatic concerns have a potential interest in the contributions of science and technology to their subject matter. Thus a further question arises as to the actual and potential role of the Department of State in providing information to the Congress about the external world in its relation to these contributions and their significance to the United States.

On this subject, U. Alexis Johnson, Under Secretary of State for Political Affairs, told the Subcommittee on National Security Policy and Scientific Developments that "our national interest is in the international environment" and that technology had outrun the

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[220] U.S. Congress, House, *Congressional Record*, 94th Cong., 1st sess., 1975, 121, p. 1432–1435. (Daily edition.)

[221] A list of principal Committees having diplomatic interests was supplied by the Foreign Affairs Division, and a list of principal Committees having science and technology interests was supplied by Mauree Ayton of the Science Policy Research Division; the commentary in this section concerns committees that appear on both lists.

[222] The new name became effective March 19, 1975.

institutions to deal with it. Throughout his testimony he offered many useful comments relevant to this study. For example:

Virtually every important field of human endeavor is now the subject of a cooperative, and, by and large, constructive, examination on an international scale. (p. 370)

The number of our critical national needs which can only be met through international action and cooperation is continuing to grow. (p. 370)

Let me stress that I am not saying these problems are made easier by cooperation between nations. I am saying that there is—literally—no other way to solve them. (p. 370)

By definition, these activities cut across the responsibilities of many agencies of government and of our civil life. We have done remarkably well in dealing with many of the problems, considering the jerry-built machinery we are using. But we cannot, in the future, leave the solution of these important problems to a process of muddling through. (p. 370)

I think you have found here that almost every committee of the Congress has some concern with some aspect of foreign affairs. Thus, I think this has been a natural development and in many ways we welcome it. It complicates life, of course. The more people involved, the more interests you have to take into account. That obviously makes things more complicated. (pp. 372–373) [223]

A continuing analysis, for congressional purposes, of the subject matter of this hearing would seem to be an essential input to the deliberations of the Congress in its foreign policy role. As Secretary Johnson made clear in the hearing, the existing organization of effort in both the legislative and executive branches was inappropriate to the needs of coherent and integrated policymaking in the international sphere.

At the conclusion of his testimony, the following colloquy occurred between Secretary Johnson and Chairman Zablocki:

Mr. ZABLOCKI. On page 370, you make a statement that intrigues me after these sessions of hearing about the efforts of our country in international relations and the many problems involved. The first full paragraph on that page of your statement refers to what the President called the new dimension of diplomacy and, quoting from that paragraph, it states,

In the years to come, our Government's performance on these problems will be a very large factor in the way our people view their Government.

This is what troubles me, your next sentence:

And we are not well organized for it.[224]

Why aren't we well organized for it? What must we do to be better organized?

Mr. JOHNSON. Well, we are not organized for it because the executive and the Congress historically are organized to deal with the problems as they were presented for us from our early days. We dealt with agriculture as agriculture, with interior as interior, dealt with commerce as commerce. We were organized along, shall I say, functional lines and in this new dimension of quality of life, if you will, pollution, preservation of natural resources, in these areas, these areas cut across these traditional functional lines and when it comes to something like energy, we have the Interior Department dealing with one aspect of oil, the oil business; we have got the Federal Power Commission dealing with gas; we have got various rate commissions dealing with electricity; we have got somebody else dealing with coal; we have got the Department of Transportation dealing with pollution of auto engines.

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[223] Hearing-Symposium, House Foreign Affairs Committee, *National Security Policy*, August 8, 1972, pp. 370, 372–373.

[224] An effort to strengthen the House arrangements for dealing with complex interdisciplinary matters was made in House Resolution 988, adopted October 8, 1974, which provides in part:

Committee Reform Amendments of 1974

Sec. 5(c) In carrying out paragraphs (a) and (b) with respect to any matter, the Speaker may refer the matter simultaneously to two or more committees for concurrent consideration or consideration in sequence (subject to appropriate time limitations in the case of any committee after the first), or divide the matter into two or more parts (reflecting different subjects or jurisdictions) and refer each such part to a different committee, or refer the matter to a special ad hoc committee appointed by the Speaker with the approval of the House (from the members of the committees having legislative jurisdiction) for the specific purpose of considering that matter and report to the House thereon, or make such other provision as may be considered appropriate.

This question of energy, conservation of energy, pollution from energy, cuts across large numbers of departments and agencies and a large number of committees in the Congress here, as well.

We aren't equipped to deal with these things within the framework that has now emerged. These are new frameworks that have emerged here that were unknown at the time that both the Congress and the executive were organizing themselves.

We have established, the President established, the Environmental Protection Agency and the Council on Environment, Judge Train's organization, in an attempt to bring these together.

What I am saying is by no means criticism of them or what has been done, but it seems to me we need both the Congress and the executive to have some new approaches on how we organize ourselves to deal with these things more effectively.[225]

Commission on the Organization of the Government for the Conduct of Foreign Policy

An initiative of the Senate Committee on Foreign Relations, accepted with qualifications by the House Committee on Foreign Affairs, was the creation of a commission to focus and coordinate decision-making relating to the use of U.S. resources by foreign affairs agencies. The Commission was established pursuant to the Foreign Relations Authorization Act of 1972 (Public Law 92–352, approved July 13, 1972). The purpose of the Commission is stated in section 601 of title VI to be to ". . . submit findings and recommendations to provide a more effective system for the formulation and execution of the Nation's foreign policy."

The original reporting date for the Commission was to be July 30, 1974; this date was subsequently extended to June 30, 1975, by the Department of State Authorization Act of 1973. One feature of the Commission's staff activity is a collection of studies of the scientific and technological aspects of foreign policy. In view of the recent addition of Vice President Rockefeller to the membership of the Commission,[226] it is expected that some of the previous studies of the Vice President's own Commission on Critical Choices for the United States may be made available to the new Commission. Accordingly, the report scheduled for the close of the fiscal year 1975 should have bearing on the subject matter of this study, even though its scope is much broader.

Growth of International Technological Concerns of Congress

Specific subjects of congressional committee investigation and analysis in international affairs are tending increasingly to involve scientific and technological aspects. Illustrations for this discussion are drawn from the agendas of the Committees on Foreign Affairs and on Science and Astronautics during the 92d and 93d Congresses. The former committee approached scientific and technological matters in relation to its concerns with U.S. diplomacy; the latter committee approached diplomatic matters in relation to its concerns with U.S. science and technology.

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[225] Hearing-Symposium, House Foreign Affairs Committee, *National Security Policy*, pp. 390–391.

[226] The chairman of the Commission is Robert D. Murphy, formerly Ambassador, and currently honorary chairman of Corning Glass Company. Other members of the Commission are, in addition to Vice President Rockefeller: Senator Mike Mansfield; Senator James B. Pearson; Representative Clement J. Zablocki; Representative William Broomfield; Mrs. Charles W. Engelhard, chairman of Engelhard Industries; Frank C. P. McGlinn, executive vice president, Fidelity Bank, Philadelphia; Dr. Stanley P. Wagner, president, Grand Valley State College, Allendale, Michigan; William J. Casey, president and chairman of the Export-Import Bank; and Dr. David Abshire, chairman, Center of Strategic and International Studies, Georgetown University.

TOPICS EXAMINED BY THE COMMITTEE ON INTERNATIONAL RELATIONS [227]

A major component of foreign aid programs is technological. Annual reviews of the budget requests from U.S. AID are conducted by the House Committee on International Relations. The committee also exercises a continuing surveillance over arms control matters and the operation of the Arms Control and Disarmament Agency. In addition, the subject of Law of the Sea, and the related question of peaceful uses of the seabed arose in the 92d Congress and continued to be a subject of interest in the 93d. A separate question that arose in the 92d Congress and was resolved in that period was the action to create an International Agency for Research on Cancer.

A substantial increase in scientific and technological subjects under study by the committee was evident in the 93d Congress. Action was taken on the United Nations Environmental Program Act of 1973, and on U.S. Participation in the International Ocean Exposition of 1975. The committee also reviewed U.S. chemical warfare policies, the world food situation, nuclear agreements with Egypt and Israel, the question of excluding imports of chromite from Rhodesia, the international implications of the energy crisis, the flooding of the Great Lakes, the status of the Gorgas Memorial Institute of Tropical and Preventive Medicine, drought in the African Sahel, the African Development Bank, the energy crisis in Asia, military uses of weather modification, and global scarcities of commodities.

TOPICS EXAMINED BY THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

From its focus on Government science, the Committee on Science and Technology annually reviews the budgets of the National Science Foundation and the National Aeronautics and Space Administration, both of which agencies have substantial foreign programs. In addition, the committee during the 92d Congress took up the topics of international environmental science, a detailed review of international cooperation in science and space by NASA and the U.S.-U.S.S.R. cooperative space agreement. The committee also examined the issue of U.S. adoption of the metric system and began a study of science policy education in the United States and Canada.

In the 93d Congress, the committee dealt with such topics as the Earth Resources Satellite System, U.S.-U.S.S.R. advanced technology transfer, the Appolo-Soyez joint program, international science and technology transfer, and the International Conference of States on the Distribution of Programme-Carrying Signals Transmitted by Satellite, at Brussels in 1974. In addition the committee held a joint briefing with the scientific attachés of the Department of State, May 22, 1974, on the occasion of their annual home visit and training period.

OBSERVATIONS ON THE ANNUAL PROGRAMS OF THE INTERNATIONAL RELATIONS AND SCIENCE AND TECHNOLOGY COMMITTEES

Both committees included in their programs a range of subject matter that included both broad policy investigations, continuing

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[227] Those listed are in addition to the dozen subjects considered in depth in the *Science, Technology, and American Diplomacy* series of which the present study is a part. Titles of the individual studies are listed on pages vii–viii.

oversight of agencies under their jurisdictions, and specific legislative issues of immediate current concern. Both committees have recruited able staffs, and both appear to have made effective use of the Congressional Research Service. However, a large effort is involved in the review of broad policy, in the selection of appropriate witnesses and consultants, in planning and structuring symposia and hearings, and in distilling the essentials from the testimony and prepared statements. The value of these reviews seems compelling, but the limitations of member time and staff resources may prevent wider use of them. Among the possibilities to enlarge the utility or increase the scope or frequency of such reviews might be the following:

—Enlist the Foreign Service Institute to manage occasional seminars and prepare reports on them;

—Arrange briefings by selected members of the Policy Planning Staff;

—Contract studies on subjects of continuing interest to the committees, acting individually or jointly;

—Construct a library of policy studies of enduring value for joint use by the two committees;

—Publish sets of invited papers with staff or CRS commentary;

—Have CRS conduct an annual seminar series on foreign policy issues; and

—Make more use of the scientific attachés as policy information sources, aside from home leave, through invited reports and special studies to meet committee needs.

Implications for the Congress of Science in State

The cultural and organizational situation in the Department of State with respect to science and technology presents the Congress with two related problems. One is the need of Congress for information and analysis. The Congress, speaking broadly, needs to know what is going on in order to decide what to instruct the executive branch to do about it. The interactions of science and technology with diplomacy are demonstrably of commanding importance. But the Congress is faced with difficulties in securing information and analyses in this field because of the persistent cultural lag in technical literacy and a lack of organizational coherence and discipline of the Department, which is after all the main source of diplomatic information for Congress. The second problem is how to strengthen the resources of the Department of State to collect, analyze, and report to the Congress on the technical aspects of diplomacy. Recent events suggest that reform is already underway. But it is also possible that further congressional encouragement might be found necessary. As time goes on, it is to be hoped, the departmental deficiencies will be corrected.

But pending such correction and even after, it would seem desirable for the Congress to strengthen its own arrangements for information analysis and filter, and option identification and evaluation.

The past structure and staffing of congressional committees, as Secretary Johnson has pointed out, has tended to compartmentalize problems in the same way that they are divided up in the Department of State.[228] Similarly, the political realities—like the diplomatic reali-

[228] On February 3, 1975, Chairman Thomas E. Morgan announced a reorganization of the subcommittees of the House Foreign Affairs (now International Relations) Committee, designed to improve the Committee's ability to deal with international problems. The principal change was to assign all subcommittees according to functional topics. Earlier five of the subcommittees had covered geographic areas corresponding to the five regional bureaus of the Department of State.

ties—compel priority attention to short-range problems and issues, while tending to defer attention to longer term trends, problems, and opportunities. A third similarity is the tendency in both diplomatic and political institutions toward a high degree of personal mobility and a correspondingly short "institutional memory."

A CONGRESSIONAL POLICY PLANNING STAFF

Accordingly, it seems reasonable that the many recommendations which have been made for a strong and technologically sophisticated policy planning staff in the Department of State might be allowed to suggest a corresponding need in the congressional environment. Such a mechanism or institution, capable of assessing prospective future trends at a reasonable confidence level, might help the Congress to design preventive actions in advance of crises. Examples of the kinds of services that might usefully be performed within such an institution might be:

—Sustained monitoring of executive branch compliance with congressional intent in the area of scientific and technological impacts on foreign policy and international relations—and vice versa;

—Assessing the present and forecasting the future diplomatic environment as changes occur in response to the global spread of technological innovation:

—Assessing the secondary impacts and interrelationships of "international" technological issues;

—Examining the adequacy of U.S. "international" institutions in the face of changes in the diplomatic environment resulting from the global spread of technological innovation;

—Structuring and making coherent the array of foreign policy interactions with science and technology; and

—Maintaining a continuity of foreign policy expertise, an extended institutional memory, and an assistance cadre for major studies for "international" committees concerned with S&T questions, S&T committees concerned with foreign policy questions, and committees monitoring major technological missions with significant international implications.

One possible legislative approach is suggested by a proposed bill "to establish a Joint Committee on National Security."[229] In introducing the proposal, Mr. Zablocki said it was intended ". . . to address itself in a more comprehensive way to a thorough and ongoing analysis and evaluation of our national security policies and goals."

> It is abundantly clear that the continuing diminution of Congress' role in foreign policy is a direct result of this communication breakdown. For too many years the Executive has failed to share with Congress the kind of adequate information needed in matters involving national security. In short, there is no proper and adequate forum for a regular and frank exchange between the Congress and the Executive on the vital issues affecting our national security.[230]

However, the joint committee called for under the bill would not "usurp the legislative or investigative functions of any present committees" but would "supplement and coordinate their efforts in a more comprehensive and effective framework." It would also facilitate

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[229] Such a bill was introduced as H.R. 54, January 14, 1975, by Congressman Clement J. Zablocki, Chairman of the Subcommittee on National Security Policy and Scientific Developments. A similar measure, S. 99, was offered in the Senate by Hubert H. Humphrey, January 16.

[230] U.S. Congress, House, *Congressional Record*, 94th Cong., 1st sess., 1975 ,121, p. 39. (Daily edition.)

"proper and meaningful consultation" between the legislative and executive branches of government.

An idea of the possible scope of the "national security," as it might concern such a joint committee, serving as a congressional instrument for continuous foreign policy planning and review, is suggested by a speech by Senator Mark O. Hatfield [231] who explained to a congressional audience that it was a "prevalent and frequent mistake" to equate it with military might. Potency of arms was "a component, but only one component, of what constitutes, in reality, our 'national security'."

> There is [said Senator Hatfield] one central truth we must realize: Protecting and preserving the life of citizens in America is directly dependent upon the conditions that will preserve and nurture life throughout the world. This increases as we realize the finite limitations to the resources necessary to preserve life. In an ultimate but very real way, the conditions for securing life here in America are dependent upon conditions and resources for sustaining life everywhere. We are tied together with mankind in a single destiny.[232]

Thus, the Senator continued, it was becoming evident that "the forces shaping our Nation's and the world's real security go far beyond what can even be insured by treaties and arms." He cited the "growing global interdependence of the world," "United States dependence on the mineral resources of the poor countries," and relative consumption of resources by rich and poor countries. And he declared:

> There is no problem faced by this world more likely to breed instability and conflict, threatening our security and that of the entire world in the years ahead, than the disparity in distribution of food and basic resources for sustaining life.[233]

THE PROBLEM OF CREDIBILITY

One problem that all institutions concerned with policy analysis encounter is in being believed by those who make decisions on policy issues. There are repeated instances of studies that clearly identified a future danger, or the need to prevent a future crisis, and were neglected until the event occurred. Unfortunately, there are also repeated instances of forecasts of disaster that didn't happen after all. It is worth noting, however, that the confidence level of any technology forecast rises not merely when it is accepted by more critics but when it is subjected to deeper and more comprehensive analysis. But while the confidence level of a study may improve with effort, it is less likely that its political acceptability or credibility will be correspondingly enhanced. Guidance on this problem calls for much further study.

A related problem is that of distinguishing between technical and normative advice. Professor Rusk, with reference to his own experience as Secretary of State, observes:

> There is one question on which high policy officers need more help. When is a scientist talking science and when is he talking politics cloaked in scientific terminology? A friend once said of Einstein, "he was a genius in mathematical physics, an amateur in music and a baby in politics." I myself have received "scientific" advice which was merely the political advice of a scientist. Obviously, a scientist is as entitled to political views as is the nearest taxi driver. Perhaps each high policy officer ought to have, or have access to, someone he can trust to help him sort wheat from chaff.[234]

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[231] U.S. Congress, House, *Congressional Record*, 93d Cong., 2d sess., 1974, 120, p. E6365. (Daily edition.)
[232] Ibid.
[233] Ibid., p. E6366.
[234] Rusk to Huddle, March 18, 1975.

X. Science and Technology in Future American Diplomacy

Mobilization of U.S. political and executive resources is called for not only to respond to the technological challenges of future diplomacy but to design initiatives to shape the future world toward U.S. purposes and goals. Among the evident challenges facing this Nation in the future are the growing interdependence among the countries of the world for resources, energy, and technological skill; the increasing interconnectedness of the major technological issues at hand; the spread and linkages of worldwide economic institutions, multilateral and nongovernmental—all in a world in which a bipolar structure is increasingly modified by the emergence of a "Third World" of less developed nations with shared aspirations for growth and development. In all of these diplomatic problems and opportunities, the factors of technology and its scientific underpinning are evident.

The salient questions that grow out of this review of the diplomatic scene in the years ahead appear to be:

Where in the U.S. Government is there an institution charged with responsibility for surveying on a continuing basis the totality of trends and prospects of the consequences for U.S. diplomacy that grow out of world technological change? Where are these findings translated into requirements upon U.S. diplomacy? What kinds of expertise are needed for such surveys and for the definition of the diplomatic requirements? How complete is the set of U.S. institutions needed to collect, assess, analyze, and structure the information to build into a data base for surveying future technological trends and their consequences for U.S. diplomacy? Where are innovative strategies to be sought, conceived, and studied? How does the world system of basic science communities relate to U.S. diplomacy? What major technological trends and needs of diplomatic consequence are already evident and how are they interrelated? What congressional options are available to strengthen the legislative role in this sphere?

Major Challenges to Future U.S. Diplomacy

The technological content is already clearly evident in may of the foremost problems of U.S. foreign policy in 1975. While it has often been observed that the Department of State as principal institution for U.S. foreign policy has no supporting lobby, the domestic impact of some international technological developments is large enough to suggest the possibility that in time a domestic diplomatic constituency may appear.

Some examples of diplomatic problems and concerns expressed in unpublished staff papers of the Department of State are excerpted in the following paragraphs. As they do not necessarily reflect coordinated and official positions they are not documented but stand on their own merits. The point is that at least some senior people in the Department concerned hold the views expressed.

SOME INFORMAL DEPARTMENTAL VIEWS

—Technological advance has become the basis for national security, for the international economy, and for national prestige.

—Technology has become thoroughly internationalized—and is likely to aggravate the difficulty of international political and economic relations and to disrupt long-standing international arrangements.

—The very future of mankind will depend on the management of such fundamental issues as population, food, the depletion of nonrenewable resources, and the ecological threat of waste and pollution.

—There is a serious bureaucratic lag in the ability to deal with these problems, not only in the Department of State but in the U.S. Government as a whole.

—The spread of nuclear weapons and the concurrent acceptance of international nuclear safeguards involve a significant degree of strain on the historic concept of national sovereignty. Other strains on national sovereignty are implicit in the spread of the multinational corporations with their largely uninhibited ability to shift technologies, capital, and employment from country to country, in the overflights of reconnaissance satellites, in the apparently advancing ability to influence the weather and redirect storms, and in the foreseen linkage of the world banking and commerce systems through satellite communications, computers, and data banks.

—On the other hand, technology also goes hand in hand with increasing nationalism. National technology programs and strategies are evolving in Japan, France, and England. International cooperative ventures in technology are being subordinated to narrower considerations of national interest. Control of the flow of industrial materials is being subjected to policy considerations of national technological advantage.

—The multilateral programs of the United Nations in science and technology, extensive and diverse, are supported in a major way by the United States, but do not yield benefits to this country commensurate with the level of their U.S. support. Similarly, there is no coherent doctrine governing bilateral science agreements of the United States with other nations, and U.S. benefits from these agreements are not maximized.

—In the special field of world health research, U.S. competence offers an opportunity of contributing in ways that greatly benefit U.S. foreign policy objectives. But these efforts are uncoordinated, diffused, and insufficiently rewarding to this country.

—Decisions on technical matters, taken early in their development, may determine their ultimate impact on foreign affairs, but an early input by the Department of State is seldom provided for.

—A tabulation of "science and technology based foreign policy issues" prepared several years ago in the Department shows the breadth of the technical activities that impinge on diplomacy. (See the accompanying list, Table 11.)

TABLE 11.—*An Unofficial Listing of "Science and Technology Based Foreign Policy Issues" Prepared in 1972*

I. Energy and Other Resources Problems
- (a) Expanding energy consumption
  1. Uranium enrichment
  2. Gaseous diffusion and centrifuge development
  3. Peaceful nuclear explosions
  4. Safe shipment of radioactive materials
  5. Safeguards
  6. Security concerns
- (b) Waste disposal problems
  1. Radioactive wastes
  2. Toxic wastes
  3. Waste policies and the oceans
- (c) Environmental pollution
- (d) Desalting technology
- (e) Oil and mineral extraction from the ocean
- (f) International cooperation in "big science"

II. Space and the Atmospheric Sciences
- (a) Political issues relating to space technologies
  1. Weather research and data collection
  2. Cost/benefit analysis of weather control
  3. Multinational programs to control storms
  4. Technical assistance to less developed countries faced with drought
  5. Agreements on prevention of injurious techniques of weather modification

III. Environment and Health
- (a) Post-Stockholm Environmental Policies
  1. Development of coordinated U.N. capacity for research, monitoring, and information exchange
  2. Priority projects for support by U.N. environmental fund
  3. Fund's relation to economic emphasis of less developed countries
- (b) Regional action on the environment
  1. Harmonizing U.S. with OECD in development of code on pollution control and cost allocations, early warning systems, and identification of chemicals adversely affecting the environment
  2. Trade problems in implementing recommendations on environmental regulation
  3. Environmental dialog of Eastern with Western Europe
  4. Canadian and Mexican border problems of environment
  5. Environmental problems encountered by U.S. AID
  6. Collaborative research with Japan and Western Europe
- (c) U.S. international health policy
  1. Pesticides and food production
  2. Fish protein concentrate
  3. Narcotics and dangerous drugs
  4. Technologies for following raw materials movements
  5. U.S. organization for coordinating international programs
  6. International Cancer Act collaboration
  7. Management of anti-cancer drugs
  8. Use of Fort Dietrick as international cancer research center

IV. Advanced Technology Problems
- (a) Problems of capitalization of large programs
- (b) Multinational corporations
- (c) Overseas licensing of U.S. technologies
- (d) Technology transfers to Communist countries
- (e) Reciprocity in technology transfers
- (f) Technology transfers under AID programs

TABLE 11.—*An Unofficial Listing of "Science and Technology Based Foreign Policy Issues" Prepared in 1972*—Continued

V. Bilateral and Multilateral Scientific Program
- (a) Relationships with Communist regimes
  1. Reassessment of technology transfer policies
  2. Exchanges outside of formal agreements
  3. Flexibility to meet a range of technological and less sophisticated scientific interests
  4. Special problems of China
  5. Taiwan exchange continuity
- (b) Relationships with non-Communist world
  1. Multilateral versus bilateral program development
  2. Continuity and refinement of Special Foreign Currency Program
  3. Arctic concerns of science and technology
  4. S & T relations with less developed countries
  5. Post-AID relations with developing countries
  6. Cooperation with U.N. programs of S & T
  7. Vietnam science and technology relations
  8. Arab/Israeli science and technology concerns

SCIENCE AS CAUSE AND CURE

The dual nature of the impact of technology on foreign relations has been described in a 1975 report by a national policy panel of the United Nations Association which noted both beneficial and adverse consequences to be considered:

> Developments in science and technology have become in many cases the basis of political power struggles. National power is constantly being deployed to achieve larger shares of the benefits of such new technologies as remote sensing of the earth's resources and recovery of mineral wealth from the world's seabeds. Where the use of internationally traded resources is at stake, some industrial states are seeking new technologies that will permit self-sufficiency, while many countries hope to use boycotts and cartels as a form of coercion for both economic and political ends. And, scientific research and development for military purposes continue to be a high priority for many nations. According to one estimate, military efforts account currently for about 40 percent of total world research and development expenditures, or nearly $25 billion, which might otherwise be available for non-military purposes.
>
> While advances in science and technology obviously have contributed both directly and indirectly to the world's problems, on balance they have made—and will continue to make—major contributions to the resolution of those problems. Alleviation of the world food problem depends importantly on scientific and technical advances which will make possible greater agricultural productivity in the developing world. The development of new types of energy sources is an essential element in relieving the problems resulting from geographically concentrated and ultimately finite supplies of petroleum. It is important that the capabilities—as well as the consequences—of science and technology be examined more carefully than they have been in the past, and in the broadest possible framework, if science and technology are to be applied effectively to benefit mankind as a whole.[235]

The report singled out the world food situation and its relationship to world population pressure, population and health, energy, nonfuel mineral resources, and environment as five areas requiring priority attention for U.N. action.

The panel urged that the United States

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[235] United Nations Association of the United States of America, National Policy Panel, *Science and Technology in an Era of Interdependence* (New York: U.N. Association of the U.S.A., January 1975), p. 18.

. . . assert a leadership role in the U.N. and other multilateral institutions. We think it is of prime importance for the U.S. to reassess the tone of its current activity in these organizations and to reexamine the way the government is organized to participate in them. We also believe that a major effort should be undertaken within the government to review those problem areas in which new or strengthened institutional arrangements might be required and to formulate appropriate proposals for international consideration.[236]

In particular, said the Panel, "The U.S. Government must give much higher priority to mobilizing its scientific and technological resources for dealing with material scarcities. At the same time, external economic incentives must be provided to reinforce the commitment to conservation." [237]

The U.N. panel report took notice of the interrelated nature of the international issues raised by developments in science and technology.

A review of the international issues which have been raised by developments in science and technology indicates that these problems have become increasingly complex and interrelated, just as the interdependencies among nations have grown. In the ongoing law-of-the-sea negotiations, there are interactions among such diverse issues as management of ocean fisheries, which are an essential component of the world's protein supply, and transit through international waters, a question of strategic interest to the major maritime powers. The worldwide rise in oil prices has meant higher cost for fertilizers and for the crops to which they are applied, as well as higher gasoline prices. And advances in the atmospheric sciences can lead not only to better forecasting but eventually to large-scale weather and climate modification. Such capabilities could in turn serve activities as diverse as air transport and agriculture.

Because of their complexity it is difficult to treat these issues as separate problems, or even to categorize them as primarily scientific, economic or political. They are issues which do not respect the standard patterns of international affairs and have already begun to transform relationships among the nations of the world.[238]

Interconnectedness of Diplomatic Problems of the Future

A feature of the world scene of today is the complex way in which so many of the great global problems intersect. Materials shortages raise questions of political jurisdiction over the deep seabed. World food shortages relate to fertilizer supply, which is tied to energy and petroleum, materials cartelization, weather modification, and water supply. Energy relates to petroleum and world distribution of coal, but also to nuclear power generation, which involves international technology transfer, the environment, nuclear safeguards, and safe disposal of nuclear wastes. Space utilization involves searches for materials, global communications, detection of agricultural blights, and information management. In fact, directly or indirectly, most of the large technological issues facing the world of the future in 1975 appear to be closely interconnected. (See the accompanying matrix analysis in Figure 2 of the more obvious interrelationships among these issues.)

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[236] Ibid., pp. 78–79.
[237] Ibid., p. 80.
[238] Ibid., p. 23.

FIGURE 2.—MATRIX ANALYSIS OF TECHNOLOGICAL INTERRELATIONS

	Energy	Environment	Fertilizers	Food	Inf. systems	Materials	Nuclear power	Oceans	Petroleum	Population	Seabed	Supertankers	Tech. transfer	Water supply	Weather modif.	World health
Energy	----	X	X	X	X	X	X	X	X	----	X	X	X	----	----	----
Environment	X	----	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fertilizers	X	X	----	X	X	X	X	X	X	X	X	X	X	X	X	X
Food	X	X	X	----	X	X	X	X	X	X	X	X	X	X	X	X
Information systems	X	X	X	X	----	X	X	X	X	X	X	----	X	X	X	X
Materials	X	X	X	X	X	----	X	X	X	X	X	----	X	X	----	----
Nuclear power	X	X	X	X	X	----	----	X	----	X	----	----	X	X	----	X
Oceans	X	X	X	X	X	X	X	----	X	X	X	X	X	X	X	X
Petroleum	X	X	X	X	X	X	X	X	----	X	X	X	X	X	----	----
Population	X	X	X	X	X	X	X	X	X	----	----	----	----	X	----	X
Seabed	X	X	X	X	X	----	----	X	X	----	----	----	X	----	----	----
Supertankers	X	X	X	X	----	----	----	X	X	----	----	----	----	----	----	----
Technology transfer	X	X	X	X	X	X	X	X	X	----	X	----	----	X	X	X
Water supply	----	X	X	X	X	X	X	X	X	X	----	----	X	----	X	X
Weather modification	----	X	X	X	X	----	----	X	----	----	----	----	X	X	----	X
World health	----	X	X	X	X	----	X	X	----	X	----	----	----	X	X	----

The implication of this demonstrated interconnectedness among international technological issues is that organizations cannot operate effectively if they are limited in scope to a particular function or issue. Coordination is essential to ensure that each mission organization, national or international, does not operate at cross-purposes with other organizations with other related missions. In the United States this coordinating function on international technological issues and functions is the responsibility of the Department of State. There does not appear to be any clearcut assignment of corresponding responsibility for coordinating international mission agency functions. Moreover, there does not appear to be any extensive discussion of the need for such international agency coordination. And, indeed, the extent to which the U.S. Department of State is organized, equipped, and manned to coordinate U.S. aspects of these functions and issues is open to serious question.

Revitalizing the Department of State for Initiative and Leadership

A critique of the Foreign Service in 1967 stressed that the rewards of promotion went to the cautious and the penalties to the "boat rockers." Said the article, in part:

> Over the long pull, the 30-year career, the survival quotient of the "boat rockers" is negligible. By and large, those who conform to the system are in charge of performance evaluation. . . .The sheer weight of opinion outside the Service as well as my own experiences, real and shared, indicate that there is some basis for our critics' attacks and our own doubts.
>
> . . . My conclusion, then, is that it is the system of rewarding the cautious and penalizing the bold that creates and maintains a Foreign Service which does not realize its responsibilities for analysis and advocacy and which does generate political and public distrust and criticism . . . .
>
> . . . What we lack is a system which permits [creative] men to realize their potential, what we have is a system which so discourages them that many turn to other careers or lapse into a safe mold.[239]

The structure of the Department of State and of the Foreign Service appears to focus attention on, and extend preferment to,

[239] Thomas D. Boyatt, "The Case for Traditional Diplomacy," *Foreign Service Journal* 44 (December 1967), p. 37.

generalist officers in the political officer ranks, and to a lesser extent to those in the administrative, economic, and consular ranks. Those specializing in technical and science policy fields receive less encouragement to enter or opportunity to advance. The cause of this personnel emphasis is suggested by a study by a panel of the United Nations Association (UNA) in 1973. In this report, the general problem was characterized as follows:

> The United States Government [like American society as a whole] is increasingly part of an interdependent world, but its organization and procedures still reflect earlier, simpler times when nation states could on most matters safely deal with each other at arms length and through career foreign services. In today's world, international relations are of necessity pervasive, technical, continuous, and intimately involved with domestic issues, and this requires new styles and new systems of governmental organization and process, which rely far more than in the past on a wide range of professional participation in policymaking.
>
> * * * * * * *
>
> Compared to the resources lavished on management improvement in a single large multinational corporation, those being devoted to the far more important and difficult problems of improving the organization of the government in a multinational setting are pitiful.[240]

Reflecting the earlier criticism quoted above, the UNA panel found that parochial tendencies, emphasis on the work of the "regional political bureaus," and "budgetary limitations" combined to cause "the decline of the Department of State as the principal initiator and coordinator of American foreign policy."

> The Foreign Service officers who staff most of the Department's key positions still give undue emphasis to the traditional political, as opposed to economic, military, or other specialized issues. Many of them, indeed, lack the technical expertise which is increasingly necessary in order to be a competent generalist in today's world. In desk and regional offices they tend to stress bilateral at the expense of multilateral policy approaches, often putting undue emphasis upon the maintenance of friendly relations with the country of their current responsibility. Most officers are preponderantly involved in day-to-day operational matters at the cost of longer term planning or efforts at substantive policy development and guidance. While by no means universal, the Foreign Service career ideal still remains the senior diplomat, the ambassador; and little in FSO diplomatic training prepares them for parliamentary diplomacy in multinational forums.[241]

In short, said the panel, it was not too strong to claim that "the Department of State, as currently oriented, organized, staffed, and operated, represents something of an anachronism in terms of ability to respond to today's global problems." What happened was that "The new and highly complex demands of a technologically oriented international society, with its new set of economic interdependencies and need for shared responsibility in keeping the peace, have simply overtaken the Department's traditional decisionmaking structure.[242] Thus, the "failure of State to keep pace with the demands of modern diplomacy" had:

> . . . contributed to dissatisfaction with its performance in recent years and to lack of confidence in its policy and operational processes. This negative evaluation has been an important contributing factor to the preemption of policy coordination and representational roles by Presidential staff. As a consequence, morale at the Department has been seriously depressed, and its standing in the councils of government has been significantly lowered. This in turn has exacerbated the

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[240] United Nations Association of the United States of America, National Policy Panel, *Foreign Policy Decision Making; The New Dimensions* (New York: U.N. Association of the U.S.A., May 1973), pp. 101–102.
[241] Ibid., p. 49.
[242] Ibid., p. 48.

Department's internal deficiencies and diminished its usefulness as a center for exercising overall surveillance and coordination of foreign affairs. Closing the circle, there accordingly results a state of affairs which only strengthens the movement toward broader coverage by the White House . . .[243]

The thrust of these critiques appears to be that political officers experienced in the arts of diplomacy concentrate on avoiding dissonant situations, and try to anticipate and prevent clashes of policy, but do not generally interest themselves in creative initiatives to achieve policy goals. The motto seems to be that of Talleyrand: "Above all, no zeal." In practice, this approach favors the treatment of each new diplomatic event or crisis *de novo*, relying on the arts of negotiation and making no particular use of systematic analysis of causations. To the technologist, committed to the world of cause and effect relationships, this universe of diplomacy is mysterious, perhaps even irrational. Yet the time is at hand to meld these differing skills and philosophies into a working combined operation. In short, the conclusion seems inescapable that it will in the future be necessary somehow to develop a Foreign Service Corps that contains both scientific diplomats and diplomatic scientists.

Proposals To Strengthen Technical Diplomatic Machinery

The 1973 report of the U.N. Association analyzed in some depth the foreign policy machinery of the U.S. Government and concluded that it needed strengthening in five areas: (1) In the coordinating function of the Bureau of International Organizations; (2) in the Presidential system of foreign policymaking other than military; (3) in the policy staff at the secretarial level of the Department of State, (4) in the Department's functional bureaus (especially Economic, Scientific, and Intelligence and Research); and (5) in the Foreign Service Officer training program. On these five areas of need the panel commented as follows:

THE STRENGTHENING OF IO

Because of its primary preoccupation with the relationship between the Department of State and the United Nations system, the UNA Panel addressed at some length the organizational needs of the Bureau of International Organizations Affairs (IO). Excerpts of findings and recommendations on this subject were as follows:

The general weaknesses of the Department of State are replicated in its primary organ for coordinating U.S. participation in miltilateral agencies—the Bureau of International Organization Affairs (IO). (p. 51)

IO is the repository of a great deal of expertise on the procedural and institutional aspects of international organizations. But its substantive expertise is limited in part because the bureau, as with other bureaus in the Department, is staffed primarily by FSOs who are rotated every two to four years. Because the Foreign Service has not emphasized technical and scientific training, and has not given priority to the developing field of multilateral diplomacy, IO is not one of the places where the ambitious officer has most wanted an assignment. Moreover, its better FSOs have not always come back later in their careers. Parenthetically, it may be mentioned that IO is seriously handicapped in its desire to rotate young or middle-level FSOs to posts in the USUN in New York for useful experience because of inability to compensate for extraordinarily high cost of living in the city. (pp. 51–52)

The Bureau is not without leverage over other officials inside and outside the Department. It helps develop and then presents to Congress the budgets for most international organizations including the UN agencies. It is the agency through

[243] Ibid., p. 50.

which policy positions and conference delegations affecting international organizations are coordinated. It reviews and defends the budgets of international organizations before the Congress. But these powers tend to be dissipated because they are not exercised within a framework of priorities and general strategy. IO presently lacks a staff capability for program analysis and policy planning. No one in the Bureau is devoting sufficient analysis to the larger potentials and problems of international organizations, particularly in the economic, social, and scientific areas. (p. 52)

In sum, the Bureau of International Organization Affairs is not suitably staffed or positioned to lend vigorous thrust and coordination to our relationships with international organizations. It can and should play a vital role in the Department. Its experience is increasingly relevant to the issues arising in the world community. (p. 52) (Italics in original.)

A separate unit in IO was proposed to coordinate the substantive and budgetary aspects of the Bureau's function:

We therefore propose the development of a high-level evaluation and planning unit in IO, devoted to the evaluation of the effectiveness of international institutions and their programs, to the development of specific initiatives for strengthening these institutions, and to enhancing U.S. participation in them. This would include an evaluation of any need for creation or elimination of organizations in particular problem areas, as well as the formulation of major reforms in existing institutions and their mandates. It would also involve encouraging international organizations themselves to perform much of this program evaluation. (pp. 85–86)

[In addition, the panel urged] that officials of the appropriate domestic agencies be invited to accompany the Assistant Secretary for International Organization Affairs when he testifies before Congressional appropriation subcommittees concerning the specialized agencies. (p. 100)

[The panel attached particular importance to three IO functions, which were:] (1) determining the level of U.S. contributions to international organizations; (2) deciding on the international conferences and programs in which the U.S. should participate; and (3) undertaking program review and evaluation of international organization activities. (p. 98)

STRENGTHENING THE PRESIDENTIAL POLICY SYSTEM IN NONMILITARY AREAS

Shortly after the UNA Panel report was issued, the President put into effect one of the three options offered in the report: the combining of the office of Secretary of State with that of National Security Assistant to the President. The report also noted, in passing, that the "senior NSC staff has not given sustained attention to economic, monetary, commercial, or technological affairs and their interaction with national security," a factor among others leading to the creation of a separate White House Council on International Economic Policy. (p. 40) Accordingly, "a clear pattern of foreign policy administration has not emerged." It should also be recognized that the strengthening of the NSC staff competence in science and technology would weaken the relative strength of the Department of State in this area, unless, of course, the science and technology personnel in the Policy Planning Staff and OES were correspondingly strengthened.

A STRONGER POLICY PLANNING MECHANISM IN THE DEPARTMENT OF STATE

In practice, said the UNA Panel, State Department officials tend to "give priority" to "overseas embassies and missions and the foreign governments with which they deal." The emphasis is on "political" and "diplomatic" problems. Policy analyses tend to be "heavily

influenced by the particular outlook of the country desk officer, overseas Ambassador, or regional Assistant Secretary," which in turn "frequently reflects the objectives and interests of the Foreign Service more than those of the President." (p. 75)

The Secretary's "greatest single need" was for a "team of top policy associates who are experienced in government and foreign policy, loyal to the Secretary and the President, and able to work as a team in advising the President and leading the bureaucracy." For current operational matters therefore,

> To assure effective top-level coordination of current policy on specific issues, the panel believes there should be a unified staff serving the Secretary, the Deputy Secretary, and the Under Secretaries. The staff should be headed by a Director, personally chosen by the Secretary, without reference to whether he has served in the career ranks. The other staff members should represent a mix, with several from non-career ranks. Care should be taken to avoid making the unified staff so large that its members lose touch with Secretarial views and priorities. (p. 81)

In addition, the panel recommended a separate planning staff for long range studies and early warning of future problems:

> We would envisage a Planning Staff in the Department of State familiar with the priority global issues, aware of the international interests and activities of all principal Executive Branch departments and agencies, and equipped to perform a continuous "scanning" role in identifying emerging issues well before they reach crisis proportions. The unit should also be able to marshal any necessary staff resources from principal technical agencies as they move to develop the salient options for U.S. policy. It should report directly to the Secretary. (p. 80)

Such a unit, said the report, p. 79, "could be of major assistance to the Secretary and his senior assistants, to the President, and to the White House staff in planning the U.S. response to the new global context."

STRENGTHENING THE FUNCTIONAL BUREAUS

Observed the Panel (p. 76): "The priority consistently given to regional over functional issues, and bilateral over multilateral relationships, makes the State Department of the past and present quite different from the one we need in the future." With respect to the Bureau of Economic and Business Affairs (EB) and the Bureau of International Scientific and Technological Affairs (SCI) [now renamed, and designated OES] ,as well as IO, the panel said:

> There is no question in our minds but that these bureaus need to be substantially strengthened, as does the relationship between such bureaus and the top Departmental leadership. In a world of transnational relationships, a State Department that cannot speak credibly on economic, social, scientific, or environmental issues will be condemned to a peripheral role, whether its weakness stems from limited staff competence at the bureau level or neglect of these issues at the top level. The priority still given to bilateral, regional bureau issues by top Departmental leadership, and the still-predominant weight of those bureaus on issues dealt with below the Seventh Floor, characterize a Department still structured more to cope with the vanishing world of bilateral inter-governmental relationships channeled mainly through foreign offices than with the new transnational political, economic, and scientific milieu. (p. 82)

However, there were "four longstanding disadvantages in relying on the functional bureaus in preference to the regional bureaus, and these were "not easy to remedy":

1. They do not have the "bargaining advantages" that grow from principal control of communications to overseas capitals.

2. They do not have large numbers of overseas assignments to offer, which lessens their attractiveness as Washington bases for Foreign Service officers thinking ahead to the next post.

3. Their substantive concerns have not ordinarily been top priority for the Secretary and his supporting team.

4. Though they have a number of specific "line" responsibilities, in their larger policy areas, some other department or agency generally has "prime" responsibility, such as Treasury for monetary matters and the Atomic Energy Commission for nuclear questions. (p. 87)

Although much of the work of the functional bureaus was "bilateral and sometimes well-removed from the emerging areas of international interdependence," nevertheless, the report suggested, "we see the areas to which these functional bureaus are devoting their attention as being of increasing importance to the U.S. ability for effective leadership in multilateral affairs." (p. 87)

FOREIGN SERVICE OFFICER TRAINING

The Panel called for a balance in FSO expertise between political and technical subject matter:

Any personnel development program designed to prepare personnel for the issues with which the U.S. will be faced in the next two decades will require training and experience in both political and technical fields. Foreign Service Officers will need to know more about domestic and substantive issues, and program agency personnel will need more knowledge of international political and economic affairs. (p. 96) (Italics in original.)

However, its prescription for remedy was limited to a proposal that would increase the range of expertise by introducing a discontinuity in the service of personnel. It was noted that a number of FSOs were serving in other agencies of the Government while some domestic agency personnel had been seconded to work in the Department of State. It was recommended that this practice be expanded:

Domestic agency personnel, particularly those from departments which are heavily involved in multilateral affairs, should be encouraged to serve in various bureaus of the Department of State, especially the functional bureaus. Service by FSOs and domestic agency personnel at the U.S. Mission to the United Nations in New York and at U.S. missions to international organizations overseas should be developed as an integral part of a training program for international diplomacy. In addition, a greater number of FSOs should be rotated periodically to serve in domestic agencies. (p. 97)

One difficulty in maintaining a continuity of foreign policy is the "short institutional memory" of State Department organizations whose personnel are moved about after short duty tours. A tradeoff between acquiring expertise and maintaining continuity would always be necessary, but this proposal of the panel would add a further complication to it.

Technology Transfer and the Multinational Corporation

In the words of an unpublished study by the Department of State, "Technology has become thoroughly internationalized." The primary medium that has brought about this internationalization is the multinational corporation. In vivid passages the *New Yorker* magazine has characterized this phenomenon of worldwide significance thus:

The rise of the global enterprise is producing an organizational revolution as profound in its implications for modern man as the Industrial Revolution and the

rise of the nation-state. Within the last ten years, global corporations have grown so fast that their combined total sales exceed the gross national product of every country except the United States and the Soviet Union. With more than two hundred billion dollars in physical assets under their control, the international corporations' average growth rate since 1950 has been two to three times greater than the growth rate of the most advanced industrial countries, including the United States. In 1971, General Motors, one of the giants of them all, had gross annual sales of twenty-eight billion dollars; Switzerland's gross national product was twenty-six billion. (p. 53)

The global corporation is revolutionizing the world economy through its increasing control over four fundamental elements of economic life—technology, finance capital, labor markets, and marketplace ideology. The internationalization of production means simply that more and more of the world's goods and services are being produced in more and more countries, and that the production process increasingly ignores national frontiers. (p. 54)

The introduction of the global payroll has produced dramatic changes in world labor markets. The essential strategy of the global corporation is based on a division of labor. Top management continues to be recruited from rich countries; workers increasingly come from low-wage areas. For a world corporation, this combination is ideal. (p. 56)

Advances in the techniques of centralization have made the world corporation possible, and sophisticated coordination at the world-headquarters level remains its chief distinguishing characteristic. (p. 57)

Perhaps the strongest argument in favor of the global corporations' claim to be engines of development is that they are a source of needed capital for backward countries. Particularly at a time when government-aid programs are drying up, the foreign corporation, it is argued, is a crucial source of the finance capital that poor countries need to stimulate local savings and to obtain foreign exchange. (pp. 68–69)

[The authors, however, discount this benefit considerably.]

The second great contribution to development that global corporations claim they are making, in addition to providing finance capital, is the transfer of technology. According to the conventional development wisdom of the past generation, American, European, and Japanese corporations can help close the gap between rich and poor by sharing their advanced technology with underdeveloped countries so as to help them increase productivity, on which rapid economic growth depends. There is no doubt that the import of technology has had a major impact on poor nations. But, as in the case of foreign capital, foreign technology has not had the positive effects claimed for it. (p. 76)

[Apart from the criticism that the technology is transferred at a heavy exaction of profit, it is also described as "the wrong kind of technology" insofar as the developing countries are concerned.] [244]

In summary, the two-part article assesses the multinational corporation as a challenge of the unadorned profit motive to the values of democratic society:

A process of concentration and internationalization has put the world economy substantially under the control of a few hundred business enterprises, and these do not compete with one another according to the rules of the classic market. Second, the interest of these enterprises is world profit maximization, and this may require profit minimization in certain countries and under certain circumstances. This is but one example of how the interests of global corporations may conflict with the interests of countries in which they operate. Third, the poor nations of Asia, Latin America, and Africa, long the hewers of wood and the drawers of water for the international economy, are increasingly becoming the principal sites of new production. This shift, which could not have been predicted even ten years ago, is changing employment patterns and living standards in the United States. Finally, this economic transformation is producing a new concentration of political power in private hands. In short, the managers of the huge corporations are not elected by the people, nor are they subject to popular scrutiny or popular pressure, even though in the course of their daily business they make decisions with more impact on the lives of ordinary people than most generals and politicians. The principal source of their power is their control of knowledge of

[244] Richard Barnet and Ronald Muller, "A Reporter at Large: Global Reach-I," *The New Yorker*, December 2, 1974, pp. 53, 54 57, 68, and 76.

three specific kinds—the technology of production, the technology of finance and accounting, and the technology of marketing.[245]

A colloquium sponsored by the National Science Foundation, November 17, 1973, explored the policy aspects of this development. One paper, by Keith Pavitt, a senior research fellow in the Science Policy Research Unit, University of Sussex, offered the following commentary:

Nonetheless, warnings about trends in the present system have been made, and one of the most pertinent to this discussion is by Steven Hymer. He argues that ". . . [multinational corporations] . . . will be able to speed up the spread of technology and to organize activities now impossible. They are a large step forward but this is not the same thing as saying that they serve the general interest as well as their own, that they are the best way to exploit the possibilities of modern science, or that they do not create certain highly intractable problems which greatly impede their efficiency." * On the one hand, improved communications break down barriers to trade and widen choices facing buyers. On the other hand, direct foreign investment reduces the alternatives facing buyers and leads to bigness and fewness: "Direct foreign investment thus has a dual nature. It is an instrument which allows business firms to transfer capital, technology and organizational skill from one country to another. It is also an instrument for restraining competition between firms of different nations." In particular, direct foreign investment can stifle the emergence of indigenous entrepreneurs, and of an indigenous decisionmaking capability in science and technology. This is particularly important in the poor countries which do not have the technical and organizational bargaining power to purchase the most appropriate technology on good terms. As a consequence, Hymer foresees a world where . . . "Income, status, authority and consumption patterns will radiate out from the centers in a declining fashion and the hinterland will be denied independence and equality." He concludes that there are ". . . two main directions in which one can proceed. Multinational corporations integrate one firm over many countries. The alternative is to integrate many industries over one country and to develop non-corporate linkages between countries for the free flow of goods and, more important, the free flow of information."

*S. Hymer, "The Efficiency (Contradictions) of Multinational Corporations," American Economic Association, *Papers and Proceedings*, 1970, pp. 441–448.[246]

A report by the U.N. Secretary General in late 1974 described the activities of U.N. agencies related to the "transnational" corporation, with respect to the impact of this form of institution on development and on international relations generally. He revealed that U.N. studies had been made of such impacts as:

—Restrictive business practices and international investment;
—Sovereignty over natural resources;
—International flow of capital;
—Direct private foreign investment;
—Economic effects on developing countries;
—Transfer of technology to developing countries;
—Transfer pricing and tax evasion;
—Legal questions of international trade law;
—Regional effects;
—Labor relations, training, and social policies; and
—Regulation and supervision requirements.

The report concluded that

The complexity and breadth of the issues involved are such that a continuing and co-ordinated analysis of the problem is essential for the further elucidation

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[245] Richard Barnet and Ronald Muller, "A Reporter at Large: Global Reach-II," *The New Yorker*, December 9, 1974, p. 100.

[246] National Science Foundation, *The Effects of International Technology Transfers on U.S. Economy*, papers and proceedings of a colloquium held in Washington, D.C., November 17, 1973 (Washington, D.C.: U.S. Government Printing Office, July 1974), p. 72.

of the issues and implementation of appropriate action. The decision to establish an information and research centre on transnational corporations is particularly important towards this end by facilitating the comprehensive consideration of the subject as a whole. In this connexion much thought is being given to the arrangements which will permit the centre to operate with maximum effectiveness and to provide the focal point where the many efforts and the interests of a number of United Nations organizations and agencies on certain aspects related to transnational corporations can be concerted.[247]

At the same time that multinational corporations, predominantly U.S.-based, are achieving worldwide economic penetration, however, there has been a growing concern over a relative decline in U.S. industrial productivity. An article in *American Scientist* by Michael Boretsky summed up the concern thus: "Decline in the rate of growth of technological innovation and rapid dissemination throughout the world of U.S. technology in a 'naked' form are having dismal effects on our economy." [248] Similarly, Sherman Gee, head of the Technology Transfer Office of the Naval Surface Weapons Center, wrote in *Science* magazine:

The decline of productivity growth in the United States and the erosion of U.S. competitiveness in world trade in recent years has caused considerable attention to be focused on developing measures to reverse these disturbing trends. The record shows that productivity growth in the United States decreased from the yearly average of approximately 2.5 percent during 1870 to 1965 to about half of this figure from the years 1965 to 1971. Furthermore, since 1950, productivity growth in this country has slipped below that prevailing in Western Europe and Japan.[249]

The author called attention to the fact that technology had become an important ingredient in U.S. diplomacy:

That technology has already become a key consideration in the conduct of foreign affairs is illustrated by some of the major issues confronting the United States-Soviet détente, such as the export of U.S. production technology to the Soviet Union and the Warsaw Pact nations. Because of the increased interest shown by other nations in advanced U.S. technology, the Department of Defense has formed a technology export advisory council to develop guidelines for the export of advanced technological products for civilian use, such as jet engines, sophisticated electronics, and computers. Although the United States has benefited from foreign technology in the past (for example, from the turbojet engine from the United Kingdom), the importance of making a more concerted effort to tap foreign technology has been given insufficient attention. Improved international cooperation in technology would not only help to increase the rate of technological innovation in the United States but could also benefit U.S. foreign relations.[250]

Like other commentators, he noted the role of the multinational corporation in the transnational movement of technology:

The growth in international trade and the increased interdependence of national economies today is reflected in the number of multinational corporations now in existence. Such corporations could become an important factor in the developing U.S. posture for increased sensitivity to foreign technological developments, though the evidence to date indicates that the multinational corporations have in the past contributed significantly to the export of U.S. technology.[251]

His main conclusions were that the U.S. Government should facilitate a closer coupling of research and development with commercial appli-

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[247] United Nations, General Assembly, *The Impact of Transnational Corporations on the Development Process and on International Relations*, Report of the Secretary General. New York, 1974, pp. 1–4. (United Nations Document: E/5592, October 21, 1974, 57th sess. General Assembly).

[248] Michael Boretsky, "Trends in U.S. Technology: A Political Economist's View," *American Scientist* 63 (January/February 1975), p. 70.

[249] Sherman Gee, "Foreign Technology and the United States Economy," *Science*, February 21, 1975, p. 622.

[250] Ibid., p. 623.

[251] Ibid., p. 625.

cation of new technology, and also take positive measures to encourage a reverse flow of foreign technology into the United States.

There would not be time or space to undertake in this study an assessment in depth of appropriate policies of the Federal Government at home and abroad to deal with the international transfer of technology or the associated emergence of the multinational corporation. It should also be recognized that not all assessments are adverse. For example, Jacques G. Maisonrouge, president of IBM World Trade Corporation, at a seminar on "Technology and International Trade" sponsored by the National Academy of Engineering contended that "multinational companies contribute much to this country and to the world—including the rapid diffusion of technology." [252]

Manifestly this dual subject is of compelling importance for diplomacy, it calls for a deep understanding of the social and economic roles of technology, and important policy questions are arising that need to be dealt with competently and authoritatively. What is not clear is where in the structure of U.S. diplomacy this can be done.

Continuing Importance and Increasing Scope of International Basic Science

Although the science office in State, in mid-1973, saw technology as of "greater concern" than science,[253] nevertheless, "the exchange of scientific information and research and the interplay of scientific knowledge [continued to foster] a collaboration desirable in itself for achieving international understanding as well as tangible scientific results."

Some measure of the extent of international contacts that result from international science activities is suggested by the annual report of Harrison Brown as retiring Foreign Secretary of the National Academy of Sciences, April 1974:

> During the past 12 years some 850 individuals served on U.S. National Committees for some 30 international organizations in which the Academy exercises membership on behalf of the U.S. scientific community. During this same period over 1,000 U.S. scientists and engineers served as Academy delegates at some 130 general assemblies or other key decision-making meetings of these international bodies. U.S. scientists contributed some 2,600 man-years of service on U.S. national committees for 12 international collaborative programs. 50,000 U.S. scientists participated in international congresses along with 160,000 colleagues from other countries.[254]

Dr. Brown noted also that assistance to developing countries had received principal recent emphasis in his office:

> As time has passed, our programs with our colleagues in developing countries have collectively become our largest effort. These programs, which have been supervised by our Board on Science and Technology for International Development, are aimed at helping our colleagues strengthen the research capabilities of their countries for the purpose of solving problems of development. Thus far we have been involved with programs in six Latin American, five Asian and three African countries. Viewed as a whole, these efforts have been remarkably successful, attributable in no small measure to the techniques we have developed with our overseas colleagues for joint deliberation and decision-making. Thus far our Academy's programs with our colleagues in developing countries have involved

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[252] National Academy of Engineering, *Technology and International Trade*, proceedings of the symposium sponsored by the National Academy of Engineering at the Sixth Autumn Meeting, October 14 and 15, 1970 (Washington, D.C.: National Academy of Sciences-National Academy of Engineering, 1971), p. xiii. (Publication partially sponsored by the Department of Commerce.)

[253] U.S. Department of State, *International Science Notes*, no. 30 (June 1973), p. 13.

[254] National Academy of Sciences, *Report of the Foreign Secretary 1974* (Washington, D.C.: National Academy of Sciences, April 1974), p. 1.

some 2,000 scientists and engineers, about one-half of them from the United States.[255]

He acknowledged funding support for the Academy's foreign programs from eight private foundations as well as from the Department of State and U.S. AID, although the "greatest fraction" of support was from the National Science Foundation.[256]

One theme that runs through much of the literature of the past 20 years on the relationship of science to diplomacy is the need for a closer relationship of the State science office to the National Academy of Sciences, the National Research Council, and, more recently, the National Academy of Engineering. Under the stewardship of Harrison Brown, the NAS has significantly expanded the scope of work of its Foreign Office. It has operational responsibilities for bilateral science agreements, personnel exchanges and foreign visits of U.S. scientists, the opening up of new international contacts, international meetings, and, the support of the International Congress of Scientific Unions and the many unions subordinate to ICSU. In recent years NAS international programs have been largely divided between these long-standing tasks and that of coordinating nongovernmental programs of scientific foreign assistance to developing countries. The relation of these activities to U.S. diplomatic goals is unmistakable. It is harder to assess their scope and impact.

It would be an impossible task to list and characterize all the interrelations of the U.S. basic scientific community, public and private, with their foreign counterparts. Annual inventories are prepared for Congress by the National Science Foundation of those international science activities that it helps to support. Several studies in the present series, *Science, Technology, and American Diplomacy*, have given coverage to the subject.[257] The significance of basic science as an instrument of diplomacy rests in part on its apolitical, nonnational character. Phenomena are the same in every political jurisdiction, as are also the canons of science. Probabilities are the same, East and West. To some extent, of course, there is national (as well as individual) competition to be first in discovery. But communications within the scientific disciplines flow readily across national boundaries and even through language barriers. The ultimate value is new information about man's universe, and preferably simplifying information that adds to the broad understanding of natural structures, functions, and relationships.

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[255] Ibid., pp. 4–5.

[256] Section 3(b) of the National Science Foundation Act of 1950, as amended by Public Law 90–407, July 18, 1968, provided that:

> (b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation or national security by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such scientific activities. Such activities when initiated or supported pursuant to requests made by the Secretary of State or the Secretary of Defense shall be financed solely from funds transferred to the Foundation by the requesting Secretary as provided in section 15(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate Secretary.

[257] See especially: U.S. Congress, House, Committee on Foreign Affairs, *U.S. Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange*, in the series Science, Technology, and American Diplomacy, prepared by Genevieve J. Knezo, Analyst in Science and Technology, Science Policy Division, Congressional Research Service, Library of Congress, April 1974. See vol. II, pp. 865–1035.

NONGOVERNMENTAL PREFERENCES OF SCIENTISTS

Except in times of war emergency, scientists have generally tended to prefer to develop their own forms of cooperation, usually on a person-to-person basis. The chief role of organizations of scientists has been to facilitate information evaluation and exchange. Herman I. Chinn stresses this preference for apolitical relationships among scientists:

Scientists generally prefer informal co-operation among themselves with a minimum of governmental involvement. The active investigators within a particular specialty are usually well known to each other. They have ample opportunities to discuss mutual problems and to arrange suitable co-operative measures. Such direct, informal dealings avoid the administrative and "bureaucratic" procedures often resulting from more formal arrangements. Although effective administration should facilitate the scientific effort, it frequently has the opposite effect. Reports, meetings and other requirements consume time that might be more profitably spent in the laboratory. There is the danger that administrative decisions may influence the scientific objectives. More seriously, some scientists fear that involvement with an official program may compromise their scientific integrity by subverting scientific considerations to political ends. Finally, a formal co-operative program introduces certain restraints in the type, duration and form of co-operation. Informal arrangements provide greater flexibility and can be more easily altered, discontinued or expanded as the occasion demands.[258]

However, the international relations among scientists have increasingly become institutionalized. Partly because of the growth in such "big science" programs as the IGY, space research, large scale weather studies, and the like, scientific activities are becoming global in scope and in organizational form.[259] According to Roger Revelle:

The supra-national values that guide scientists in their search for truth conflict at times with the foreign policies of nations; resolution of these conflicts calls for a high order of statesmanship. Cooperation in scientific truth-seeking can be a powerful tool for building international understanding only if its cohesive force is aided by national attitudes, policies, and actions.

In the search for truth, a structure of world-wide working relationships among scientists is essential in such major areas of inquiry as geophysics, meteorology, oceanography, animal and human ecology, astrophysics, and public health. These sciences take most meaningful form only on a global framework. Hurricanes, droughts, and pestilence know no national boundaries.[260]

Professor Revelle suggests the the Department of State has neglected the "immediate cultural values of American science for our relations with other countries." He saw such useful diplomatic gains to be achieved in this direction as the following:

Science . . . is a form of art, and one in which the United States now leads the world. By encouraging and promoting the widest possible range of international activities for American science, the Department could greatly foster acceptance of

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[258] Herman I. Chinn, "International Scientific Co-operation," *Bulletin of the Atomic Scientists* 25, no. 9 (November 1969), p. 34.

[259] Thus, the "largest, most complex, and most comprehensive international scientific undertaking" ever carried out in peacetime—the International Geophysical Year—is testimony to the abilities of scientists to organize on a grand scale, given a purpose and an occasion. Not only was the IGY mainly developed and managed by the scientists themselves, rather than by their governments; it established patterns of cooperation for later government-to-government efforts and relationships, including the negotiation of treaties. See: U.S. Congress, House, Committee on Foreign Affairs, Subcommittee on National Security Policy and Scientific Developments, *The Political Legacy of the International Geophysical Year*, in the series Science, Technology, and American Diplomacy, prepared by Harold Bullis, Congressional Research Service, Library of Congress, November 1973. See vol. I, pp. 293–360.

[260] Roger Revelle, "International Cooperation and the Two Faces of Science," in *Cultural Affairs and Foreign Relations* (Washington, D.C.: Columbia Books, 1968), p. 137.

the Western intellectual tradition, improve relationships with intellectual groups in the communist world, help develop common goals and objectives both with the rich and poor nations, strengthen international organizations, and enhance the image of the United States as a nation concerned with more than material things.[261]

One European author has suggested that shared participation of scientists in international programs provides the four essential ingredients of political unity. These were indicated to be a common language, mutual understanding, shared effort, and a common purpose.[262] However, this same author notes elsewhere that "The dimensions of scientific cooperation have changed:"

> It is no longer simply a matter of exchanges and communications for the exclusive use of specialized circles; it is now a matter of the joint realization of great enterprises (high energy physics, industrial exploitation of nuclear energy, exploration of space, etc.), within intergovernmental institutions whose budgets are going to compete with national research budgets. Its responsibilities have also changed; it began and developed essentially on the initiative of scientific circles, but it is now to a considerable degree stimulated and financed by governments. Furthermore, the objectives and activities of the institutions in which it takes place are not exclusively scientific. Finally, the direction of scientific cooperation has changed: the cost and the advantages of joint actions are no longer measured only in relation to the interests of science in general, but also in relation to the objectives pursued by each country, in the form of its own programmes of scientific, technological, economic or military expansion. The participation of a country is thus seen as one form of national investment among others, an instrument of broader policies and objectives.[263]

In a presentation before the Subcommittee on International Cooperation of the House Committee on Science and Astronautics, May 18, 1971, Herman Pollack presented lists of the various "specific objectives of international cooperation, science and technology"; he divided these into the categories of Scientific, Humanitarian, Political, Economic, and National Security. The "scientific" goals, according to Pollack, were:

a. To advance the world's store of knowledge by free interchange of ideas and data (e.g., International Decade of Ocean Exploration).

b. To create a "critical mass" of intellect and or instrumentation in attacking common problems (e.g., Global Atmospheric Research Program).

c. To speed the solution of critical problems by task apportionment or complementary research (e.g., safety vehicle development by United States, Italy, Germany (CCMS) (NATO Committee on the Challenges of Modern Society).

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[261] Ibid., p. 170. Incidentally, he suggests that: "The science attaché program might be considerably improved if it were operated jointly by the State Department and the National Science Foundation. Just as the military and agricultural attachés are the joint responsibility of the Departments of Defense and Agriculture, respectively, the Foundation could provide both guidance for the program and personnel for service as Science Attachés." A similar suggestion was made on several occasions by [then] Chairman Daddario of the Subcommittee on Science, Research and Development.

For example in a report on NSF appropriation authorizations for the fiscal year 1971, Mr. Daddario submitted the following item:

> The committee recognizes the important aspects of scientific research, and the valuable role which the NSF can play therein. The committee has given consideration to appropriate methods for constructive participation by the Foundation in our international science activities. It proposes that the Foundation and the Department of State give further study to this issue during the coming year.
>
> The committee has no intention of recommending a system of dual scientific representation by NSF and the State Department in foreign countries. However, it does feel that the Science Foundation and its personnel can make a valuable contribution to the existing science attaché program. Appropriate administrative procedures could be worked out whereby NSF staff members might function as staff members of individual embassies, and also have the opportunity to provide a meaningful interface between American science and the scientists of the host country. The Committee believes that such a program, properly implemented, would further the progress of American science, and also contribute to the technical knowledge and reasoned judgements necessary to an increasing proportion of foreign policy decisions. (U.S. Congress, House, *Authorizing Appropriations to the National Science Foundation*, Rept. No. 91-991, 91st Cong., 2d sess., April 1970, p. 60.)

However, it does not appear that any action was taken by either SCI or NSF in response to this proposal.

[262] Jean-Jacques Salomon, *Science and Politics* (Cambridge, Mass.: The M.I.T. Press, 1973), pp. 223–224.

[263] Jean-Jacques Salomon, "The Internationale of Science," *Science Studies* 1, No. 1 (January 1971), p. 33.

d. To meet the need in many studies of simultaneous or coordinated observations from many sites (e.g., World Weather Watch).

e. To compare the effects of geographic, climatic, cultural, etc., variables on a target system under study (e.g., International Biological Program).

f. To avoid unnecessary duplicatory research by information and personnel exchange (e.g. Medlars (Medical Literature Abstract and Retrieval System) information exchange).

g. To make available to scientists everywhere unique resources or experimental conditions otherwise available to only a few (e.g., SEATO Cholera Research Laboratory, Pakistan).

h. To develop international "banks" of scarce materials (germ plasm, microorganisms, geological samples, etc.) for the use of all scientists (e.g., lunar rock study program).

i. To concentrate the talents of many nations on a transitory phenomenon (eclipse, volcanic eruption, etc.) to provide maximum scientific benefit (e.g., international task force at Mexico solar eclipse).[264]

The exploitation of international science for diplomatic advantage appears to require that the several participating nations share the advantages of cooperation. For the United States, publicly funded enterprises of this kind would seem appropriately to require some sort of initial finding by the diplomatic apparatus of Government that proposed undertakings met the criteria of scientific merit, economic feasibility, soundness of the organizational approach, and the like. In view of the enormous numbers of different institutional forms that can be taken by international scientific activities, a heavy administrative burden would be placed on any institution (OES, for example) that attempted a comprehensive preevaluation of such activities, even if restricted to basic science alone. Joint researches of this kind may be performed by UNESCO or other of the United Nations family of institutions, OECD, NATO, any of the hundreds of international scientific societies under the general cognizance of the National Academy of Sciences, the National Science Foundation, various European joint agencies in which the United States is more than an interested bystander, many of the bilateral science programs, and many mission agencies of the U.S. Government. Keeping track of such enterprises in their entirety, and of their U.S. component in particular, would be an onerous task indeed. Yet, it may be contended that the diplomatic and other national goals of the United States warrant substantial effort.

One possible line of development might be the encouragement of a closer relationship between OES and the National Academy of Sciences-National Academy of Engineering-National Institute of Medicine-National Research Council complex. Both Dean Harvey Brooks and David Beckler advocate this course.[265] Herman Pollack, while concurring, suggests that the general relationship is already quite close and useful, within existing limits of funds and manpower.[266]

Sources of Foreign Policy Initiatives in Science and Technology

The technical aspects of diplomacy can be categorized roughly as follows: (1) policies to encourage the international advance of basic science, e.g., support for the International Biological Program; (2) policies to advance and exploit the national posture in technology, e.g., agreements for the sale of enriched uranium fuel elements; (3)

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[264] Herman Pollack, "Objectives of International Cooperation in Science and Technology," *Department of State Bulletin*, June 28, 1971, pp. 840–841.

[265] See footnote 282, p. 175.

[266] Pollack to Huddle, March 25, 1975.

policies to deal with global or international problems calling for technological resolution, e.g., satellite surveys of pollution sources and diffusion patterns; and (4) policies employing science and technology to alter diplomatic relationship in some beneficial way, e.g., U.S.–U.S.S.R. science agreement to further détente.

There have been numerous references in the literature to the need to exploit the fourth of these types of technical diplomacy, and a few examples can be recalled, such as the "Open Skies" and "Atoms for Peace" proposals of President Eisenhower, the joint U.S.–U.S.S.R. space collaboration proposal of President Kennedy, the Mekong development offer of President Johnson, and the numerous bilateral science agreements and the proposal for a technical institute for foreign aid advanced by President Nixon.

However, in recent years the quest for science-based diplomatic initiatives has neither been pushed strongly nor has it been particularly fruitful. Except in the area of bilateral agreements, where the device may actually have been pushed beyond a capacity to manage and support it properly, the creation of diplomatic initiatives to exploit U.S. scientific and technological preeminence has not been extensive. Certainly it is not described as particularly rewarding or inventive.

Various proposals have been made, from time to time, that an aggressive program be instituted to create on demand initiatives to further U.S. diplomatic goals. For example, a presidential task force, April 1970, recommended "that the President continue to encourage the major Departments and Agencies of Government to suggest specific new science-based foreign policy initiatives and opportunities for international cooperation."[267]

Also, during his tenure as Presidential Science Adviser, Dr. Edward E. David, Jr., in 1971 asked the members of the FCST International Subcommittee to come up with suggestions for possible consideration in the White House, with emphasis on programs or projects of mutual benefit, as well as ways to strengthen U.S. ability to respond to international scientific or technological opportunities.

It is not evident whether the general want of success of this effort to elicit fresh ideas for diplomatic initiatives has been attributable to the lack of appropriate organization for creativity, to the uncertainty as to the reception of bold and unconventional concepts, or perhaps an asserted tendency of the diplomatic community toward a reactive rather than innovative style of thought. Certainly there exist numerous areas in which opportunity for innovation is offered, and in which the United States has unique competence. For example, the World Health Organization, the Food and Agriculture Organization, and various regional organizations of the United Nations have programs that lag seriously and could be greatly strengthened at relatively modest cost. The staffing of international organizations with technical personnel from the United States as a form of training for their future participation in the technical elements of the Department of State or the Foreign Service might be considered. Positive action on the U.N. university proposal, or such aspects of it as studies

[267] U.S., President's Task Force on Science Policy, *Science and Technology; Tools for Progress* (Washington, D.C.: U.S. Government Printing Office, April 1970), p. 42.

of the multinational corporation, normalization of world resources, and seabed management, might warrant exploitation as mutual interest initiatives. One of the more interesting possibilities is an open invitation to foreign technologists to identify and help correct technological lags in the United States as a counterpart to U.S. assistance of this type abroad.

Innovative institutional arrangements are another form of initiative that might be considered. For example,

> Special attention is drawn to the possibility of making wider use of the services of co-operative industrial research associations. Further, in view of the increasing emphasis which in the advanced countries is continually being laid on the need for co-operation between universities and industry, it is suggested that a "composite" partner body comprising a university department plus support from industry could be of immense assistance to a corresponding body in a developing country.[268]

Such cooperative arrangements need not, of course, be limited to services to less-developed countries.

Ultimately, the difficulty with any attempt to create initiatives on demand is that bold new ideas, forcefully advanced and adopted, without careful screening and analysis as to implications and side effects, can turn out to be injurious if not disastrous. On the other hand, a labored screening of such ideas to winnow out the risky or dangerous ones can leave behind only the dull, commonplace, and trivial. Diplomacy then must turn to endless repetition of things that have worked before.

But this approach, too, has its disadvantages. As was shown in the discussion of bilateral science agreements (Chapter VI), a small number of such programs can be extremely rewarding but fifty or a hundred such programs would impose difficult problems of management and policy coordination. Each new nuclear reactor given to another country lessens the effect of such generosity, burdens the U.S. atomic energy industry with additional costs of fuel element processing and radioactive waste disposal, and widens the problem of "safeguards."

Perhaps the best that can be said for this problem is that the study of institutions to promote diplomatic creativity, and encouragement of the U.S. academic community to generate creative thought in this area, might show the way to a higher degree of initiative. The importance of the Department of State in this field, moreover, should not be overlooked.[269]

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[268] United Nations Educational, Scientific and Cultural Organization, *Bilateral Institutional Links in Science and Technology*, Science Policy Studies and Documents Series, no. 13 (1969), p. 30.

[269] For example, in discussing the merits of a proposed Congressional diplomatic initiative "to facilitate the transfer to certain less developed countries of United States discoveries, inventions, and research developments . . ." to be managed by NSF, Dr. H. Guyford Stever, director of NSF, warned: "The close interrelation of science and technology with other U.S. policies and initiatives in international affairs would seem to argue for the closest possible coordination of all of these efforts." Accordingly, it was necessary to "take advantage of the capabilities of the Department of State, which I believe are essential to the success of such an undertaking." (U.S. Congress, House, Committee on Science and Astronautics, International Cooperation in Science and Space Subcommittee, *International Science and Technology Transfer Act of 1974*, Hearings, 93d Cong., 2d sess., May 21–23, 1974, p. 21.)

XI. Summary and Concluding Observations

This study has presented some of the historical roots of science in the Department of State, and has traced the uncertain but accelerating growth of the Department's science activities since 1950. A substantial science bureau has grown up, and a number of overseas embassies have scientific attachés and staffs. Congressional support for the science office and recognition by three Secretaries of State have attested to its valid role in the Department.

The year 1975, and the years immediately ahead, look like a time of opportunity in an environment in flux. New decisions are pending as to the relationship between the science bureau and other bureaus of the Department, as to the future missions and structure of overseas science staffs, and as to the design of the President's policymaking organization in the field of scientific and technological diplomacy. Teamwork of OES with the Policy Planning Staff and the staff of the National Security Council appears to be valuable for the diplomacy of the future. The possibility that the 94th Congress will act on the creation of a new science policy institution in the Executive Office offers further problems and opportunities to the new science bureau in State.

Also for the future to determine is the extent of the effort to bring a heightened "technical literacy" into the Foreign Service, whether by renewed emphasis on the Foreign Service Institute or by other means.

Another question is the creation of further science units in the functional bureaus of the Department, manned and equipped to cooperate with the science bureau in the formulation of diplomatic policy and the initiation of new science- and technology-based programs toward U.S. foreign policy objectives.

The pace of technological change and the innumerable technological issues that confront U.S. policymakers in maintaining and developing relations with the rest of the world leave no doubt as to the importance of the science function in the Department of State. A foremost problem is the establishment of the priorities in dealing with the array of issues already at hand, while also sparing some time for the analysis and evaluation of technological prospects for the future.

Distinctive Position of the Department of State

First among cabinet Secretariats, the Department of State has strengths and weaknesses not evident in other departments. In protocol it ranks highest; its role and mission are to support the President in his conduct of foreign policy; its senior officers deployed abroad are empowered to speak for the President; and the information it accumulates enables the President to function as Chief Diplomat. Its weaknesses are its want of domestic support; in the gross disproportion between the scope of its responsibilities and the resources it can command; and in the inherent conflict between the pluralism of a democratic society and the need for national diplomatic processes to be coherent, unified, and single-voiced.

It is a further particularity of the Department that its business is the peaceful relations of the United States with other countries. This business is both of literally vital importance and vast intellectual complexity. It involves both the strongest normative values and the deepest scholarly challenges. Few areas of concern approach it in the volume of literature generated to advocate policies or criticize performance.

Into this complex structure it is necessary to inject a second great range of concerns: the policy, conduct, and consequences of science and technology. The scholarly challenges of science and technology easily match in scope if not in complexity those of foreign relations. And the interactions of the consequences of technology with political and social values add to the complexity of framing rational courses of diplomacy for a pluralistic society.

A persuasive case could be made that the American diplomatic style has tended to be reactive rather than initiatory. This hypothesis finds support in the fact that the ultimate decisions proposed are those of the President; the departmental role has tended to be to staff initiatives rather than to propose them, and to analyze the actions and initiatives of other nations to chart the options for U.S. responses.

The thesis of this study is that the world environment of diplomacy has changed in ways that make necessary a deeper involvement of the Department of State in science and technology, a more perspicacious outlook toward technical trends for the future, and a more positive approach to the generation of innovative technical policy.

Two changes of greatest import have been (a) the conversion of "total" armed conflict among "superpowers" from a test of relative national strengths to mutual national suicide; and (b) the progress of the nations of the world toward a single global system of technology, economics, information resources, and environmental quality—which are all part of the idea of global interdependence among nations. Both of these two great changes were wrought by technology; undeniably, further great changes are in store. The ability of the United States to survive, to thrive and prosper, to live in peace and amity, and to contribute constructively toward a better future world for all people, in the face of these great present and future changes, is the task that U.S. diplomacy is called upon to undertake. The institution that manages that diplomacy is the Department of State. The question remaining to be discussed is whether and how the Department can be strengthened to manage better the technologically oriented diplomacy of the future.

Staffing the State Department for Technological Diplomacy

It would be premature to infer what actions the new Assistant Secretary of the Bureau of Oceans and International Environmental and Scientific Affairs will take to consolidate and strengthen her organization for its expanded future role. Accordingly, this section of the study is limited to an identification of some possible directions that might be taken to strengthen the Department to meet the needs of present and future diplomacy in a scientific age. One thing seems clear: that technical literacy must be recognized as necessary in all policymaking elements of the Department. How might this requirement be met?

OPTIONS TO INCREASE TECHNICAL LITERACY

One possible approach might be to examine incoming candidates to the Foreign Service for their basic skills and general familiarity with phases of science, science policy, and technological development. Another approach might be to motivate middle-level FSOs to seek further inhouse training in science policy, and perhaps to introduce courses in the Foreign Service Institute along the lines of the War College case studies on strategic problems.[270] Exchanges of personnel might be initiated or increased between OES and other departmental bureaus, between State Department personnel and other agencies with international technical functions. Departmental personnel, OES or other, might serve internships on congressional committee staffs concerned with science, technology, or diplomacy. Of particular value would be an OES exchange arrangement with the Office of Management and Budget. Another important purpose might be served by detailing to IO people with budget and management experience related to such U.N. agencies as the World Health Organization, the Food and Agriculture Organization, and UNESCO.

STRENGTHENING FIELD STAFFS

The problem with strengthening the field organization for science and technology—the scientific attachés deployed in U.S. Embassies abroad—raises a number of interesting organizational questions. Attachés apparently serve three masters: the Ambassador at the Embassy, the regional bureau to which that Embassy reports, and the State science office that coordinates the work of all scientific attachés. Field science offices must compete with political, economic, and other offices for the limited billets in Embassies. Their function is judged for utility to the regional bureau in competition with the products of political and economic officers. The science office itself has the two-sided problem of winning billets for scientific attachés and their supporting staff and also of recruiting qualified candidates. Invariably, some posts remain unfilled. Despite these obstacles, it would seem useful to maintain a full complement of technologically knowledgeable analyst-observers at all Embassies in countries where technological advances are of consequence to the United States. A suggested alternative might be the establishment of a number of strong regional observation posts each covering a number of countries.

The attempt by Herman Pollack to designate "science officers" in Embassies without scientific attachés seems not to have worked very consistently, but perhaps it might be tried again, on a more modest basis but with more attention to the motivation and interests of the persons designated for this assignment. Another possible experiment would be the assignment of interns with graduate degrees in science policy to Embassies to report on significant technological developments. (An increasing number of universities in the United States give advanced degrees in this field.)

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[270] In a personal communication Professor Rusk writes:

> I am sure that Foreign Service Officers will become more and more competent in science and technology because of sheer necessity. However, I think we can speed up the process by seeking out more science-trained young people for the Foreign Service and arrange a considerable number of study leaves for concentrated work on what science and technology are all about. Special courses of study might be arranged at the FSI or in universities—somewhat like the Nieman Fellowship for journalists at Harvard.

(Dean Rusk to Franklin Huddle, March 18, 1975.)

The general thrust of this discussion is not to imply the need for elaborate reorganization of the Foreign Service or the Department, but to suggest that opportunities might usefully be sought to increase the technical competence and resources available to the Department.

Differing Treatment of Scientific and Technological Matters

It serves no purpose to attempt a precise distinction between science and technology. They overlap and intermix considerably. However, it may be useful to consider broadly the different diplomatic problems presented by these two elements, and also the difference in the operations of an organization in the Department of State in dealing with scientific as contrasted with technological matters. It is possible that two quite different organizational forms and styles of management are required.

THE SCIENCE ROLE

It has been contended in this study that science is basically an international activity, with a world network of communication among practitioners of the separate scientific disciplines. Government funding is generally welcomed but government direction is not. Science *per se* has little impact on diplomacy, and that mostly beneficial, while diplomacy can pave the way for expanded scientific exchanges of persons and joint or multinational projects. Scientific programs are rarely the subject of serious diplomatic controversy. They tend mostly to low-cost activities.

Accordingly, the diplomatic role with respect to scientific activities tends to be centered on facilitating international travel and information flow, assuring appropriate participation in conferences, helping to establish professional contacts, and maintaining information on national science policy and budgets. Much of this work is performed in the United States by the National Science Foundation or by the Office of the Foreign Secretary of the National Academy of Sciences with funding support largely from NSF. As has been shown, NSF also plays a major role in supporting a number of bilateral science agreements. And in the field of multilateral science activities the Bureau of International Organization Affairs has a considerable role. The science function of OES is, in consequence, a more general policy overview, and the primary emphasis has for some time been shifting from science to technology.

THE TECHNOLOGICAL ROLE

In contrast with science, the impacts of technology on diplomacy are numerous and powerful. While many of these impacts are loosely identified as "scientific," it is more precise to refer to them as the technological applications of new scientific principles. The spread of technology is increasingly global, tending in the process to infringe national sovereignties. The inroads are caused by such technical effects as satellite overflights and penetration of the deep oceans, and by such institutional developments as the multinational corporation and multination cartels. On the other hand, both the uses of technology and the scarcity of resources consumed in these uses may encourage a more intense nationalism. Science may respond beneficially to diplomatic initiatives, but technology determines in major ways the whole

environment of diplomacy and national power. It is therefore a fit subject for broad policy analysis on a major and continuing basis. It requires extensive information inputs. Quantitative as well as qualitative factors are involved. Technical knowledge and understanding are needed in the analysis, but broader social and political understanding are also essential.

A number of those consulted in the preparation of this study advised against any attempt to separate science from technology in the design of arrangements to handle the diplomatic aspects of technical matters.[271] However, it is the view of this author that at least the operational elements of scientific diplomacy need not be included as functional responsibilities of an office or institution engaged in the analysis of the interactions of diplomacy with technology.

Although Herman Pollack distinguishes science ("poses no diplomatic problems of note to government") from technology ("major

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[271] Thus, Professor Rusk counsels:

> So far as the Department of State is concerned I would be careful about separating science, science policy and technology. The Department must do its best to see things as a whole. It should resist the ridiculous super-specialization which has infected our universities and deprived us of the universal men and women, such as Benjamin Franklin and Thomas Jefferson, whom we desperately need.

(Rusk to Huddle, March 18, 1975.)

And in the same vein, Dean Brooks suggests a unity of policy and a distinction between policy and operations:

> I think responsibility for science and technology should be within a single organizational unit in State. Although the two are readily separable at the extremes, they blend into each other too continuously in practice for a separation to be either practical or desirable. Those aspects of technology which are closely identified with national interests are the province of the Department of Commerce, but a growing number of aspects of technology are transnational in character, and should be handled in what you refer to as an "un-national" perspective. Such questions as the conservation and utilization of ocean resources and facilities, the management of global environmental problems, earth resources satellites, the international management of nuclear power and nuclear fuels, and hundreds of other issues are inherently transnational in scope, and involve technology. *Implementation* of policy in these and similar areas is properly left to the specialized agencies with expertise in the particular technology, such as ERDA, NASA, or DOI, but this should be under firm *policy guidance* from State, which should have sufficient expertise to argue with the agencies on a more or less equal basis, and be capable at least of questioning some of the working assumptions of the specialized agencies without having an inferiority complex. Contrary to the implication of your question, I would assert that science and technology belong together more than ever before. The weakness in the past in State has been that the technological aspects have been somewhat slighted.

(Dr. Harvey Brooks, Dean, Division of Engineering and Applied Physics and the Kennedy School of Government, Harvard University, to Franklin Huddle, February 10, 1975.)

From the point of view of senior staff experience, Mr. Beckler analyzes the problem in similar terms:

> It is most important that the science and technology functions be carried out within a single organizational unit in the Department of State for the following reasons:
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> a. The inherent inseparability and mutual interactions of science and technology—e.g., in energy (the spectrum from fusion research to coal gasification), in the environment (the science underlying environmental standard setting and environmental control technologies), in the oceans (oceanographic research and mineral extraction), in developing countries (scientific infrastructure and industrialization).
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> b. Thus, separating the science and technology functions organizationally would pose additional problems of horizontal coordination within the Department which is even now difficult to achieve between S&T and other organizational units in the Department.
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> Cooperation in fundamental scientific research proceeds with little need for government intervention other than to assure that [political] barriers are minimized. Increasingly, however, strategic planning is shaping the directions of international scientific collaboration, emphasizing areas of basic research relevant to national concerns.
>
> Whereas in the case of a White House science and technology mechanism, care needs to be taken to separate science and technology from the standpoint of minimizing the "advocacy" of science role, this is much less of a problem in the Department of State. In fact, retaining science in an office having a strong technology focus can help to avoid the appearance of science *qua* science.

(David Beckler, Assistant to the President, National Academy of Sciences, to Franklin Huddle, March 5, 1975.)

source of diplomatic headaches"), he would keep them together in the Department of State for practical purposes:

> I would opt for keeping the functions together for I don't believe the science function would fare well by itself in bureaucratic terms because the relationship to foreign affairs is not immediate or obvious. Moreover, the distinction is a difficult one to maintain in fact or in practice. If science and technology were to be considered a spectrum, no more than one quarter would be white or black; the rest would be various shades of grey. Governmental organizations, here and abroad, tend to keep these two areas together. (Witness recent developments at NSF.) If the two were separated at State, there would be double representation to meetings, dual schedules of appointments for visitors, etc. Moreover, I don't see any advantage to be gained that could not be obtained as readily within a single organization.[272]

Coordination of Foreign Activities of U.S. Technical Mission Agencies

In three distinct types of activity the programs of U.S. agencies with technical missions can exert impacts on U.S. diplomacy. The question is: what roles should the Department of State play in coordinating, assisting, or policy formation, toward each type of activity. The three types are: (1) U.S. agency participation in bilateral, multilateral, or other overseas research and development; (2) activities by foreign governments as a part of domestic programs of U.S. agencies: and (3) domestic programs of U.S. agencies that impact on U.S. diplomacy, or that have potential for future impacts, beneficial or injurious.

It is difficult to identify all the different elements in the Department of State with various degrees of responsibility for one or more of these three types of activity. Except in rare instances, the third type appears to be essentially neglected as a subject for diplomatic attention. No instances were turned up in which the Department played a noticeably active role in congressional hearings or elsewhere to advance a domestic research and development program of another agency for diplomatic benefit, or to oppose one to prevent diplomatic disadvantage.[273]

Similarly with the role of foreign officials, or persons, working in the United States in collaboration with U.S. personnel on mission agency programs: such activities appear to be conducted mainly on an *ad hoc* basis, without much concern on the part of the State Department. In the first type, that of U.S. overseas R&D programs, some degree of coordination is exercised, but not across-the-board. Information is sparce concerning exchanges of persons funded by the U.S. Government;[274] funding requests for U.N. technical agencies with U.S. agency participation do not generally entail technical reviews of costs

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[272] Pollack to Huddle, March 25, 1975.

[273] However, as Mr. Beckler points out, there have been a number of domestic U.S. programs that have furthered U.S. diplomacy. He notes:

> They include the outer space initiatives (particularly ERTS and joint docking) and atomic energy cooperation, the opening of the Fort Dietrick facility to international cooperation in cancer research, and the recent energy R&D initiatives, among others. . . .

(Beckler to Huddle, April 3, 1975.)

[274] See: Foreign Affairs Committee, *U.S. Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange*, op. cit. (Vol. II, pp. 865–1035.)

and benefits;[275] on the other hand, there is substantial participation by the Department of State in coordinating bilateral science programs, and in assisting in arrangements for overseas space tracking stations and other remote scientific deployments.

In summary, the primary emphasis of the Department in these categories appears to be operational rather than policy-oriented. Under these conditions, it would be unlikely to expect the Department to propose new diplomatic initiatives to advance U.S. diplomatic objectives when these involve overseas (or domestic) research and development activities of other agencies. An assessment by the National Academy of Sciences of the "complex" policy process for "international aspects of programs in which science and technology are closely involved" observes that "many of the subjects relevant to science and technology receive little leadership or effective guidance until they reach crisis proportions or cause major political problems." (In the assessment quoted here, no reference was made to initiatives, and only the monitoring function was discussed.) Accordingly, the report recommended as one of the functions of a proposed Council for Science and Technology, in the Executive Office of the President, a "strong coupling" between this Council and the Department of State, in consultation with the National Security Council. Said the report:

That coupling would enable the council to provide in international matters the early warning and coordinated attention to crisis management and selective

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[275] On this point Dean Brooks comments:

Although I see its disadvantages I do not see how State can avoid being the coordinator and defender of the U.N. agency budgets. This is because the relative emphasis on the various U.N. specialized agencies is a question of U.S. foreign policy, and consequently State must have a hand in determing the overall priorities. The real problem is, I think, that U.N. affairs generally are accorded too low a priority within State, and within the Government as a whole. The reasons are understandable, but I think not correct, especially insofar as they pertain to the specialized agencies. We are going to have to come to terms with the multilateral mode of dealing with the world, unsatisfactory as the present mechanisms are. I do not think the situation is helped by the U.S. signalling its generally low opinion of U.N. agencies to the world. Our policy should be to constantly seek ways to make them work better, and keep them as non-political as possible. If the U.N. agency budgets were coordinated and defended by the relevant U.S. specialized agencies, our national posture with respect to the U.N. would be even more uncoordinated than at present, a step in the wrong direction. I do not see why State could not make better use of the assistance of the specialized agencies in defending U.N. budget contributions, but the process should be orchestrated by State.

(Brooks to Huddle, February 10, 1975.)

In response to a question as to "state and agency relationships to U.N. organizations," Mr. Beckler considered it "one of the most difficult and troublesome problems in delivering on our commitments and realizing the opportunities for science and technology to contribute to our foreign policy objectives." He continued:

The government's scientific and technical resources and capabilities reside in substantive mission departments and agencies that, for the most part, have neither the statutory mandate nor the budgets to carry out international cooperative activities. The Department of State has the mission but lacks both the technical capabilities and the financial resources. For this reason, the U.S. now finds itself overcommitted in ability to provide scientific and technical follow-through of major initiatives by the President and Secretary of State expressed in the U.N. and bilateral agreements. How to redress this imbalance requires special study. My preference is to seek legislative authority and budgets for the operating departments and agencies to engage in international activities as an integral part of their missions under the general policy purview of the Department of State.

Your questions fail to point up an equally troublesome problem of coordination *within* the Department of State. Typically, IO concerns itself with the funding and operation of U.N. agencies, regional desks such as ARA with the substantive work of those agencies, and the Bureau of Oceans and International Environmental and Scientific Affairs with the science and technology aspects. Innovative procedures and organizational arrangements need to be instituted to facilitate a coherent and coordinated approach so that the expertise of the Department can be marshalled in support of the Secretary. One possible mechanism for doing this would be to strengthen the Policy Planning Staff so that it could operate in the mode of the NSC staff—formally defining the terms of reference for studies of major issues (in the name of the Secretary) and assigning responsibilities within the Department for the conduct of the studies, drawing where necessary on outside contributions. Through such mechanism, the issues and the pros and cons of alternative approaches could systematically be developed and placed before the Secretary. Although this may now be done to a limited extent, the process could be institutionalized with advantage and offers the possibility of generating more guidance and leadership from the top of the Department.

(Beckler to Huddle, March 5, 1975.)

program development that have been suggested here as among the principal functions of the council. It would enable the council to intervene, side by side with those within the Department of State responsible for scientific affairs, at the points where policy is actively determined, particularly where Presidential initiatives or interests are immediately involved.[276]

State and Presidential Policymaking in Science

The combined role of Dr. Kissinger as Secretary of State and Special Assistant for National Security Affairs ties the Department more closely to the National Security Council, and to Presidential policymaking generally. On the other hand, the action by President Nixon in eliminating the Presidential Office of Science Adviser and the Office of Science and Technology (OST), and in transferring the function to the Director of NSF,[277] may have had adverse effects on science policymaking in State. In particular, it eliminated a point of access and a source of support and stimulus useful to the State science office. At the same time it increased the responsibility of SCI/OES for coordinating interagency science policy in the international field. (For example, the FCST international committee was transferred to SCI shortly after the PSAC international committee was dissolved along with OST. These actions left SCI, along with a small Science and Technology Policy Office (STPO), formed to assist the NSF Director in his Presidential advisory role, as the residual claimants to the function of international science and technology policy planning and coordination.)

Dean Brooks (Dr. Harvey Brooks, dean, Division of Engineering and Applied Physics and the Kennedy School of Government, Harvard University), indeed, sees difficulties both domestic and foreign, in the removal of the science advisory function from close proximity to the White House:

I think the difficulties with the transfer of the science office to NSF are probably greater in domestic than in foreign policy, but there is no question that there are universal difficulties in confusing the roles of operating and policy organizations. It is true that the NSF Directors wears an independent "hat" in his advisory role, but that fiction will be maintained with increasing difficulty as time goes on. As Skolnikoff and I state in our *Science* article, a science and technology policy office in State needs a counterpart in the Executive Office which can channel its recommendations and policy perspectives directly to the Presdient. The removal of the science advisory mechanism to NSF has left a vacuum of independent

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[276] National Academy of Sciences, *ad hoc* Committee on Science and Technology, *Science and Technology in Presidential Policymaking: A Proposal* (Washington, D.C.: National Academy of Sciences, June 1974), p. 45.

[277] These actions were accomplished in Reorganization Plan No. 1, January 26, 1973, and became effective July 1, 1973. The action also eliminated the President's Science Advisory Committee (PSAC) and transferred the Federal Council for Science and Technology to NSF jurisdiction.

An assessment of the three-way interaction among SCI-NSF-NSC after Reorganization Plan No. 1 became effective is offered by Pollack as follows:

> The transfer of the Presidential science and technology machinery to the Director of NSF was interpreted in the Department of State as a weakening of the White House role which, in international scientific matters, had previously been rather strong. Witness the Hornig, DuBridge and David foreign trips for example. As a consequence of the shift the Department of State science and technology activity did attempt to be more assertive in exercising inter-departmental leadership and in managing relationships with foreign science and technology leadership. However, the absence of a White House official identified with science and technology and the somewhat ambivalent status of the head of NSF did weaken the U.S. in its international scientific relationships. In this day and age, there is a need for a clearly recognized leader of science within the government structure to order affairs within the government for international relations and other purposes as well.
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> As for relations on science and technology matters between the State Department and the National Security Council, the President's Science Adviser and his staff were usually a third party to the relationship. Under the present arrangement neither the Director of NSF or his staff has served in that capacity except on a few issues. The State Department and the NSC staff were left to their own devices and as a consequence the cooperation between them deepened, perhaps of necessity. Of course, it was helpful to have NSC and the State Department headed by the same man.

(Pollack to Huddle, March 25, 1975.)

technical advice on national security matters which can give the President a different perspective than what he gets from the Pentagon, which is required by law to look at national security from one and only one point of view, namely that of the application of force in furtherance of the security interests of the U.S. Alternatives to force are not likely to receive sufficient attention in this perspective.[278]

And David Beckler (Assistant to the President, National Academy of Sciences), sees in the action a reduced capacity for foreign policy initiatives in science and technology:

The transfer of responsibilities from the former Presidential Science Adviser and the Office of Science and Technology has generated certain instabilities of leadership in the area of science and technology. Under the previous arrangement, many initiatives were taken by the White House science and technology mechanism. Its direct relationship to the President, the NSC and OMB reinforced its leadership role in the substantive aspects of science, technology, and foreign affairs, a role that was accepted by State and respected by the departments and agencies. With the shift of responsibilities to the Director of NSF, minus the national security function, the psychology, if not the symbol, of leadership changed. Since the NSF has been heavily involved in international science cooperation, the Science Adviser and Director of NSF roles are somewhat blurred. In this situation, it appears necessary to have a clear understanding of respective roles and prerogatives, with strengthening of the S&T capabilities of the Department of State to frame S&T follow-up in response to Presidential and Secretary of State initiatives, to take the lead in coordinating agency response, and to deal directly with the NSC staff mechanism on matters that have in the past had a strong scientific and technical input from the OST.[279]

During the early months of 1975 moves underway in both Houses of Congress were aiming to restore in one way or another the science policy framework in the Executive Office. Action in this area would be likely to have consequences not only for domestic science policymaking but for the diplomatic aspects as well.

However, pending action on the Presidential science policy system, the current situation is that aspects of international science and technology policy, in the upper reaches of policymaking are spread among:

—The Bureau of Oceans and International Environmental and Scientific Affairs;

—The State Department Policy Planning Staff;

—The immediate staff of the Secretary of State;

—The National Security Council, and the Under Secretaries Committee;

—The Director of NSF and the Science and Technology Planning Office; and

—Council on International Economic Policy.[280]

Precisely how policy initiatives and responses can evolve out of this rather complex congeries of high level institutions is not clear. It is possible that a sharper definition of the tasks to be performed and a formal definition of functions might help to sort things out a bit. The complications may actually be more apparent than real, in view of the extensive resort of Dr. Kissinger to personal diplomacy and also

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[278] Brooks to Huddle, February 10, 1975.

[279] Beckler to Huddle, March 5, 1975.

[280] The Council on International Economic Policy (CIEP) was created by Presidential memorandum in January 1971. The Congress first authorized the CIEP in the International Economic Policy Act of 1972 (86 Stat. 616), and granted further authorization by the act of October 4, 1973 (87 Stat. 447).

the extent to which the same leadership group turns up in different policy group meetings.[281]

Somewhere in this policy complex, perhaps most logically in a cooperative venture of OES and the Policy Planning Staff, it would seem desirable to initiate a number of policy studies of such subjects as the following:

—An understanding of the diplomatic implications of the multinational corporations;

—Assessment of the comparative diplomatic merits, problems, potentialities, and future action implications of multilateral science and technology programs and institutions versus bilateral programs;

—Examination of the implications for U.S. diplomacy of the effects of technology that simultaneously weaken sovereignty and intensify nationalism—and as to whether these combined effects point toward increased tensions and instabilities among nations;

—Resolution of the conflicting assertions about the merits of U.S. sales of technology abroad and the relatively more rapid rate of economic development of nations purchasing U.S. technology—including the diplomatic policies appropriate to the situation;

—Analysis of the adverse or potentially adverse consequences for international amity and stability of such technologies as seabed mining, weather modification, and atomic power; and

—Analysis of the diplomatic and policy aspects of the unbalance between global food supply and populations.

The kinds of technology-oriented foreign policy studies listed above are urgently needed to chart future courses for both U.S. diplomacy and science policy. Other items could readily be added. The results of such studies would be of value not only to the President and his diplomatic corps, but also to the Congress and particularly those committees with concern for foreign affairs, science and technology, or both.[282] However, to the extent that such studies and analyses

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[281] For example, in an interview with *Business Week*, Dr. Kissinger was asked:

Is there any chance of coordinating better U.S. international economic policy, particularly since the Council for International Economic Policy seems to be losing its power? He responded:

"You can't look at policies of a government in terms of organizational mechanisms. The CIEP was created at a time when the National Security Council was essentially divorced from economic policies. Then it became clear that every economic policy had profound foreign policy implications and really required political inspiration and leadership to make it effective. You could never implement the energy policy as a purely economic matter; it has been a foreign policy matter from the beginning.

"When that happens, the issue tends to be pulled back into the orbit of the National Security Council. What you have had is a greater foreign policy involvement in economic policy decisions.

"On the other hand, I think the relations between the State Department and Treasury have never been better, despite the occasional disagreements that surface in the newspapers. You expect disagreements. The issue is not whether there are disagreements but how they are settled. And they are always settled in a constructive positive way.

"On energy, we have a group which I described before of Arthur Burns, Simon, myself, Robinson, and a few others who meet regularly to set the basic strategy in the international field. Whether we meet as the Council for International Economic Policy or the National Security Council, the group has essentially the same membership."

(Source: "Kissinger on Oil, Food, and Trade," *Business Week*, January 13, 1975, p. 76.)

[282] Both Dean Brooks and Mr. Beckler see the newly formed Commission on International Relations of the National Research Council as a useful resource in this context. Dr. Brooks suggests that it would be "desirable if State could provide the Commission with some relatively unencumbered funds in order that it could explore and develop new initiatives in the international science and technology area, rather than merely respond to government requests in a problem-solving mode." (Brooks to Huddle, February 10, 1975.) And Mr. Beckler suggested "strengthening the cooperative relationship between the Department of State and the NAS-NAE-NRC structure: (a) to draw upon the NRC in ways that can serve the Department as-a-whole (this will be particularly facilitated if the Policy Planning Staff mechanism is strengthened along the lines suggested above); and (b) to make broader and more systematic use of the NAS-NAE-NRC studies through direct dialogue between the authors of the studies and the responsible officers of the Department." Beckler to Huddle, March 5, 1975.

are not forthcoming from the executive branch, it is possible that strengthened institutional resources of the Congress itself could supply at least some of the needed policy analyses and options for these big problems.

Congressional Institutions for Technical Foreign Policy Planning

In the last analysis the Constitution vests in the Congress of the United States a large share of decisionmaking power on foreign as well as domestic affairs. Senatorial assent is the *sine qua non* of treaty-making. The power of the purse defines congressional control over all positive actions and programs of the Federal Government, foreign as well as domestic. The control of foreign trade and international transfers of persons, no less than the regulation of armed forces and the right to declare war, rests in the Congress.

Although this study has dealt mainly with the institutions of the executive branch, and has discussed at length the policymaking elements of that branch in the interaction of science and technology with diplomacy, the subject of congressional decisionmaking in this field also demands attention. Perhaps the most salient question is whether the Congress should rely mainly on policy studies and recommendations of the executive branch, or whether these sources should be supplemented by information and analyses by competent authorites directly and exclusively responsible to the Congress.

CONGRESSIONAL RESEARCH SERVICE

On several recent occasions the Congress has acted to augment its own committee staffs, and to create or expand research institutions to supplement its own staff resources with other professional expertise. One such action was the Legislative Reorganization Act of 1970 [283] that changed the name of the Legislative Reference Service to Congressional Research Service, and under section 203(d)(1) made it responsible (excerpt):

> . . . upon request, to advise and assist any committee of the Senate or House of Representatives and any joint committee of Congress in the analysis, appraisal, and evaluation of legislative proposals within that committee's jurisdiction, or of recommendations submitted to Congress, by the President or any executive agency, so as to assist the committee in —
>
> (A) determining the advisability of enacting such proposals;
>
> (B) estimating the probable results of such proposals and alternatives thereto; and
>
> (C) evaluating alternative methods for accomplishing those results;
>
> and by providing such other research and analytical services as the committee considers appropriate for these purposes, otherwise to assist in furnishing a basis for the proper evaluation and determination of legislative proposals and recommendations generally . . .

Under this and other authorities conferred by this act, the Congressional Research Service has substantially expanded its professional personnel, and the range of studies "in depth" it performs at the request of congressional committees. Moreover, a positive effort has been made in CRS to develop an interdisciplinary approach to the study of larger subjects and problems, and to introduce futures research and forecasting as a discipline applicable to all public policy areas. Given this resource in being, might consideration be given to

[283] Public Law 91-510, approved October 23, 1970.

charging it with responsibility for performing the kind of large, long-range, future-oriented studies needed in charting the future course of American technology-oriented diplomacy?

While the use of an existing organization is usually an attractive alternative in preference to creating a new one, there are several difficulties in the way of this use of CRS. For one thing, CRS has many competing committee and member calls for its services and has been charged with responding to them all—i.e., with making its whole spectrum of informational, research, and analytical services as widely available as possible to both members and committees. Moreover, most of the congressional requests are for partial summaries or brief analyses related to immediate problems and pending legislation. Under these conditions it has been difficult to isolate study teams, freeing them from other tasks and supporting them for continuing service on policy studies requiring months or even years. Nevertheless, recent developments and current aims are pointing CRS in this direction. According to testimony by CRS Director Lester S. Jayson before the Joint Committee on Congressional Operations on May 16, 1974: "[A problem with which CRS has] wrestled in recent years is that of freeing our staff to produce more indepth analytical studies on appropriate public policy issues. Up to this point we have increased our staff to respond to the specific requests of the committees and Members of Congress. In the future, we should—on our own initiative—be exploring ways of pinpointing subjects of longer range interest to the Congress. The Reorganization Act tells us to engage in anticipatory work. The same act tells us to discuss emerging issues with committees. Our senior staff are enormously knowledgeable in their fields of specialization. They can and should be identifying problems of this kind. Perhaps on the basis of such identification, followed by consultations with committee chairmen or the leadership, they could designate longer range issues worthy of intense and exhaustive study. With the subjects chosen, appropriate senior staff or multidisciplinary teams could be insulated from the daily activities of the Service to undertake such studies. When appropriate, they could be augmented by outside specialists, by outstanding experts from the private sector, by scholars from the universities, and by services provided through contract with research organizations. The Reorganization Act gave us the charter and the authority to engage in activities of this kind, and there is no doubt that broader studies like these could be beneficial to the Congress." [284]

OFFICE OF TECHNOLOGY ASSESSMENT

Another possibility might be the use of the Office of Technology Assessment (OTA) by extending its studies of technological impacts into the foreign field. OTA, created pursuant to the Technology Assessment Act of 1972,[285] contains (sec. 2) "findings and declaration of purpose" altogether germane to the subject at hand. The text reads:

(a) As technology continues to change and expand rapidly, its applications are—
(1) large and growing in scale; and

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[284] U.S. Congress, Joint Committee on Congressional Operations, *Congressional Research Support and Information Services*, Hearings, 93rd Congress, 2d sess., May 16, 1974, pp. 7-8.
[285] Public Law 92-484, approved October 13, 1972.

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.

(b) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(c) The Congress further finds that:

(1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological applications, and

(2) the present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

(d) Accordingly, it is necessary for the Congress to—

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

The "basic function" of OTA is thus: ". . . to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress."

The appropriateness of OTA to support congressional requirements for analyses of the long-range interactions of science and technology with diplomacy turns on such questions as the following:

—Can OTA reserve resources for very long-range studies of great scope and complexity or is it (like CRS) constrained by shorter range requirements related to current problems and pending legislation?

—Would the fact that the bulk of OTA studies are "contracted out" tend to render it less useful in sensitive diplomatic studies?

—Is OTA's heavy emphasis on technology compatible with the need to give coequal attention to international social and diplomatic aspects of complex global issues in order to provide diplomatic policy guidance?

It seems possible that CRS or OTA could contribute substantially in the field of technical foreign policy. OTA has—up to now—been able to concentrate large resources on a small number of major problems. However, it is to be recognized that to delegate to it responsibility for studies in the technology/diplomacy area would mean a substantial increase in OTA's scope.

JOINT COMMITTEE ON NATIONAL SECURITY AFFAIRS

Another possible institutional vehicle for the purpose might be a joint committee on National Security Policy along the lines of that proposed by Chairman Zablocki of the Subcommittee on International Security and Scientific Affairs (see pp. 143-144). Such a committee, without legislative responsibilities and limited to policy studies and recommendations, might be able to free itself from shorter term considerations. Presumably, such an organization would enlist the services of a highly qualified professional staff, policy-oriented, and deliberately instructed to concentrate on large problems of the

long-range future. As a general proposition, Members of Congress are faced with so many legislative commitments and committee responsibilities that they find it difficult to reserve time to monitor in detail the activities of legislative committee staffs. However, a policy committee whose staff issued well-thought-out analyses in great depth at less frequent intervals could presumably budget its time to review the product with the attention and care it would merit, and be able to translate such studies into recommendations for legislative (or executive) action. The implications of the present study suggest that the scope of the term "national security" would need to be stretched far into nonmilitary areas for the proposed joint committee and its staff to supply the Congress with indepth studies across the whole range of "science, technology, and American diplomacy."

A CONGRESSIONAL OFFICE

Related to this possible approach is still another: the creation of a congressional "Office of International Technology Analysis," patterned after OTA and dealing with the nonmilitary aspects of national security, tension reduction, and policies for the application and control of technology toward U.S. diplomatic goals.

Whatever institutional arrangement might be judged suitable for the purpose, the fact remains (as shown in Chapter X) that the congressional resources for dealing today with the great and complicated issues of science, technology, and American diplomacy are widely diffused: i.e., the need seems to exist for some form of arrangement to bring to a focus, and into logical unity, the diverse strands of diplomacy now being separately pursued by perhaps a dozen committees of Congress. This concentration and focusing of analysis appears to be the purpose of Chairman Zablocki's bill, and could reasonably apply as well to the study of a future diplomacy under the growing influence of technology.

A Concluding Comment

To bring to a close this review of the State Department's science policy structure, the discussion returns briefly to the role of that Department and to its own needs. Ultimately, the foreign policy of the United States must be one that can be accepted by both its congressional sponsors and its executive implementors. The policy dialog must necessarily flow between these two centers of governmental power. Technological and diplomatic competence must be shared, along with the substantive information that makes the world of the present understandable and the world of the future manageable.

By way of conclusion, reference is made to a 1971 issue of the *Foreign Service Journal.* This particular issue was devoted to a symposium of articles on various technological developments that were perceived to have powerful impacts on U.S. diplomacy: information systems, population growth, automation, nuclear applications, and "Global Changes: Actual and Possible." A brief editorial introduction to the issue contains some observations important for this paper because they express its theme well, and because the source is the Foreign Service itself.[286] The statement declares: "The objective of

[286] "About this Issue," *Foreign Service Journal* 48, no. 3 (March 1971), p. 2.

diplomacy is to reconcile conflicting interests in a constantly changing world, and today a major factor behind change is technology." The statement continues: ". . . Possibly the most important global change brought on by technology has been the bringing together of the world's nations."

What then does this new proximity of nations, brought about by rapid technological change, require of diplomacy? It seems to ask for something more than traditional bilateral ironing out of differences and development of cooperative arrangements. Technological advance has created problems which affect all of the world's nations, and require their cooperation for the solution. For example, arrangements to prevent the pollution of the seas cannot be made bilaterally. What is necessary is a new innovative multilateralism.

The statement concludes with a reassertion of the need for an innovative multilateral diplomacy in a world system largely shaped by technology:

As technology develops, the prospect is that cooperative use of the world's resources in ways which preserve the quality of life will require greater innovation in the field of multilateral cooperation. Already we are groping toward the forms and procedures of an international organization which will govern the exploitation of the resources of the ocean's floor. Cooperative arrangements have already been worked out for international weather forecasting. It will not be so easy to work out multilateral techniques governing weather control. The thought that anything so vital as a nation's rainfall might be manipulated, even accidentally, by a neighbor, indicates how important it is that the world move along toward development of more effective international institutions.

Perhaps the greatest problem of all relates to the pollution of man's environment and the population pressures which increase that pollution. National solutions will not be enough, but can nations agree among themselves to strict international standards and a machinery by which they may be imposed?

The diplomats of the future will require all of the tools they can get if they are to succeed in this new multilateral diplomacy.

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