FIELDS, FACTORIES

AND

WORKSHOPS

OR

INDUSTRY COMBINED WITH AGRICULTURE
AND BRAIN WORK WITH MANUAL WORK

BY

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Illustrated and Unabridged

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PREFACE.

UNDER the name of profits, rent, interest upon capital, surplus value, and the like, economists have eagerly discussed the benefits which the owners of land or capital, or some privileged nations, can derive, either from the under-paid work of the wage-labourer, or from the inferior position of one class of the community towards another class, or from the inferior economical development of one nation towards another nation. These profits being shared in a very unequal proportion between the different individuals, classes and nations engaged in production, considerable pains were taken to study the present apportionment of the benefits, and its economical and moral consequences, as well as the changes in the present economical organisation of society which might bring about a more equitable distribution of a rapidly accumulating wealth. It is upon questions relating to the right to that increment of wealth that the hottest battles are now fought between economists of different schools.

In the meantime the great question—"What have we to produce, and how?" necessarily

remained in the background. Political economy, as it gradually emerges from its semi-scientific stage, tends more and more to become a science devoted to the study of the needs of men and of the means for satisfying them with the least possible waste of energy, that is:—a sort of physiology of society. But few economists, as yet, have recognised that this is the proper domain of economics, and have attempted to treat their science from this point of view. The main subject of social economy, *i.e.*, the *economy of energy required for the satisfaction of human needs*, is consequently the last subject which one expects to find treated in a concrete form in economical treatises.

The following pages are a contribution to a portion of this vast subject. They contain a discussion of the advantages which civilised societies could derive from a combination of industrial pursuits with intensive agriculture, and of brain work with manual work.

The importance of such a combination has not escaped the attention of a number of students of social science. It was eagerly discussed some fifty years ago under the names of "harmonised labour," "integral education," and so on. It was pointed out at that time that the greatest sum total of well-being can be obtained when a variety of agricultural, industrial and intellectual pursuits are combined in each community; and that man shows his best when he is in a position to apply his usually-varied

capacities to several pursuits in the farm, the workshop, the factory, the study or the studio, instead of being riveted for life to one of these pursuits only.

At a much more recent date, in the seventies, Herbert Spencer's theory of evolution gave origin in Russia to a remarkable work, *The Theory of Progress*, by M. M. Mikhailovsky. The part which belongs in progressive evolution to *differentiation*, and the part which belongs in it to an *integration* of aptitudes and activities, were discussed by the Russian author with depth of thought, and Spencer's differentiation-formula was accordingly completed.

And, finally, out of a number of smaller monographs, I must mention a suggestive little book by J. R. Dodge, the United States' statistician (*Farm and Factory: Aids derived by Agriculture from Industries*, New York, 1886). The same question was discussed in it from a practical American point of view.

Half a century ago a harmonious union between agricultural and industrial pursuits, as also between brain work and manual work, could only be a remote desideratum. The conditions under which the factory system asserted itself, as well as the obsolete forms of agriculture which prevailed at that time, prevented such a union from being feasible. Synthetic production was impossible. However, the wonderful simplification of the technical processes in both industry and agriculture, partly due to an ever-

increasing division of labour—in analogy with what we see in biology—has rendered the synthesis possible ; and a distinct tendency towards a synthesis of human activities becomes now apparent in modern economical evolution. This tendency is analysed in the subsequent chapters—a special weight being laid upon the present possibilities of agriculture, which are illustrated by a number of examples borrowed from different countries, and upon the small industries to which a new impetus is being given by the new methods of transmission of motive power.

The substance of these essays was published in 1888-1890 in the *Nineteenth Century*, and of one of them in the *Forum*. However, the tendencies indicated therein have been confirmed during the last ten years by such a mass of evidence that a very considerable amount of new matter had to be introduced, while the chapters on agriculture and the small trades had to be written anew.

I take advantage of this opportunity to address my best thanks to the editors of the *Nineteenth Century* and the *Forum* for their kind permission of reproducing these essays in a new form, as also to those friends and correspondents who have aided me in collecting information about agriculture and the petty trades.

P. KROPOTKIN.

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CHAPTER I.

THE DECENTRALISATION OF INDUSTRIES.

Division of labour and integration—The spread of industrial skill—Each nation its own producer of manufactured goods—The United Kingdom—France—Germany—Russia—"German competition"

WHO does not remember the remarkable chapter by which Adam Smith opens his inquiry into the nature and causes of the wealth of nations? Even those of our contemporary economists who seldom revert to the works of the father of political economy, and often forget the ideas which inspired them, know that chapter almost by heart, so often has it been copied and recopied since. It has become an article of faith; and the economical history of the century which has elapsed since Adam Smith wrote has been, so to speak, an actual commentary upon it.

"Division of labour" was its watchword. And the division and subdivision—the permanent subdivision—of functions has been pushed so far as to divide humanity into castes which are almost as firmly established as those of old India. We have, first, the broad division into producers and consumers: little-consuming producers on the one hand, little-producing consumers on the other hand. Then, amidst the former, a series of further subdivisions: the manual worker and the intellectual worker, sharply separated from one another to the detriment of both; the agricultural labourers and the workers in the manufacture; and, amidst the mass of the latter, numberless sub-

divisions again—so minute, indeed, that the modern ideal of a workman seems to be a man or a woman, or even a girl or a boy, without the knowledge of any handicraft, without any conception whatever of the industry he or she is employed in, who is only capable of making all day long and for a whole life the same infinitesimal part of something: who from the age of thirteen to that of sixty pushes the coal cart at a given spot of the mine or makes the spring of a pen-knife or "the eighteenth part of a pin" Mere servants to some machine of a given description; mere flesh-and-bone parts of some immense machinery; having no idea how and why the machinery performs its rhythmical movements.

Skilled artisanship is being swept away as a survival of a past condemned to disappear. For the artist who formerly found æsthetic enjoyment in the work of his hands is substituted the human slave of an iron slave. Nay, even the agricultural labourer, who formerly used to find a relief from the hardships of his life in the home of his ancestors—the future home of his children—in his love of the field, and in a keen intercourse with nature, even he has been doomed to disappear for the sake of division of labour. He is an anachronism we are told: he must be substituted, in a Bonanza farm, by an occasional servant hired for the summer, and discharged as the autumn comes: a tramp who will never again see the field he has harvested once in his life. "An affair of a few years," the economists say, "to reform agriculture in accordance with the true principles of division of labour and modern industrial organisation."

Dazzled with the results obtained by our century of marvellous inventions, especially in England, our economists and political men went still farther in their dreams of division of labour. They proclaimed the necessity of dividing the whole of humanity into

national workshops having each of them its own speciality. We were taught, for instance, that Hungary and Russia are predestined by nature to grow corn in order to feed the manufacturing countries; that Britain had to provide the world-market with cottons, iron goods and coal; Belgium with woollen cloth; and so on. Nay, within each nation, each region had to have its own speciality. So it has been for some time since; so it ought to remain. Fortunes have been made in this way, and will continue to be made in the same way. It being proclaimed that the wealth of nations is measured by the amount of profits made by the few, and that the largest profits are made by means of a specialisation of labour, the question was not conceived to exist as to whether human beings *would* always submit to such a specialisation; whether nations could be specialised like isolated workmen. The theory was good for to-day—why should we care for to-morrow? To-morrow might bring its own theory!

And so it did. The narrow conception of life which consisted in thinking that *profits* are the only leading motive of human society; and the stubborn view which supposes that what has existed yesterday would last for ever, proved in disaccordance with the tendencies of human life; and life took another direction. Nobody will deny the high pitch of production which may be attained by specialisation. But, precisely in proportion as the work required from the individual in modern production becomes simpler and easier to be learned, and, therefore, also more monotonous and wearisome—the requirements of the individual for varying his work, for exercising all his capacities, become more and more prominent. Humanity perceives that there is no advantage for the community in riveting a human being for all his life to a given spot, in a workshop or a mine; no gain in depriving him of such work as would bring

him into free intercourse with nature, make of him a conscious part of the grand whole, a partner in the highest enjoyments of science and art, of free work and creation.

Nations, too, refuse to be specialised. Each nation is a compound aggregate of tastes and inclinations, of wants and resources, of capacities and inventive powers. The territory occupied by each nation is again a most varied texture of soils and climates, of hills and valleys, of slopes leading to a still greater variety of territories and races. Variety is the distinctive feature, both of the territory and its inhabitants; and that variety implies a variety of occupations. Agriculture calls manufactures into existence, and manufactures support agriculture. Both are inseparable; and the combination, the integration of both, brings about the grandest results. In proportion as technical knowledge becomes everybody's virtual domain, in proportion as it becomes international, and can be concealed no longer, each nation acquires the possibility of applying the whole variety of her energies to the whole variety of industrial and agricultural pursuits. Knowledge ignores artificial political boundaries. So also do the industries; and the present tendency of humanity is to have the greatest possible variety of industries gathered in each country, in each separate region, side by side with agriculture. The needs of human agglomerations correspond thus to the needs of the individual; and while a *temporary* division of functions remains the surest guarantee of success in each separate undertaking, the *permanent* division is doomed to disappear, and to be substituted by a variety of pursuits—intellectual, industrial, and agricultural—corresponding to the different capacities of the individual, as well as to the variety of capacities within every human aggregate.

When we thus revert from the scholastics of our text-books, and examine human life as a whole, we

soon discover that, while all the benefits of a temporary division of labour must be maintained, it is high time to claim those of the *integration of labour*. Political economy has hitherto insisted chiefly upon *division*. We proclaim *integration*, and we maintain that the ideal of society—that is, the state towards which society is already marching—is a society of integrated labour; a society where each individual is a producer of both manual and intellectual work; where each able-bodied human being is a worker, and where each worker works both in the field and the industrial workshop; where each aggregation of individuals, large enough to dispose of a certain variety of natural resources—it may be a nation, or rather a region—produces and itself consumes most of its own agricultural and manufactured produce.

Of course as long as society remains organised so as to permit the owners of the land and capital to appropriate for themselves, under the protection of the State and historical rights, the yearly surplus of human production, no such change can be thoroughly accomplished. But the present industrial system, based upon a permanent specialisation of functions, already bears in itself the germs of its proper ruin. The industrial crises, which grow more acute and protracted, and are rendered still worse and still more acute by the armaments and wars implied by the present system, are rendering its maintenance more and more difficult. Moreover, the workers plainly manifest their intention to support no longer patiently the misery occasioned by each crisis. And each crisis accelerates the day when the present institutions of individual property and production will be shaken to their foundations with such internal struggles as will depend upon the more or less good sense of the now privileged classes.

But we maintain also that any Socialist attempt at remodelling the present relations between Capital and

Labour will be a failure, if it does not take into account the above tendencies towards integration. Those tendencies have not yet received, in our opinion, due attention from the different Socialist schools—but they must. A reorganised society will have to abandon the fallacy of nations specialised for the production of either agricultural or manufactured produce. It will have to rely on itself for the production of food and many if not most of the raw materials; it must find the best means of combining agriculture with manufacture—the work in the field with a decentralised industry—and it will have to provide for "integrated education," which education alone, by teaching both science and handicraft from earliest childhood, can give to society the men and women it really needs.

Each nation her own agriculturist and manufacturer; each individual working in the field and in some industrial art; each individual combining scientific knowledge with the knowledge of a handicraft—such is, we affirm, the present tendency of civilised nations.

The prodigious growth of industries in Great Britain, and the simultaneous development of the international traffic which now permits the transport of raw materials and articles of food on a gigantic scale, have created the impression that a few nations of West Europe were destined to become *the* manufacturers of the world. They need only—it was argued—to supply the market with manufactured goods, and they will draw from all over the surface of the earth the food they cannot grow themselves, as well as the raw materials they need for their manufactures. The steadily increasing speed of transoceanic communications and the steadily increasing facilities of shipping have contributed to enforce the above impression. If we take the enthusiastic pictures of international traffic, drawn in such a masterly way by Neumann Spallart—the statistician and almost the poet of the world-trade—we are inclined indeed to fall

into ecstasy before the results achieved. "Why shall we grow corn, rear oxen and sheep, and cultivate orchards, go through the painful work of the labourer and the farmer, and anxiously watch the sky in fear of a bad crop, when we can get, with much less pain, mountains of corn from India, America, Hungary, or Russia, meat from New Zealand, vegetables from the Azores, apples from Canada, grapes from Malaga, and so on?" exclaim the West Europeans. "Already now," they say, "our food consists, even in modest households, of produce gathered from all over the globe. Our cloth is made out of fibres grown and wool sheared in all parts of the world. The prairies of America and Australia; the mountains and steppes of Asia; the frozen wildernesses of the Arctic regions; the deserts of Africa and the depths of the oceans; the tropics and the lands of the midnight sun are our tributaries. All races of men contribute their share in supplying us with our staple food and luxuries, with plain clothing and fancy dress, while we are sending them in exchange the produce of our higher intelligence, our technical knowledge, our powerful industrial and commercial organising capacities! Is it not a grand sight, this busy and intricate exchange of produce all over the earth which has suddenly grown up within a few years?"

Grand it may be, but is it not a mere nightmare? Is it necessary? At what cost has it been obtained, and how long will it last?

Let us turn eighty years back. France lay bleeding at the end of the Napoleonic wars. Her young industry, which had begun to grow by the end of the last century, was crushed down. Germany, Italy, were powerless on the industrial field. The armies of the great Republic had struck a mortal blow to serfdom on the Continent; but with the return of reaction efforts were made to revive the decaying institution, and serfdom meant no industry worth speaking of. The terrible wars between

France and England, which wars are often explained by merely political causes, had a much deeper meaning —an economical meaning. They were wars for the supremacy on the world market, wars against French commerce and industry—and Britain won the battle. She became supreme on the seas. Bordeaux was no more a rival to London, and the French industries seemed to be killed in the bud. And, favoured by the powerful impulse given to natural sciences and technology by the great era of inventions, finding no serious competitors in Europe, Britain began to develop her manufactures. To produce on a large scale in immense quantities became the watchword. The necessary human forces were at hand in the peasantry, partly driven by force from the land, partly attracted to the cities by high wages. The necessary machinery was created, and the British production of manufactured goods went on at a gigantic pace. In the course of less than seventy years—from 1810 to 1878—the output of coal grew from 10 to 133,000,000 tons; the imports of raw materials rose from 30 to 380,000,000 tons; and the exports of manufactured goods from 46 to 200,000,000 pounds. The tonnage of the commercial fleet was nearly trebled. Fifteen thousand miles of railways were built.

It is useless to repeat at what a cost the above results were achieved. The terrible revelations of the parliamentary commissions of 1840-42 as to the atrocious condition of the manufacturing classes, the tales of "cleared estates" and kidnapped children are still fresh in the memory. They will remain standing monuments for showing by what means the great industry was implanted in this country. But the accumulation of wealth in the hands of the privileged classes was going on at a speed never dreamed of before. The incredible riches which now astonish the foreigner in the private houses of England were accumulated during that period; the exceedingly expensive standard of life which makes a

person considered rich on the Continent appear as only of modest means in Britain was introduced during that time. The taxed property alone doubled during the last thirty years of the above period, while during the same years (1810 to 1878) no less than £1,112,000,000 —nearly £2,000,000,000 by this time—was invested by English capitalists either in foreign industries or in foreign loans.

But the monopoly of industrial production could not remain with England for ever. Neither industrial knowledge nor enterprise could be kept for ever as a privilege of these islands. Necessarily, fatally, they began to cross the Channel and spread over the Continent. The Great Revolution had created in France a numerous class of peasant-proprietors, who enjoyed nearly half a century of a comparative well-being, or, at least, of a guaranteed labour. The ranks of homeless town workers increased slowly. But the middle-class revolution of 1789-1793 had already made a distinction between the peasant householders and the village *prolétaires*, and, by favouring the former to the detriment of the latter, it compelled the labourers who had no household nor land to abandon their villages, and thus to form the first nucleus of working classes given up to the mercy of manufacturers. Moreover, the peasant-proprietors themselves, after having enjoyed a period of undeniable prosperity, began in their turn to feel the pressure of bad times, and were compelled to look for employment in manufactures. Wars and revolution had checked the growth of industry; but it began to grow again during the second half of our century; it developed, it improved; and now, notwithstanding the loss of Alsace, France is no longer the tributary to England for manufactured produce which she was forty years ago. To-day her exports of manufactured goods are valued at nearly one-half of those of Great Britain, and two-thirds of them are textiles;

while her imports of the same consist chiefly of the finer sorts of cotton and woollen yarn—partly re-exported as stuffs—and a small quantity of woollen goods. For her own consumption France shows a decided tendency towards becoming entirely a self-supporting country, and for the sale of her manufactured goods she is tending to rely, not on her colonies, but especially on her own wealthy home market.*

Germany follows the same lines. During the last twenty-five years, and especially since the last war, her industry has undergone a thorough reorganisation. Her machinery has been thoroughly improved, and her new-born manufactures are supplied with a machinery which mostly represents the last word of technical progress; she has plenty of workmen and technologists endowed with a superior technical and scientific education; and in an army of learned chemists, physicists and engineers her industry has a most powerful and intelligent aid. As a whole, Germany offers now the spectacle of a nation in a period of *Aufschwung*, with all the forces of a new start in every domain of life. Thirty years ago she was a customer to England. Now she is already a competitor in the markets of the south and east, and at the present speedy rate of growth of her industries her competition will be soon yet more acute than it is.

The wave of industrial production, after having had its origin in the north-west of Europe, spreads towards the east and south-east, always covering a wider circle. And, in proportion as it advances east, and penetrates into younger countries, it implants there all the improvements due to a century of mechanical and chemical inventions; it borrows from science all the help that science can give to industry; and it finds populations eager to grasp the last results of modern knowledge.

* See Appendix A.

The new manufactures of Germany begin where Manchester arrived after a century of experiments and gropings; and Russia begins where Manchester and Saxony have now reached. Russia, in her turn, tries to emancipate herself from her dependency upon Western Europe, and rapidly begins to manufacture all those goods she formerly used to import, either from Britain or from Germany.

Protective duties may, perhaps, sometimes help the birth of new industries; always at the expense of some other growing industries, and always checking the improvement of those which already exist; but the decentralisation of manufactures goes on with or without protective duties—I should even say, notwithstanding the protective duties. Austria, Hungary and Italy follow the same lines—they develop their home industries—and even Spain and Servia are going to join the family of manufacturing nations. Nay, even India, even Brazil and Mexico, supported by English and German capital and knowledge, begin to start home industries on their respective soils. Finally, a terrible competitor to all European manufacturing countries has grown up of late in the United States. In proportion as technical education spreads more and more widely, manufactures *must* grow in the States; and they do grow at such a speed—an American speed—that in a very few years the now neutral markets will be invaded by American goods.

The monopoly of the first comers on the industrial field has ceased to exist. And it will exist no more, whatever may be the spasmodic efforts made to return to a state of things already belonging to the domain of history. New ways, new issues must be looked for: the past *has* lived, and it will live no more.

Before going farther, let me illustrate the march of industries towards the east by a few figures. And, to

begin with, let me take the example of Russia. Not because I know it better, but because Russia is the latest comer on the industrial field. Forty years ago she was considered as the ideal of an agricultural nation, doomed by nature itself to supply other nations with food, and to draw her manufactured goods from the west. So it was, indeed, forty years ago—but it is so no more.

In 1861—the year of the emancipation of the serfs—Russia and Poland had only 14,060 manufactories, which produced every year the value of 296,000,000 roubles (about £36,000,000). Twenty years later the number of establishments rose to 35,160, and their yearly production became nearly four times the above, *i.e.*, 1,305,000,000 roubles (about £131,000,000); and in 1894, although the census left the smaller manufactures and all the industries which pay excise duties (sugar, spirits, matches) out of account, the aggregate production in the Empire reached already 1,759,000,000 roubles, *i.e.*, £180,000,000. The most noteworthy feature of Russian industry is, that while the number of workmen employed in the manufactures has not even doubled since 1861 (it attained 1,555,000 in 1894), the production per workman has more than doubled: in has trebled in the leading industries. The average was less than £70 per annum in 1861; it reaches now £163. The increase of production is thus chiefly due to the improvement of machinery.

If we take, however, separate branches, and especially the textile industries and the machinery works, the progress appears still more striking. Thus, if we consider the eighteen years which preceded 1879 (when the import duties were increased by nearly 30 per cent. and a protective policy was definitely adopted), we find that even without protective duties the bulk of production in cottons increased three times, while the number of workers employed in that industry rose by only 25 per

cent. The yearly production of each worker had thus grown from £45 to £117. During the next nine years (1880-89) the yearly returns were more than doubled, attaining the respectable figure of £49,000,000 in money and 3,200,000 cwts. in bulk; and it must be remarked that, with a population of 130,000,000 inhabitants, the home market for Russian cottons is almost unlimited; while some cottons are also exported to Persia and Central Asia.*

True, that the finest sorts of yarn, as well as sewing cotton, have still to be imported. But Lancashire manufacturers will soon see to that; they now plant their mills in Russia. Two large mills for spinning the finest sorts of cotton yarn were opened in Russia last year, with the aid of English capital and English engineers, and a factory for making thin wire for cotton-carding has lately been opened at Moscow by a well-known Manchester manufacturer. Capital is international and, protection or no protection, it crosses the frontiers.

The same is true of woollens. In this branch Russia is relatively backward. However, wool-combing, spinning and weaving mills, provided with the best modern plant, are built every year in Russia and Poland by English, German and Belgian mill-owners; so that last year four-fifths of the ordinary wool, and as much of the finer sorts obtainable in Russia, were combed and spun at home—one fifth part only of each being sent abroad. The times when Russia was known as an exporter of raw wool are thus irretrievably gone.†

* The yearly imports of raw cotton attain 4,000,000 cwts.; out of which 300,000 cwts. from Central Asia and Transcaucasia. These last are a quite recent growth, the first plantations of the American cotton tree having been introduced in Turkestan by the Russians, as well as the first sorting and pressing establishments. The relative cheapness of the plain cottons in Russia, and the good qualities of the printed cottons, have attracted the attention of the British Commissioner at the Nijni Novgorod Exhibition in 1897, and are spoken of at some length in his report.

† The yearly production of the 1085 woollen mills of Russia and Poland was valued at about £12,000,000 in 1894.

In machinery works no comparison can even be made between nowadays and 1861, or even 1870; the whole of that industry having grown up within the last fifteen years. In an elaborate report Prof. Kirpitcheff points out that the progress realised can be best judged by the perfection attained in Russia in building the best steam engines and in the manufacture of water-pipes, which fully compete with Glasgow work. Thanks to English and French engineers to begin with, and afterwards to technical progress within the country itself, Russia needs no longer to import any part of her railway plant. And as to agricultural machinery, we know, from several British Consular reports, that Russian reapers and ploughs successfully compete with the same implements of both American and English make. During the last eight or ten years this branch of manufactures has largely developed in the Southern Urals (as a village industry, brought into existence by the Krasnoufimsk Technical School of the local District Council, or *zemstvo*), and especially on the plains sloping towards the Sea of Azov. About this last region Vice-Consul Green reported, in 1894, as follows: "Besides some eight or ten factories of importance," he wrote, "the whole of the consular district is now studded with small engineering works, engaged chiefly in the manufacture of agricultural machines and implements, most of them having their own foundries. . . . The town of Berdyansk," he added, "can now boast of the largest reaper manufactory in Europe, capable of turning out three thousand machines annually." *

* Report of Vice-Consul Green, *The Economist*, 9th June, 1894: "Reapers of a special type, sold at £15 to £17, are durable and go through more work than either the English or the American reapers". In the year 1893, 20,000 reaping machines, 50,000 ploughs, and so on, were sold in that district only, representing a value of £822,000. Were it not for the simply prohibitive duties imposed upon foreign pig-iron (two and a half times its price in the London market), this industry would have taken a still greater development. But in order to protect the home iron industry—which consequently continues to cling to obsolete forms

Moreover the above figures, including only those manufactures which show a yearly return of more than £200, do not include the immense variety of domestic trades which also have considerably grown of late, side by side with the manufactures. The domestic industries — so characteristic of Russia, and so necessary under her climate—occupy now more than 7,500,000 peasants, and their aggregate production was estimated a few years ago at more than the aggregate production of all the manufactures. It exceeded £180,000,000 per annum. I shall have an occasion to return later on to this subject, so that I shall be sober of figures, and merely say that even in the chief manufacturing provinces of Russia round about Moscow domestic weaving —for the trade—shows a yearly return of £4,500,000; and that even in Northern Caucasia, where the petty trades are of a recent origin, there are, in the peasants' houses 45,000 looms showing a yearly production of £200,000.

As to the mining industries, notwithstanding over-protection, and notwithstanding the competition of fuel-wood and naphtha,* the output of the coal mines of the Don has doubled during the last ten years, and in Poland it has increased fourfold. Nearly all steel, three-quarters of the iron, and two-thirds of the pig-iron used in Russia are home produce, and the eight Russian works for the manufacture of steel rails are strong enough to throw on the market 6,000,000 cwts. of rails every year.†

It is no wonder, therefore, that the imports of manufactured goods into Russia are so insignificant, and that

in the Urals—a duty of 61s. a ton of imported pig-iron is levied. The consequences of this policy for Russian agriculture, railways and State's budget have lately been discussed in full in a work by A. A. Radzig, *The Iron Industry of the World*. St. Petersburg, 1896 (Russian).

* Out of the 1246 steamers which ply on Russian rivers one-quarter are heated with naphtha, and one-half with wood; wood is also the chief fuel of the railways and ironworks in the Urals.

† See Appendix B.

since 1870—that is, nine years before the general increase of duties—the proportion of manufactured goods to the aggregate imports has been on a steady decrease. Manufactured goods make now only one-fifth of the imports; and while the imports of Britain into Russia were valued at £16,300,000 in 1872, they were only £6,884,500 in 1894.* Out of them, manufactured goods were valued at a little more than £2,000,000—the remainder being either articles of food or raw and half-manufactured goods (metals, yarn and so on). In fact, the imports of British home produce have declined in the course of ten years from £8,800,000 to £5,000,000, so as to reduce the value of British manufactured goods imported into Russia to the following trifling items: machinery, £2,006,600; cottons and cotton yarn, £395,570; woollens and woollen yarn, £287,900; and so on. But the depreciation of British goods imported into Russia is still more striking. Thus, in 1876 Russia imported 8,000,000 cwts. of British metals, and then paid £6,000,000; but in 1884, although the same quantity was imported, the amount paid was only £3,400,000. And the same depreciation is seen for all imported goods, although not always in the same proportion.

It would be a gross error to imagine that the decline of foreign imports is mainly due to high protective duties. The decline of imports is much better explained by the growth of home industries. The protective duties have no doubt contributed (together with other causes) towards attracting German and English manufacturers to Poland and Russia. Lodz—the Manchester of Poland—is quite a German city, and the Russian trade directories are full of English and German names. English and German capitalists, English engineers and foremen, have planted within Russia the improved cotton manufactures of their mother countries; they are busy

* £7,185,185 in 1896.

now in improving the woollen industries and the production of machinery; while Belgians are rapidly improving the iron trades in South Russia. There is now not the slightest doubt—and this opinion is shared, not only by economists, but also by several Russian manufacturers—that a free-trade policy would not check the further growth of industries in Russia. It would only reduce the high profits of those manufacturers who do not improve their factories and chiefly rely upon cheap labour and long hours.

Moreover, as soon as Russia succeeds in obtaining more freedom, a further growth of her industries will immediately follow. Technical education — which, strange to say, has been systematically suppressed until lately by the Government—would rapidly grow and spread; and in a few years, with her natural resources and her laborious youth, which even now tries to combine workmanship with science, Russia would soon see her industrial powers increase tenfold. She *farà da sè* in the industrial field. She will manufacture all she needs; and yet she will remain an agricultural nation. At present only 1,000,000 of men and women, out of 80,000,000 population of European Russia, work in manufactures, and 7,500,000 combine agriculture with manufacturing. This figure may treble without Russia ceasing to be an agricultural nation; but if it be trebled, there will be no room for imported manufactured goods, because an agricultural country can produce them cheaper than those countries which live on imported food.

The same is still more true with regard to other European nations, much more advanced in their industrial development, and especially with regard to Germany. So much has been written of late about the competition which Germany offers to British trade, even in the British markets, and so much can be learned

about it from a mere inspection of the London shops, that I need not enter into lengthy details. Several articles in reviews; the correspondence exchanged on the subject in *The Daily Telegraph* in August, 1886; numerous consular reports, regularly summed up in the leading newspapers, and still more impressive when consulted in originals; and, finally, political speeches, have familiarised the public opinion of this country with the importance and the powers of German competition.* Moreover, the forces which German industry borrows from the technical training of her workmen, engineers and numerous scientific men, have been so often discussed by the promoters of technical education in England that the sudden growth of Germany as an industrial power can be denied no more.

Where half a century was required in olden times to develop an industry a few years are sufficient now. In the year 1864 only 160,000 cwts. of raw cotton were imported into Germany, and only 16,000 cwts. of cotton goods were exported; cotton spinning and weaving were mostly insignificant home industries. Twenty years later the imports of raw cotton were already 3,600,000 cwts., and in another two years they rose to 5,556,000 cwts.; while the exports of cotton stuffs and yarn were valued at £3,600,000 in 1883, and £7,662,000 in 1893. A great industry was thus created in less than thirty years. The necessary technical skill was developed, and at the present time Germany remains tributary to Lancashire for the finest sorts of yarn only. However, Herr Francke believes † that even this disadvantage will soon be equalised. Very fine spinning mills have lately been erected, and the

* Many facts in point have also been collected lately in a little book, *Made in Germany*, by E. E. Williams. Unhappily, the facts relative to the recent industrial development of Germany are so often used in a partisan spirit in order to promote protection that their real importance is often misunderstood.

† *Die neueste Entwickelung der Textil-Industrie in Deutschland.*

emancipation from Liverpool, by means of a cotton exchange established at Bremen, is in fair progress.*

In the woollen trade the number of spindles was rapidly doubled, and in 1894 the value of the exports of woollen goods attained £8,220,300, out of which £907,569 worth were sent to the United Kingdom.† The flax industry has grown at a still speedier rate, and as regards silks Germany, with her 87,000 looms and a yearly production valued at £9,000,000, is second only to France.

The progress realised in the German chemical trade is well known, and it is only too badly felt in Scotland and Northumberland; while the reports on the German iron and steel industries which one finds in the publications of the Iron and Steel Institute and in the inquiry which was made by the British Iron Trade Association, show how formidably the production of pig-iron and of finished iron has grown in Germany for the last twenty years. (See Appendix C.) No wonder that the imports of iron and steel into Germany were reduced by one-half during the same twenty years while the exports grew nearly four times. As to the machinery works, if the Germans have committed the error of too slavishly copying English patterns, instead of taking a new departure and of creating new patterns, as the Americans did, we must still recognise that their copies are good and that they very successfully compete in cheapness with the tools and machinery produced in this country. (See Appendix D.) I hardly need mention the superior make of German scientific apparatus. It is well known to scientific men, even in France.

In consequence of the above, all imports of manu-

* *Cf.* Schulze Gäwernitz, *Der Grossbetrieb*, etc. See Appendix E.

† The imports of German woollen stuffs into this country have steadily grown from £607,444 in 1890 to £907,569 in 1894. The British exports to Germany (of stuffs and yarns) were valued at £2,769,392 in 1890 and £3,017,163 in 1894.

factured goods into Germany are in decline. The aggregate imports of textiles (inclusive of yarn) stand so low as to be compensated by nearly equal values of exports. And there is no doubt that not only the German markets for textiles will be soon lost for other manufacturing countries, but that German competition will be felt stronger and stronger both in the neutral markets and those of Western Europe! One can easily win applause from uninformed auditories by exclaiming with more or less pathos that German produce can *never* equal the English! The fact is that it competes in cheapness, and sometimes also—where it is needed—in an equally good workmanship; and this circumstance is due to many causes.

The "cheap labour" cause, so often alluded to in discussions about "German competition" which take place in this country and in France, must be dismissed by this time, since it has been well proved by so many recent investigations that low wages and long hours do not necessarily mean cheap produce. Cheap labour and protection simply mean the possibility for a number of employers to continue working with obsolete and bad machinery; but in highly developed staple industries, such as the cotton and the iron industries, the cheapest produce is obtained with high wages, short hours and the best machinery. When the number of operatives which is required for each 1000 spindles can vary from seventeen (in many Russian factories) to three (in England), no reduction of wages can possibly compensate for that immense difference. Consequently, in the best German cotton-mills and iron-works the wages of the worker (we know it directly for the iron-works from the above-mentioned inquiry of the British Iron Trade Association) are not lower than they are in Great Britain. All that can be said is, that the worker in Germany gets more for his wages than he gets in this country—the paradise of the middleman—a paradise

which it will remain so long as it lives chiefly on imported food produce.

The chief reason for the successes of Germany in the industrial field is the same as it is for the United States. Both countries just now enter the industrial phase of their development, and they enter it with all the energy of youth and novelty. Both countries enjoy a widely-spread scientifically-technical — or, at least, concrete scientific—education. In both countries manufactories are built according to the newest and best models which have been worked out elsewhere; and both countries are in a period of awakening in all branches of activity —literature and science, industry and trade. They enter on the same phase in which Great Britain was in the first half of this century, when British workers invented so much of the wonderful modern machinery.

We have simply before us a fact of *the consecutive development of nations.* And instead of decrying or opposing it, it would be much better to see whether the two pioneers of the great industry—Britain and France—cannot take a new initiative and do something new again; whether an issue for the creative genius of these two nations must not be sought for in a new direction—namely, the utilisation of both the land and the industrial powers of man for securing well-being to the whole nation instead of to the few.

CHAPTER II.

THE DECENTRALISATION OF INDUSTRIES—(*continued*).

Italy and Spain—India—Japan—The United States—The cotton, wool and silk trades—The growing necessity for each country to rely chiefly upon home consumers.

THE flow of industrial growths spreads, however, not only east; it moves also south-east and south. Austria and Hungary are rapidly gaining ground in the race for industrial importance. The Triple Alliance has already been menaced by the growing tendency of Austrian manufacturers to protect themselves against German competition; and even the dual monarchy has recently seen its two sister nations quarrelling about customs duties. Austrian industries are a modern growth, and still they show a yearly return which exceeds £100,000,000. Bohemia, in a few decades, has grown to be an industrial country of considerable importance; and the excellence and originality of the machinery used in the newly reformed flour-mills of Hungary show that the young industry of Hungary is on the right road, not only to become a competitor to her elder sisters, but also to add her share to our knowledge as to the use of the forces of nature. Let me add, by the way, that the same is true to some extent with regard to Finland. Figures are wanting as to the present state of the aggregate industries of Austria-Hungary; but the relatively low imports of manufactured goods are worthy of note. For British manufacturers Austria-Hungary is, in fact, no customer worth speaking of; but even with

regard to Germany she is rapidly emancipating herself from her former dependence. (See Appendix F.)

The same industrial progress extends over the southern peninsulas. Who would have spoken twenty years ago about Italian manufactures? And yet—the Turin Exhibition of 1884 has shown it—Italy ranks now among the manufacturing countries. "You see everywhere a considerable industrial and commercial effort made," wrote a French economist to the *Temps*. "Italy aspires to go on without foreign produce. The patriotic watchword is, Italy all by herself! It inspires the whole mass of producers. There is not a single manufacturer or tradesman, who, even in the most trifling circumstances, does not do his best to emancipate himself from foreign guardianship." The best French and English patterns are imitated and improved by a touch of national genius and artistic traditions. Complete statistics are wanting, so that the statistical *Annuario* resorts to indirect indications. But the rapid increase of imports of coal (9,000,000 tons in 1896, as against 779,000 tons in 1871); the growth of the mining industries, which have trebled their production during the last fifteen years; the increasing production of steel and machinery (nearly £3,000,000 in 1886), which—to use Bovio's words—shows how a country having no fuel nor minerals of her own can have nevertheless a notable metallurgical industry; and, finally, the growth of textile industries disclosed by the net imports of raw cottons and the number of spindles having nearly doubled within five years *—all these show that the tendency towards becoming a manufacturing country capable of satisfying her needs by her own manufactures is not a mere dream. As to the efforts made for

* The net imports of raw cotton reached 291,680 quintals in 1880, and 594,118 in 1885. Number of spindles 1,800,000 in 1885, as against 1,000,000 in 1877. The whole industry has grown up since 1859. Net imports of pig-iron from 700,000 to 800,000 quintals during the five years 1881 to 1885.

taking a more lively part in the trade of the world, who does not know the traditional capacities of the Italians in that direction?

I ought also to mention Spain, whose textile, mining and metallurgical industries are rapidly growing; but I hasten to go over to countries which a few years ago were considered as eternal and obligatory customers to the manufacturing nations of Western Europe. Let us take, for instance, Brazil. Was it not doomed by economists to grow cotton, to export it in a raw state, and to receive cotton goods in exchange? Twenty years ago its nine miserable manufactories could boast only of an aggregate of 385 spindles. But already in 1887 there were in Brazil 46 cotton manufactories, and five of them had already 40,000 spindles; while altogether their nearly 10,000 looms threw every year on the Brazilian markets more than 33,000,000 yards of cotton stuffs. Nay, even Vera Cruz, in Mexico, under the protection of customs officers, has begun to manufacture cottons, and boasted in 1887 its 40,200 spindles, 287,700 pieces of cotton cloth, and 212,000 lb. of yarn. Since that year progress has been steady, and in 1894 Vice-Consul Chapman reported that some of the finest machines are to be found at the Orizaba spinning mills, while "cotton prints," he wrote, "are now turned out as good if not superior to the imported article"*

The flattest contradiction to the export theory has, however, been given by India. She was always considered as the surest customer for British cottons, and so she has been until now. Out of the total of cotton goods exported from Britain she used to buy more than one-quarter, very nearly one-third (from £17,000,000

* *The Economist*, 12th May, 1894, p. 9: "A few years ago the Orizaba mills used entirely imported raw cotton; but now they use home-grown and home-spun cotton as much as possible".

to £22,000,000, out of an aggregate of about £75,000,000 in the last decade, and from £16,100,000 to £18,242,000 during the years 1893 and 1894). But things have begun to change. The Indian cotton manufactures, which—for some causes not fully explained—were so unsuccessful at their beginnings, suddenly took firm root.

In 1860 they consumed only 23,000,000 lb. of raw cotton, but the quantity was nearly four times as much in 1887, and it trebled again within the next ten years: 283,000,000 lb. of raw cotton were used in 1887-88. The number of cotton mills grew up from 40 in 1877 to 147 in 1895; the number of spindles rose from 886,100 to 3,844,300 in the same years; and where 57,188 workers were employed in 1887, we find, seven years later, 146,240 operatives; while the capital engaged in cotton mills and presses by joint-stock companies rose from 7,000,000 tens of rupees in 1882 to 14,600,000 in 1895.* As for the quality of the mills, the blue-books praise them; the German chambers of commerce state that the best spinning mills in Bombay "do not now stand far behind the best German ones"; and two great authorities in the cotton industry, Mr. James Platt and Mr. Henry Lee, agree in saying "that in no other country of the earth except in Lancashire do the operatives possess such a natural leaning to the textile industry as in India".†

The exports of cotton twist from India more than doubled in five years (1882-1887), and already in 1887 we could read in the *Statement* (p. 62) that "what cotton twist was imported was less and less of the coarser and even medium kind, which indicates that the Indian (spinning) mills are gradually gaining hold of the home markets". Consequently, while India con-

* Ten rupees are, as is known, nearly equal to £1 sterling.
† Schulze Gäwernitz, *The Cotton Trade*, etc., p. 123.

tinued to import nearly the same amount of British cotton goods (slightly reduced since), she threw already then (in 1887) on the foreign markets no less than £3,635,510 worth of her own cottons of Lancashire patterns; she exported 33,000,000 yards of *grey cotton piece goods* manufactured in India with Indian workmen. And the export has continued to grow since, so that in the years 1891-93, 73,000,000 to 80,000,000 yards of cotton piece goods were exported,* as well as from 161,000,000 to 189,000,000 lb. of yarn. Finally, in 1897, the value of the yarns and textiles exported reached the respectable figure of 14,073,600 tens of rupees.

The jute factories in India have grown at a still speedier rate,† and the once flourishing jute trade of Dundee was brought to decay, not only by the high tariffs of continental powers, but also by Indian competition. Even woollen mills have lately been started, while the iron industry took a sudden development in India, since the means were found, after many experiments and failures, to work furnaces with local coal. In a few years, we are told by specialists, India will be self-supporting for iron. Nay, it is not without apprehension that the English manufacturers see that the imports of Indian manufactured textiles to this country are steadily growing, while in the markets of the Far East and Africa India becomes a serious competitor to the mother country. But why should she not? What *might* prevent the growth of Indian manufactures? Is

* 312,000 bales were exported to China and Japan in 1893, instead of 112,100 bales ten years before.

† In 1882 they had 5633 looms and 95,937 spindles. Two years later (1884-85) they had already 6926 looms and 131,740 spindles, giving occupation to 51,900 persons. Now, or rather in 1895, the twenty-eight jute mills of India have 10,580 looms and 216,140 spindles (doubled in twelve years) and they employ a daily average number of 78,889 persons. The progress realised in the machinery is best seen from these figures. The exports of jute stuffs from India were £1,543,870 in 1884-85 and £5,213,900 in 1895. (See Appendix H.)

it the want of capital? But capital knows no fatherland; and if high profits can be derived from the work of Indian coolies whose wages are only one-half of those of English workmen, or even less, capital will migrate to India, as it has gone to Russia, although its migration may mean starvation for Lancashire and Dundee. Is it the want of knowledge? But longitudes and latitudes are no obstacle to its spreading; it is only the first steps that are difficult. As to the superiority of workmanship, nobody who knows the Hindoo worker will doubt about his capacities. Surely they are not below those of the 86,500 children less than thirteen years of age, or the 363,000 boys and girls less than eighteen years old, who are employed in the British textile manufactories.*

Ten years surely are not much in the life of nations. And yet within the last ten years another powerful competitor has grown in the East. I mean Japan. In October, 1888, the *Textile Recorder* mentioned in a few lines that the annual production of yarns in the cotton mills of Japan had attained 9,498,500 lb., and that fifteen more mills, which would hold 156,100 spindles, were in course of erection.† Two years later, 25,000,000 lb. of yarn were spun in Japan; and while in 1886-88 Japan imported five or six times as much yarn from abroad as was spun at home, next year two-thirds only of the total consumption of the country were imported from abroad.‡ From that date the production

* The number of boys *above* thirteen but under eighteen, working full time, was, in the year 1890, 86,998. The number of girls of that age is not given; they are considered as "women," and work full time. But the proportion of women to men being as two to one in the textile factories of the United Kingdom, the number of girls of that age (thirteen to eighteen) may be taken as twice the number of boys, that is, about 190,000. This would give a total of at least 363,000 boys and girls less than eighteen years of age, out of a total of 1,084,630 operatives employed in all the textile trades of the United Kingdom. More than one-third. (*Statesman's Year-book* for 1898, p. 75.)

† *Textile Recorder*, 15th October, 1888.

‡ 17,778,000 kilogrammes of yarn were imported in 1886 as against 2,919,000 kilogrammes of home-spun yarn. In 1889 the figures were: 25,687,000 kilogrammes imported and 12,160,000 kilogrammes home-spun.

grew up regularly. From 6,503,300 lb. in 1886, it reached 91,950,000 lb. in 1893, and 153,444,000 lb. in 1895. In nine years it had thus increased twenty-four times. The total production of tissues, valued at £1,200,000 in the year 1887, rapidly rose to £14,270,000 in 1895—cottons entering into the amount to the extent of nearly two-fifths. Consequently, the imports of foreign cotton goods from Europe fell from £1,640,000 in 1884 to £849,600 in 1895, while the exports of silk goods rose to £3,246,000. Moreover, the coal and iron industries grow so rapidly that Japan will not long remain a tributary to Europe for iron goods; nay, the ambition of the Japanese is to have their own shipbuilding yards, and last summer 300 engineers left the Elswick works of Mr. Armstrong in order to start shipbuilding in Japan. But they were engaged for five years only. In five years the Japanese expect to have learned enough to be their own shipbuilders.* As to such plain things as matches, the industry, after its failure in 1884, has risen again, and in 1895 the Japanese exported over 15,000,000 gross of matches valued at £1,246,550.

All this shows that the much-dreaded invasion of the East upon European markets is in rapid progress. The Chinese slumber still; but I am firmly persuaded from what I saw of China, that the moment they will begin to manufacture with the aid of European machinery—and the first steps have already been made—they will do it with more success, and necessarily on a far greater scale, than even the Japanese.

But what about the United States, which cannot be accused of employing cheap labour or of sending to Europe "cheap and nasty" produce? Their great

* The mining industry has grown as follows: Copper extracted: 2407 tons in 1875; 11,064 in 1887. Coal: 567,200 tons in 1875; 1,669,700 twelve years later; 4,259,000 in 1894. Iron: 3447 tons in 1875; 15,268 in 1887; over 20,000 in 1894. (K. Rathgen, *Japan's Volkwirthschaft und Staatshaushaltung*, Leipzig, 1891; Consular Reports.)

industry is of yesterday's date; and yet the States already send to old Europe constantly increasing quantities of machinery, while this year they began even to send iron. In the course of twenty years (1870-90) the number of persons employed in the American manufactures has more than doubled, and the value of their produce has nearly trebled.* The cotton industry, supplied with excellent home-made machinery,† is rapidly developing, and the exports of cottons of domestic manufacture attained last year about £2,800,000. As to the yearly output of pig iron and steel, it is already in excess of the yearly output in Britain,‡ and the organisation of that industry is also superior, as Mr. Berkley pointed out in November, 1891, in his address to the Institute of Civil Engineers.§

But all this has grown almost entirely within the last twenty or thirty years whole industries having been created entirely since 1860.‖ What will, then, American industry be twenty years hence, aided as it is by a wonderful development of technical skill, by excellent schools, a scientific education which goes hand in hand with technical education, and a spirit of enterprise which is unrivalled in Europe?

Volumes have been written about the crisis of 1880-87, a crisis which, to use the words of the Parliamentary Commission, lasted since 1875, with but "a short

* Workers employed in industries: 2,054,000 in 1870; 4,712,000 in 1890. Value of produce: 5,385,861,000 dollars in 1870, and 9,372,243,280 dollars in 1890. Yearly production per head of workers: 1648 dollars in 1870, and 1989 dollars in 1890.

† *Textile Recorder.*

‡ It was from 7,255,070 to 9,511,030 tons of pig-iron during the years 1890-94; 4,051,200 tons of "Bessemer and Clapp-Griffiths steel" were obtained in 1890.

§ "The largest output of one blast furnace in Great Britain does not exceed 750 tons in the week, while in America it had reached 2000 tons" (*Nature*, 19th Nov., 1891, p. 65).

‖ J. R. Dodge, *Farm and Factory: Aids to Agriculture from other Industries*, New York and London, 1884, p. 111. I can but highly recommend this little work to those interested in the question.

period of prosperity enjoyed by certain branches of trade in the years 1880 to 1883," and a crisis, I shall add, which extended over all the chief manufacturing countries of the world. All possible causes of the crisis have been examined; but, whatever the cacophony of conclusions arrived at, all unanimously agreed upon one, namely, that of the Parliamentary Commission, which could be summed up as follows: "The manufacturing countries do not find such customers as would enable them to realise high profits". Profits being the basis of capitalist industry, low profits explain all ulterior consequences. Low profits induce the employers to reduce the wages, or the number of workers, or the number of days of employment during the week, or eventually compel them to resort to the manufacture of lower kinds of goods, which, as a rule, are paid worse than the higher sorts. As Adam Smith said, low profits ultimately mean a reduction of wages, and low wages mean a reduced consumption by the worker. Low profits mean also a somewhat reduced consumption by the employer; and both together mean lower profits and reduced consumption with that immense class of middlemen which has grown up in manufacturing countries, and that, again, means a further reduction of profits for the employers.

A country which manufactures chiefly for export, and therefore lives chiefly on the profits derived from her foreign trade, stands very much in the same position as Switzerland, which lives to a great extent on the profits derived from the foreigners who visit her lakes and glaciers. A good "season" means an influx of from £1,000,000 to £2,000,000 of money imported by the tourists, and a bad "season" has the effects of a bad crop in an agricultural country: a general impoverishment follows. So it is also with a country which manufactures for export. If the "season" is bad, and the exported goods cannot be sold abroad for twice their

value at home, the country which lives chiefly on these bargains suffers. Low profits for the innkeepers of the Alps mean narrowed circumstances in large parts of Switzerland; and low profits for the Lancashire and Scotch manufacturers, and the wholesale exporters, mean narrowed circumstances in Great Britain. The cause is the same in both cases.

For many decades past we had not seen such a cheapness of wheat and manufactured goods as we saw lately, and yet the country was suffering from a crisis. People said, of course, that the cause of the crisis was over-production. But over-production is a word utterly devoid of sense if it does not mean that those who are in need of all kinds of produce have not the means for buying them with their low wages. Nobody would dare to affirm that there is too much furniture in the crippled cottages, too many bedsteads and bedclothes in the workmen's dwellings, too many lamps burning in the huts, and too much cloth on the shoulders, not only of those who used to sleep (in 1886) in Trafalgar Square between two newspapers, but even in those households where a silk hat makes a part of the Sunday dress. And nobody will dare to affirm that there is too much food in the homes of those agricultural labourers who earn twelve shillings a week, or of those women who earn from fivepence to sixpence a day in the clothing trade and other small industries which swarm in the outskirts of all great cities. Over-production means merely and simply a want of purchasing powers amidst the workers. And the same want of purchasing powers of the workers was felt everywhere on the Continent during the years 1885-87.

After the bad years were over a sudden revival of international trade took place; and, as the British exports rose in four years (1886 to 1890) by nearly 24 per cent., it began to be said that there was no reason for being alarmed by foreign competition; that the

decline of exports in 1885-87 was only temporary, and general in Europe; and that England, now as of old, fully maintained her dominant position in the international trade. It is certainly true that if we consider exclusively the money value of the exports for the years 1876 to 1895, we see no permanent decline, we notice only fluctuations. British exports, like commerce altogether, seem to show a certain periodicity. They fell from £201,000,000 sterling in 1876 to £192,000,000 in 1879; then they rose again to £241,000,000 in 1882, and fell down to £213,000,000 in 1886; again they rose to £264,000,000 in 1890, but fell again, reaching a minimum of £216,000,000 in 1894, to be followed next year by a slight movement upwards.

This periodicity being a fact, Mr. Giffen could make light of "German competition" by showing that exports from the United Kingdom had not decreased. It can even be said that, per head of population, they have remained what they were twenty years ago, notwithstanding all fluctuations.* However, when we come to consider the *quantities* exported, and compare them with the *money values* of the exports, even Mr. Giffen must acknowledge that the prices of 1883 were so low in comparison with those of 1873 that in order to reach the same money value the United Kingdom would have had to export four pieces of cotton instead of three, and eight or ten tons of metallic goods instead of six. "The aggregate of British foreign trade, if valued at the prices of ten years previously, would have amounted

* Per head of population they appear, in shillings, as follows:—

1876	121s.	1886	117s.
1877	119s.	1887	121s.
1878	114s.	1888	127s.
1879	112s.	1889	134s.
1880	129s.	1890	141s.
1881	134s.	1891	131s.
1882	137s.	1892	119s.
1883	135s.	1893	114s.
1884	130s.	1894	111s.
1885	118s.	1895	112s.

to £861,000,000 instead of £667,000,000," we were told by no less an authority than the Commission on Trade Depression.

It might, however, be said that 1873 was an exceptional year, owing to the inflated demand which took place after the Franco-German war. But the same downward movement continues. In fact, if we take the figures given in the last *Statesman's Year-book*, we see that while the United Kingdom exported, in 1883, 4,957,000,000 yards of piece goods (cotton, woollen and linen) and 316,000,000 lb. of yarn in order to reach an export value of £104,500,000, the same country had to export, in 1895, no less than 5,478,000,000 yards of the same stuffs and 330,000,000 lb. of yarn in order to realise £99,700,000 only. As to the year 1894, which was a minimum year, the proportion was even still worse. And it would appear still worse again if we took the cottons alone, or made a comparison with the year 1860, when 2,776,000,000 yards of cotton cloth and 197,000,000 lb. of cotton yarn were valued at £52,000,000, while thirty-five years later almost twice as many million yards (5,033,000,000) and 252,000,000 lb. of yarn were required to make up £68,300,000.* And we must not forget that one-half (in value) of British and Irish exports is made up by textiles.

We thus see that while the total value of the exports from the United Kingdom remains, broadly speaking, unaltered for the last twenty years, the high prices which could be got for these exports twenty years ago, and with them the high profits, are irretrievably gone. And no amount of arithmetical calculations will persuade the British manufacturers that such is not the case. They know perfectly well that the home markets grow continually overstocked; that the best foreign markets are escaping; and that in the neutral markets Britain

* *Statesman's Year-book*, 1896, p. 78.

is being undersold. This is the unavoidable consequence of the development of manufactures all over the world. (See Appendix G.)

Great hopes are now laid in Australia as a market for British goods; but Australia will soon do what Canada already does. She will manufacture. And the last colonial exhibition, by showing to the "colonists" what they are able to do, and how they must do, will only have accelerated the day when each colony *farà da sè* in her turn. Canada and India already impose protective duties on British goods. As to the much-spoken-of markets on the Congo, and Mr. Stanley's calculations and promises of a trade amounting to £26,000,000 a year if the Lancashire people supply the Africans with loin-cloths, such promises belong to the same category of fancies as the famous nightcaps of the Chinese which were to enrich England after the Chinese war. The Chinese prefer their own home-made nightcaps; and as to the Congo people, four countries at least are already competing for supplying them with their poor dress: Britain, Germany, the United States, and, last but not least, India.

There was a time when this country had almost the monopoly in the cotton industries; but about 1880 she possessed only 55 per cent. of all the spindles at work in Europe, the United States and India (40,000,000 out of 72,000,000), and a little more than one-half of the looms (550,000 out of 972,000). In 1893 the proportion was still further reduced to 41 per cent. of the spindles (45,300,000 out of 91,340,000).* She was thus losing ground while the others were winning. And the fact is quite natural: it might have been foreseen. There is no reason why Britain should always be the great cotton manufactory of the world, when raw cotton has to be imported into this country as elsewhere. It was

* *The Economist*, 13th January, 1894.

quite natural that France, Germany, Italy, Russia, India, Japan, the United States, and even Mexico and Brazil, should begin to spin their own yarns and to weave their own cotton stuffs. But the appearance of the cotton industry in a country, or in fact, of any textile industry, unavoidably becomes the starting-point for the growth of a series of other industries; chemical and mechanical works, metallurgy and mining feel at once the impetus given by a new want. The whole of the home industries, as also technical education altogether, *must* improve in order to satisfy that want as soon as it has been felt.

What has happened with regard to cottons is going on also with regard to other industries. Britain and Belgium have no longer the monopoly of the woollen trade. Immense factories at Verviers are silent; the Belgian weavers are misery-stricken, while Germany yearly increases her production of woollens, and exports nine times more woollens than Belgium. Austria has her own woollens and exports them; Riga, Lodz, and Moscow supply Russia with fine woollen cloths; and the growth of the woollen industry in each of the last-named countries calls into existence hundreds of connected trades.

For many years France has had the monopoly of the silk trade. Silkworms being reared in Southern France, it was quite natural that Lyons should grow into a centre for the manufacture of silks. Spinning, domestic weaving, and dyeing works developed to a great extent. But eventually the industry took such a development that home supplies of raw silk became insufficient, and raw silk was imported from Italy, Spain and Southern Austria, Asia Minor, the Caucasus and Japan, to the amount of from £9,000,000 to £11,000,000 in 1875 and 1876, while France had only £800,000 worth of her own silk. Thousands of peasant boys and girls

were attracted by high wages to Lyons and the neighbouring district; the industry was prosperous. However, by-and-by new centres of silk trade grew up at Basel and in the peasant houses around Zürich. French emigrants imported the trade, and it developed, especially after the civil war of 1871. The Caucasus Administration invited French workmen and women from Lyons and Marseilles to teach the Georgians and the Russians the best means of rearing the silkworm, as well as the whole of the silk trade, and Stavropol became a new centre for silk weaving. Austria and the United States did the same; and what are now the results? During the years 1872 to 1881 Switzerland more than doubled the produce of her silk industry; Italy and Germany increased it by one-third; and the Lyons region, which formerly manufactured to the value of 454,000,000 francs a year, showed in 1887 a return of only 378,000,000. The exports of Lyons silks, which reached an average of 425,000,000 francs in 1855-59, and 460,000,000 in 1870-74, fell down to 233,000,000 in 1887. And it is reckoned by French specialists that at present no less than one-third of the silk stuffs used in France are imported from Zürich, Crefeld, and Barmen. Nay, even Italy, which had 2,000,000 spindles and 30,000 looms in 1880 (as against 14,000 in 1870), sends her silks to France and competes with Lyons. The French manufacturers may cry as loudly as they like for protection, or resort to the production of cheaper goods of lower quality; they may sell 3,250,000 kilogrammes of silk stuffs at the same price as they sold 2,500,000 in 1855-59—they will never again regain the position they occupied before. Italy, Switzerland, Germany, the United States and Russia have their own silk factories and will import from Lyons only the highest qualities of stuffs. As to the lower sorts, a foulard has become a common attire with the St. Petersburg housemaids, because the North Caucasian

domestic trades supply them at a price which would starve the Lyons weavers. The trade has been decentralised, and while Lyons is still a centre for the higher artistic silks, it will never be again the chief centre for the silk trade which it was thirty years ago.

Like examples could be produced by the score. Greenock no longer supplies Russia with sugar, because Russia has plenty of her own at the same price as it sells at in England. The watch trade is no more a speciality of Switzerland: watches are now made everywhere. India extracts from her ninety collieries two-thirds of her annual consumption of coal. The chemical trade which grew up on the banks of the Clyde and Tyne owing to the special advantages offered for the import of Spanish pyrites and the agglomeration of such a variety of industries along the two estuaries is now in decay. Spain, with the help of English capital, is beginning to utilise her own pyrites for herself; and Germany has become a great centre for the manufacture of sulphuric acid and soda—nay, she already complains about over-production.

But enough! I have before me so many figures, all telling the same tale, that examples could be multiplied at will. It is time to conclude, and, for every unprejudiced mind, the conclusion is self-evident. Industries of all kinds decentralise and are scattered all over the globe; and everywhere a variety, an integrated variety, of trades grows, instead of specialisation. Such are the prominent features of the times we live in. Each nation becomes in its turn a manufacturing nation; and the time is not far off when each nation of Europe, as well as the United States, and even the most backward nations of Asia and America, will themselves manufacture nearly everything they are in need of. Wars and several accidental causes may check for some time the scattering of in-

dustries: they will not stop it; it is unavoidable. For each new-comer the first steps only are difficult. But, as soon as any industry has taken firm root, it calls into existence hundreds of other trades; and as soon as the first steps have been made, and the first obstacles have been overcome, the industrial growth goes on at an accelerated rate.

The fact is so well felt, if not understood, that the race for colonies has become the distinctive feature of the last twenty years. Each nation will have her own colonies. But colonies will not help. There is not a second India in the world, and the old conditions will be repeated no more. Nay, some of the British colonies already threaten to become serious competitors with their mother country; others, like Australia, will not fail to follow the same lines. As to the yet neutral markets, China will never be a serious customer to Europe: she can produce much cheaper at home; and when she begins to feel a need for goods of European patterns she will produce them herself. Woe to Europe if the day that the steam engine invades China she is still relying on foreign customers! As to the African half-savages, their misery is no foundation for the well-being of a civilised nation.

Progress is in another direction. It is in producing for home use. The customers for the Lancashire cottons and the Sheffield cutlery, the Lyons silks and the Hungarian flour-mills, are not in India nor in Africa. They are amidst the home producers. No use to send floating shops to New Guinea with German or British millinery when there are plenty of would-be customers for British millinery in these very islands, and for German goods in Germany. And, instead of worrying our brains by schemes for getting customers abroad, it would be better to try to answer the following questions: Why the British worker, whose industrial capacities are so highly praised in political speeches;

why the Scotch crofter and the Irish peasant, whose obstinate labours in creating new productive soil out of peat bogs are occasionally so much spoken of, are no customers to the Lancashire weavers, the Sheffield cutlers and the Northumbrian and Welsh pitmen? Why the Lyons weavers not only do not wear silks, but sometimes have no food in their attics? Why the Russian peasants sell their corn, and for four, six, and sometimes eight months every year are compelled to mix bark and auroch grass to a handful of flour for baking their bread? Why famines are so common amidst the growers of wheat and rice in India?

Under the present conditions of division into capitalists and labourers, into property-holders and masses living on uncertain wages, the spreading of industries over new fields is accompanied by the very same horrible facts of pitiless oppression, massacre of children, pauperism, and insecurity of life. The Russian Fabrics Inspector's Reports, the Reports of the Plauen Handelskammer, and the Italian inquests are full of the same revelations as the Reports of the Parliamentary Commissions of 1840 to 1842, or the modern revelations with regard to the "sweating system" at Whitechapel and Glasgow, and London pauperism. The Capital and Labour problem is thus universalised; but, at the same time, it is also simplified. To return to a state of affairs where corn is grown, and manufactured goods are fabricated, for the use of those very people who grow and produce them—such will be, no doubt, the problem to be solved during the next coming years of European history. Each region will become its own producer and its own consumer of manufactured goods. But that unavoidably implies that, at the same time, it will be its own producer and consumer of agricultural produce; and that is precisely what I am going to discuss next.

CHAPTER III.

THE POSSIBILITIES OF AGRICULTURE.

The development of agriculture—Over-population prejudice—Can the soil of Great Britain feed its inhabitants?—British agriculture—Compared with agriculture in France; in Belgium—Market gardening: its achievements—Is it profitable to grow wheat in Great Britain?—American agriculture: intensive culture in the States.

THE industrial and commercial history of the world during the last thirty years has been a history of decentralisation of industry. It was not a mere shifting of the centre of gravity of commerce, such as Europe has witnessed in the past, when the commercial hegemony migrated from Italy to Spain, to Holland, and finally to Britain: it had a much deeper meaning, as it excluded the very possibility of commercial or industrial hegemony. It has shown the growth of quite new conditions, and new conditions require new adaptations. To endeavour to revive the past would be useless: a new departure must be taken by civilised nations.

Of course, there will be plenty of voices to argue that the former supremacy of the pioneers must be maintained at any price: all pioneers are in the habit of saying so. It will be suggested that the pioneers must attain such a superiority of technical knowledge and organisation as to enable them to beat all their younger competitors; that force must be resorted to if necessary. But force is reciprocal; and if the god of war always sides with the strongest battalions, those battalions are strongest which fight for new rights

against outgrown privileges. As to the honest longing for more technical education—surely let us all have as much of it as possible: it will be a boon for humanity; for humanity, of course—not for a single nation, because knowledge cannot be cultivated for home use only. Knowledge and invention, boldness of thought and enterprise, conquests of genius and improvements of social organisation have become international growths; and no kind of progress—intellectual, industrial or social—can be kept within political boundaries; it crosses the seas, it pierces the mountains; steppes are no obstacle to it. Knowledge and inventive powers are now so thoroughly international that if a simple newspaper paragraph announces to-morrow that the problem of storing force, of printing without inking, or of aerial navigation, has received a practical solution in one country of the world, we may feel sure that within a few weeks the same problem will be solved, almost in the same way, by several inventors of different nationalities. Continually we learn that the same scientific discovery, or technical invention, has been made within a few days' distance, in countries a thousand miles apart; as if there were a kind of atmosphere which favours the germination of a given idea at a given moment. And such an atmosphere exists: steam, print and the common stock of knowledge have created it.

Those who dream of monopolising technical genius are therefore fifty years behind the times. The world—the wide, wide world—is now the true domain of knowledge; and if each nation displays some special capacities in some special branch, the various capacities of different nations compensate one another, and the advantages which could be derived from them would be only temporary. The fine British workmanship in mechanical arts, the American boldness for gigantic enterprise, the French systematic mind, and the German pedagogy, are becoming international capacities.

Sir William Armstrong in his Italian and Japanese workshops communicates to Italians and Japanese those capacities for managing huge iron masses which have been nurtured on the Tyne; the uproarious American spirit of enterprise pervades the Old World; the French taste for harmony becomes European taste; and German pedagogy—improved, I dare say—is at home in Russia. So, instead of trying to keep life in the old channels, it would be better to see what the new conditions are, what duties they impose on our generation.

The characters of the new conditions are plain, and their consequences are easy to understand. As the manufacturing nations of West Europe are meeting with steadily growing difficulties in selling their manufactured goods abroad, and getting food in exchange, they will be compelled to grow their food at home; they will be bound to rely on home customers for their manufactures, and on home producers for their food. And the sooner they do so the better.

Two great objections stand, however, in the way against the general acceptance of such conclusions. We have been taught, both by economists and politicians, that the territories of the West European States are so overcrowded with inhabitants that they cannot grow all the food and raw produce which are necessary for the maintenance of their steadily increasing populations. Therefore the necessity of exporting manufactured goods and of importing food. And we are told, moreover, that even if it were possible to grow in Western Europe all the food necessary for its inhabitants, there would be no advantage in doing so as long as the same food can be got cheaper from abroad. Such are the present teachings and the ideas which are current in society at large. And yet it is easy to prove that both are totally erroneous: plenty of food could be grown on the territories of Western Europe for much more than their present populations, and an immense benefit would be

derived from doing so. These are the two points which I have now to discuss.

To begin by taking the most disadvantageous case: is it possible that the soil of Great Britain, which at present yields food for one-third only of its inhabitants, could provide all the necessary amount and variety of food for 33,000,000 human beings when it covers only 56,000,000 acres all told—forests and rocks, marshes and peat-bogs, cities, railways and fields—out of which only 33,000,000 acres are considered as cultivable?* The current opinion is, that it by no means can; and that opinion is so inveterate that we even see men of science, who are generally cautious when dealing with current opinions, endorse that opinion without even taking the trouble of verifying it. It is accepted as an axiom. And yet, as soon as we try to find out any argument in its favour, we discover that it has not the slightest foundation, either in facts or in judgment upon well-known facts.

Let us take, for instance, J. B. Lawes' estimates of crops which are published every year in *The Times*. In his estimate of the year 1887 he made the remark that during the eight harvest years 1853-1860 "nearly three-fourths of the aggregate amount of wheat consumed in the United Kingdom was of home growth, and little more than one-fourth was derived from foreign sources"; but five and twenty years later the figures were almost reversed, that is, "during the eight years 1879-1886, little more than one-third has been provided by home crops and nearly two-thirds by imports". But neither the increase of population by 8,000,000 nor the increase of consumption of wheat by six-tenths

* Twenty-three per cent. of the total area of England, 40 per cent. in Wales, and 75 per cent. in Scotland are now under wood, coppice, mountain, heath, water, etc. The remainder, *i.e.*, 32,777,513 acres, which are either under culture or under permanent pasture, may be taken as the "cultivable" area of Great Britain.

of a bushel per head could account for the change. In the years 1853-60 the soil of Britain nourished one inhabitant on every two acres cultivated: why did it require three acres in order to nourish the same inhabitant in 1887? The answer is plain: merely and simply because agriculture had fallen into neglect.

In fact, the area under wheat had been reduced since 1853-60 by full 1,590,000 acres, and therefore the average crop of the years 1883-86 was below the average crop of 1853-60 by more than 40,000,000 bushels; and this deficit alone represented the food of more than 7,000,000 *inhabitants*. At the same time the area under barley, oats, beans, and other spring crops had also been reduced by a further 560,000 acres, which, at the low average of thirty bushels per acre, would have represented the cereals necessary to complete the above for the same 7,000,000 inhabitants. And it could be said that if the United Kingdom imported cereals for 17,000,000 inhabitants in 1887, instead of for 10,000,000 in 1860, it was simply because more than 2,000,000 acres had gone out of cultivation.* These facts are well known; but usually they are met with the remark that the character of agriculture had been altered: that instead of growing wheat, meat and milk were produced in this country. However, the figures for 1887, compared with the figures for 1860, show that the same downward movement also took place under the heads of green crops and the like. The area under potatoes was reduced by 280,000 acres; under turnips by 180,000 acres; and although there was an

* Average area under wheat in 1853-60, 4,092,160 acres; average crop, 14,310,779 quarters. Average area under wheat in 1884-87, 2,509,055 acres; average crop (good years), 9,198,956 quarters. See Professor W. Fream's *Rothamstead Experiments* (London, 1888), page 83. I take in the above Sir John Lawes' figure of 5·65 bushels per head of population every year. It is very close to the yearly allowance of 5·67 bushels of the French statisticians. The Russian statisticians reckon 5·67 bushels of winter crops (chiefly rye) and 2·5 bushels of spring crops (sarrazin, barley, etc.).

increase under the heads of mangold, carrots, etc., still the aggregate area under all these crops was reduced by a further 330,000 acres. An increase of area was found only for permanent pasture (2,800,000 acres) and grass under rotation (1,600,000 acres); but we should look in vain for a corresponding increase of live stock. The increase of live stock which took place during those twenty-seven years was not sufficient to cover even the area reclaimed from waste land.*

Since the year 1887 affairs went, however, from worse to worse. If we take Great Britain alone, we see that in 1885 the area under all corn crops was 8,392,006 acres; that is very small, indeed, in comparison to the area which could have been cultivated; but even that little was further reduced to 7,400,227 acres in 1895. The area under wheat was 2,478,318 acres in 1885 (as against 3,630,300 in 1874); but it dwindled away to 1,417,641 acres in 1895, while the area under the other cereals increased by a trifle only —from 5,198,026 acres to 5,462,184—the total loss on all cereals being nearly 1,000,000 *acres in ten years!* Another 5,000,000 people were thus compelled to get their food from abroad.

Did the area under green crops increase during that decade? Not in the least! It was further reduced by nearly 300,000 acres (3,521,602 in 1885, and 3,225,762 in 1895). Or, was the area under clover and grasses in rotation increased in proportion to all these reductions? Alas, no! It remained almost stationary (4,654,173 acres in 1885, and 4,729,801 in 1895). In short, taking all the land that is under crops

* There was an increase of 1,800,000 head of horned cattle, and a decrease of 4¼ million sheep (6⅔ millions, if we compare the year 1886 with 1868), which would correspond to an increase of 1¼ million of units of cattle, because eight sheep are reckoned as equivalent to one head of horned cattle. But five million acres having been reclaimed upon waste land since 1860; the above increase should hardly do for covering that area, so that the 2¼ million acres which were cultivated no longer remained fully uncovered. They were a pure loss to the nation.

in rotation (17,201,490 acres in 1885 and 16,166,950 acres in 1895), we see that within the last ten years another 1,000,000 acres went out of cultivation, without any compensation whatever. It went to increase that already enormous area of more than 16,000,000 acres —*one-half of the cultivable area*—which goes under the head of "permanent pasture," that is, hardly suffices to feed one cow on each three acres!

Need I say, after that, that quite to the contrary of what we are told about the British agriculturists becoming "meat-makers" instead of "wheat-growers" no increase of live stock took place during the last ten years. Where, indeed, could they find their food? Far from devoting the land freed from cereals to "meat-making," the country further reduced its live stock. It had 6,597,964 head of horned cattle in 1885, and 6,354,336 only in 1895; 26,534,600 sheep in 1885 and 25,792,200 sheep in 1895. True, the number of horses was increased; every butcher and greengrocer runs now a horse "to take orders at the gents' doors" (in Sweden and Switzerland, by the way, they do it by telephone); and consequently Great Britain has 1,545,228 horses instead of the 1,408,788 she had in 1885. But the horses are imported, as also the oats and a considerable amount of the hay that is required for feeding them. And if the consumption of meat has really increased in this country, it is due to cheap imported meat, not to the meat that would be produced in these islands.* In short, agriculture has not changed its direction, as we are often told; it simply went down in all directions. Land is going out of culture at a perilous rate, while the latest improvements in market-gardening, fruit-growing and poultry-keeping are but a mere trifle if we compare them with what has

* No less than 5,877,000 cwts. of beef and mutton, 1,065,470 sheep and lambs, and 415,565 pieces of cattle were imported in 1895.

been done in the same direction in France, Belgium and America.

The cause of this general downward movement is self-evident. It is the desertion, the abandonment of the land. Each crop requiring human labour has had its area reduced; and one-third of the agricultural labourers have been sent away since 1861 to reinforce the ranks of the unemployed in the cities,* so that far from being over-populated, the fields of Britain are *starved of human labour* as James Caird used to say. The British nation does not work on her soil; she is prevented from doing so; and the would-be economists complain that the soil will not nourish its inhabitants!

I once took a knapsack and went on foot out of London, through Sussex. I had read Léonce de Lavergne's work and expected to find a soil busily cultivated; but neither round London nor still less farther south did I see men in the fields. In the Weald I could walk for twenty miles without crossing anything but heath or woodlands, rented as pheasant-shooting grounds to "London gentlemen," as the labourers said. "Ungrateful soil" was my first thought; but then I would occasionally come to a farm at the crossing of two roads and see the same soil bearing a rich crop; and my next thought was *tel seigneur, telle terre*, as the French peasants say. Later on I saw the rich fields of the midland counties; but even there I was struck by not perceiving the same busy human labour which I was accustomed to admire on the Belgian and French fields. But I ceased to wonder when I learnt that only 1,383,000 men and women in England and Wales work in the fields, while more than 16,000,000 belong to the "professional, domestic, indefinite, and unproductive class," as these pitiless statisticians say. One million

* Agricultural labourers in England and Wales: 2,100,000 in 1861; 1,383,000 in 1884; 1,311,720 in 1891.

and three hundred thousand human beings cannot productively cultivate an area of 33,000,000 acres unless they can resort to the Bonanza farm's methods of culture.

Again, taking Harrow as the centre of my excursions, I could walk five miles towards London, or turning my back upon it, and I could see nothing east or west but meadow land on which they hardly cropped two tons of hay per acre—scarcely enough to keep alive one milch cow on each two acres. Man is conspicuous by his absence from those meadows; he rolls them with a heavy roller in the spring; he spreads some manure every two or three years; then he disappears until the time has come to make hay. And that—within ten miles from Charing Cross, close to a city with 5,000,000 inhabitants, supplied with Flemish and Jersey potatoes, French salads and Canadian apples. In the hands of the Paris gardeners, each thousand acres situated within the same distance from the city would be cultivated by at least 2000 human beings, who would get vegetables to the value of from £50 to £300 per acre. But here the acres which only need human hands to become an inexhaustible source of golden crops lie idle, and they say to us, "Heavy clay!" without even knowing that in the hands of man there are no unfertile soils; that the most fertile soils are not in the prairies of America, nor in the Russian steppes; that they are in the peat-bogs of Ireland, on the sand downs of the northern sea-coast of France, on the craggy mountains of the Rhine, where they have been made by man's hands.

The most striking fact is, however, that in some undoubtedly fertile parts of the country things are even in a worse condition. My heart simply ached when I saw the state in which land is kept in South Devon, and when I learned to know what "permanent pasture" means. Field after field is covered with nothing but

grass, three inches high, and thistles in profusion. Twenty, thirty such fields can be seen at one glance from the top of every hill; and thousands of acres are in that state, notwithstanding that the grandfathers of the present generation have devoted a formidable amount of labour to the clearing of that land from the stones, to fencing it, roughly draining it and the like. In every direction I could see abandoned cottages and orchards going to ruin. A whole population has disappeared, and even its last vestiges must disappear if things continue to go on as they have gone. And this takes place in a part of the country endowed with a most fertile soil and possessed of a climate which is certainly more congenial than the climate of Jersey in spring and early summer—a land upon which even the poorest cottagers occasionally raise potatoes as early as the first half of May. But how can that land be cultivated when there is nobody to cultivate it? "We have fields; men go by, but never go in," an old labourer said to me; and so it is in reality.*

It will be said, of course, that the above opinion strangely contrasts with the well-known superiority of British agriculture. Do we not know, indeed, that British crops average twenty-eight bushels of wheat per acre, while in France they reach only seventeen bushels? Does it not stand in all almanacs that Britain gets every year £180,000,000 sterling worth of animal produce—milk, cheese, meat and wool—from her fields? All that is true, and there is no doubt that in many respects British agriculture is superior to that of many other nations. As regards obtaining the greatest amount of pro-

* Round the small hamlet where I stayed for two summers, there were: one farm, 370 acres, four labourers and two boys; another, about 300 acres, two men and two boys; a third, 800 acres, five men only and probably as many boys. In truth, the problem of cultivating the land with the least number of men has been solved in this spot by not cultivating at all as much as two-thirds of it.

duce with the least amount of labour, Britain undoubtedly took the lead until she was superseded by America. Again, as regards the fine breeds of cattle, the splendid state of the meadows and the results obtained in separate farms, there is much to be learned from Britain. But a closer acquaintance with British agriculture as a whole discloses many features of inferiority. However splendid, a meadow remains a meadow, much inferior in productivity to a cornfield; and the fine breeds of cattle appear to be poor creatures as long as each ox requires three acres of land to be fed upon. Certainly one may indulge in some admiration at the average twenty-eight bushels grown in this country; but when we learn that only 1,417,000 acres, out of the cultivable 33,000,000, bear such crops, we are quite disappointed. Any one could obtain like results if he were to put all his manure into one-twentieth part of the area which he possesses. Again, the twenty-eight bushels no longer appear to us so satisfactory when we learn that without any manuring, merely by means of a good culture, they have obtained at Rothamstead an average of fourteen bushels per acre from the same plot of land for forty consecutive years;* while with manuring they obtain thirty-eight bushels instead of twenty-eight, and under the allotment system the crops reach forty bushels. In some farms they occasionally attain even fifty and fifty-seven bushels per acre.

If we intend to have a correct appreciation of British agriculture, we must not base it upon what is obtained on a few selected and well-manured plots; we must inquire what is done with the territory, taken as a whole.† Now, out of each 1000 acres of the aggregate

* The *Rothamstead Experiments*, 1888, by Professor W. Fream, p 35 *seq.*

† The figures which I take for these calculations are given in the *Statesman's Year-book*, 1896, and the *Agricultural Returns of the Board of Agriculture* for 1895.

They are as follows:—

	Acres.
Total area (Great Britain)	56,457,500

FIG. 1.—Proportion of the cultivated area which is given to cereals altogether, and to wheat, in Great Britain and Ireland.

territory of England, Wales and Scotland, 418 acres are left under wood, coppice, heath, buildings and so on. We need not find fault with that division, because it depends very much upon natural causes. In France and Belgium one-third of the territory is in like manner also treated as uncultivable, although portions of it are continually reclaimed and brought under culture. But, leaving aside the "uncultivable" portion, let us see what is done with the 582 acres out of 1000 of the "cultivable" part (32,777,000 acres in Great Britain). First of all, it is divided into two almost equal parts, and one of them—295 acres out of 1000—is left under "permanent pasture," that is, in most cases it is entirely uncultivated. Very little hay is obtained from it,* and some cattle are grazed upon it. More than one-half of the cultivable area is thus left without cultivation, and the remainder, *i.e.*, 287 acres only out of each 1000 acres, is under culture. Out of these last, 110 acres are under corn crops, twenty-one acres under potatoes, fifty-

	Acres.	
Uncultivable area:—		
England	7,481,000	
Wales	1,885,000	
Scotland	14,314,000	
Great Britain		23,680,000
Cultivable area:—		
Great Britain		32,777,500
Out of it, under:—		
Permanent pasture		16,610,563
Clover and mature grasses		4,729,801
Corn crops and potatoes (541,217 acres)		7,400,227
Green crops		3,225,762
Bare fallow, etc.		475,650
Hops		58,940
Small fruit		74,547
Flax		2,023
Under culture (including permanent pasture giving hay)		16,166,950

Out of the 6,879,825 acres given to corn crops, 1,417,641 acres were under wheat; 2,166,279 under barley, and 3,225,905 under oats.

* Only from each eighty-five acres, out of these 295, hay is obtained. The remainder are grazing grounds.

seven acres under green crops and eighty-four acres under clover fields and grasses under rotation. And finally, out of the 110 acres given to corn crops, the best twenty-five acres (one-fortieth part of the territory, one-twenty-third of the cultivable area) are picked out and sown with wheat. They are well cultivated, well manured, and upon them an average of twenty-eight bushels to the acre is obtained; and upon these twenty-five acres out of 1000 the world superiority of British agriculture is based.

The net result of all that is, that on nearly 33,000,000 acres of cultivable land the food is grown for one-third part only of the population (two-thirds of the food it consumes is imported), and we may say accordingly that, although nearly two-thirds of the territory is cultivable, British agriculture provides home-grown food for each 125 or 130 inhabitants only per square mile (out of 378). In other words, nearly three acres of the *cultivable area* are required to grow the food for each person. Let us then see what is done with the land in France and Belgium.

Now, if we simply compare the average twenty-eight bushels per acre of wheat in Great Britain with the average seventeen bushels in France, the comparison is all in favour of these islands; but such averages are of little value because the two systems of agriculture are totally different in the two countries. The Frenchman also has his picked and heavily manured "twenty-five acres" in the north of France and in Ile-de-France, and from these picked acres he obtains average crops ranging from thirty-one to thirty-three bushels.* How-

* That is, thirty-one to thirty-three bushels on the average; forty bushels in good farms, and fifty in the best. The area under wheat is 17,500,000 acres: the cultivated area, 95,000,000 acres; and the aggregate superficies of France, 132,000,000 acres. Compare Lecouteux, *Le blé, sa culture extensive et intensive*, 1883; Risler, *Physiologie et culture du blé*, 1886; Boitet, *Herbages et prairies naturelles*, 1885; Baudrillart, *Les populations agricoles de la Normandie*, 1880; Grandeau, *La production agricole en France;* Léonce de Lavergne's last edition; and so on.

ever, he sows with wheat, not only the best picked out acres, but also such fields on the Central Plateau and in Southern France as hardly yield ten, eight and even six bushels to the acre, without irrigation; and these low crops reduce the average for the whole country. The Frenchman cultivates much that is left here under permanent pasture—and this is what is described as his "inferiority" in agriculture. In fact, although the proportion between what we have named the "cultivable area" and the total territory is very much the same in France as it is in Great Britain (624 acres out of each 1000 acres of the territory), the area under wheat crops is nearly *six times* as great, in proportion, as what it is in Great Britain (146 acres instead of twenty-five, out of each 1000 acres); the corn crops altogether cover more than two-fifths of the cultivable area, and large areas are given besides to green crops, industrial crops, vine, fruit and vegetables.

Taking everything into consideration, although the Frenchman keeps less cattle, and especially grazes less sheep than the Briton, he nevertheless obtains from his soil nearly all the food that he and his cattle consume. He imports, in an average year, but one-tenth only of what the nation consumes, and he exports to this country considerable quantities of food produce (£10,000,000 worth), not only from the south, but also, and especially, from the shores of the Channel (Brittany butter and vegetables; fruit and vegetables from the suburbs of Paris, and so on).*

The net result is that, although one-third part of the territory is also treated as "uncultivable," the soil of

* The exports from France in 1894 (average year) attained: wine 233,000,000 fr., spirits 54,000,000 fr., cheese, butter and sugar 114,000,000 fr. To this country France sent, same year, £2,744,870 worth of wine, £2,227,360 worth of refined sugar, £2,351,870 worth of butter, £982,800 worth of eggs (£1,611,500 in 1893), and £1,402,300 worth of brandy, all of French origin only, in addition to £14,403,040 worth of manufactured silks and woollens. The exports from Algeria are not taken in the above figures.

France yields the food for 170 inhabitants per square mile (out of 188), that is, for forty persons more, per square mile, than this country.*

It is thus apparent that the comparison with France is not so much in favour of this country as it is said to be; and it will be still less favourable when we come, in our next chapter, to horticulture. As to the comparison with Belgium, it is even more striking—the more so as the two systems of culture are similar in both countries. To begin with, in Belgium we also find an average crop of twenty-seven and eight-tenths bushels of wheat to the acre; but the area given to wheat is five times as big as Great Britain, in comparison to the cultivable area, and the cereals cover almost one half of the land available for culture.† The land is so well cultivated that the average crops for the years 1889-

* Each 1000 acres of French territory are disposed of as follows: 376 acres are left under wood, coppice, communal grazing grounds, etc., and 624 acres are treated as "cultivable". Out of each "cultivable" 624 acres, 128 are under meadows (now irrigated to a great extent), ninety-two under bare fallow and various cultures, 272 under cereals, eighty-three under green and industrial crops, forty-seven under vineyards. No less than 146 acres are under wheat, which yields twenty-eight to thirty bushels in two departments, twenty-six bushels in twelve departments.

On the whole, more than seventeen bushels per acre is the average in one half of the country, and less than seventeen bushels in the other half.

As to cattle, we find in Great Britain 6,353,336 cattle (*i.e.*, nineteen head per each 100 acres of the cultivable area), including in that number over 1,250,000 calves under one year, and 25,792,195 sheep (*i.e.*, seventy-nine sheep per 100 acres of the same). In France we find 12,879,240 cattle (sixteen head per each 100 acres of cultivable area) and only 20,721,850 sheep (twenty-five sheep per 100 acres of the same). In other words, the proportion of horned cattle is nearly the same in both countries (nineteen head and sixteen head per 100 acres), a considerable difference appearing in favour of this country only as to the number of sheep (seventy-nine as against twenty-five). The heavy imports of hay, oil-cake, oats, etc., into this country must, however, not be forgotten, because, for each head of cattle which lives on imported food, eight sheep can be grazed, or be fed with home-grown fodder. As to horses, both countries stand on nearly the same footing.

† Out of each 1000 acres of the territory, 673 are cultivable, and 327 are left as uncultivable. Of the former, 317 acres are given to cereals, 182 to green crops and grasses under rotation; 121 acres are given to wheat and wheat mixed with rye (ninety-four to pure wheat). Moreover, upon each sixty-three acres, out of 1000, catch crops of carrots, mangold and swedes are obtained.

92 (the very bad year of 1891 being left out of account) were twenty-eight and six-tenths bushels per acre for winter wheat; nearly forty-seven bushels for oats (thirty-five to forty-one and a half in Great Britain), and forty bushels for winter barley (twenty-nine to thirty-five in Great Britain); while on no less than 459,800 acres catch crops of swedes (2,226,250 tons)* and carrots (155,000 tons) were obtained. All taken, they grow in Belgium more than 76,000,000 bushels of cereals, *i.e.*, fifteen and seven-tenths bushels per acre of the cultivable area, while the corresponding figure for Great Britain is only eight and a half bushels; and they keep almost twice as much cattle upon each cultivable acre as is kept in Great Britain.* Large portions of the land are given besides to the culture of industrial plants, potatoes for spirit, beet for sugar, and so on.

However, it must not be believed that the soil of Belgium is more fertile than the soil of this country. On the contrary, to use the words of Laveleye, "only one half, or less, of the territory offers natural conditions which are favourable for agriculture"; the other half consists of a gravelly soil, or sands, "the natural sterility of which could be overpowered only by heavy manuring" Man, not nature, has given to the Belgian soil its present productivity. With this soil and labour, Belgium succeeds in supplying nearly all the food of a population which is denser than that of England and Wales, and numbers 544 inhabitants to the square mile. If the exports and imports of agricultural produce from and into Belgium be taken into account, we can say that

* Taking all horses, cattle and sheep in both countries, and reckoning eight sheep as equivalent to one head of horned cattle, we find that Belgium has *twenty-three* cattle units and horses upon each 100 acres of territory, as against *twenty* same units and horses in Great Britain. If we take cattle alone, the disproportion is much greater, as we find *thirty-six* cattle units on each 100 acres of cultivable area, as against *nineteen* in Great Britain. The annual value of animal produce in Belgium is estimated by the *Annuaire Statistique de la Belgique* (1893, p. 263) at £58,039,050, including poultry (£1,534,000).

Laveleye's conclusions are still good, and that only one inhabitant out of each ten to twenty requires im-

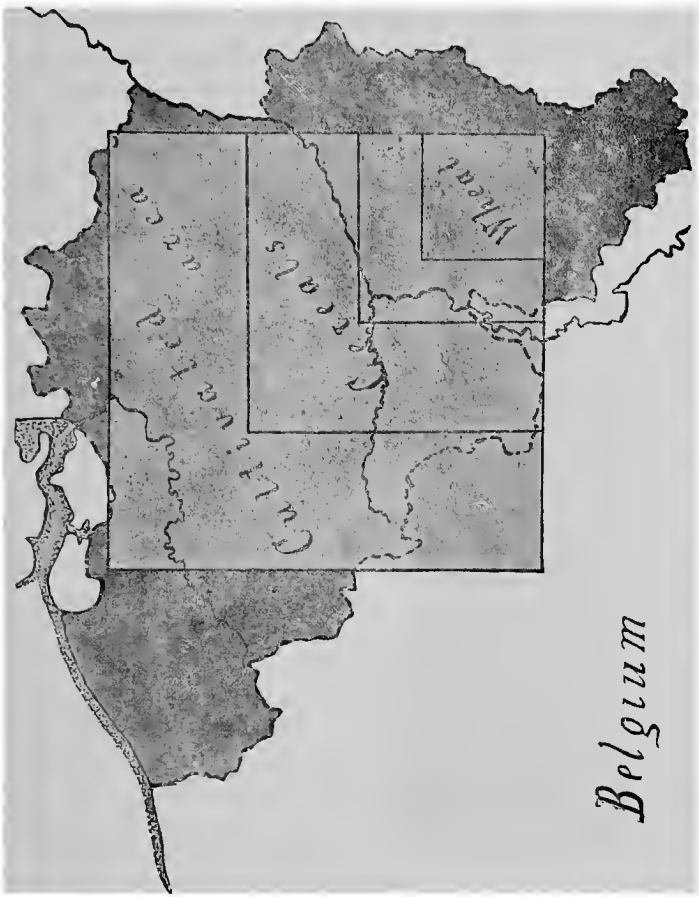

FIG. 2.—Proportion of the cultivated area which is given to cereals altogether, and to wheat, in Belgium. The square which encloses the wheat square represents the area given to both wheat and a mixture of wheat with rye.

ported food. The soil of Belgium supplies with home-grown food no less than 490 *inhabitants per square mile*,

and there remains something for export—no less than £1,000,000 worth of agricultural produce being exported

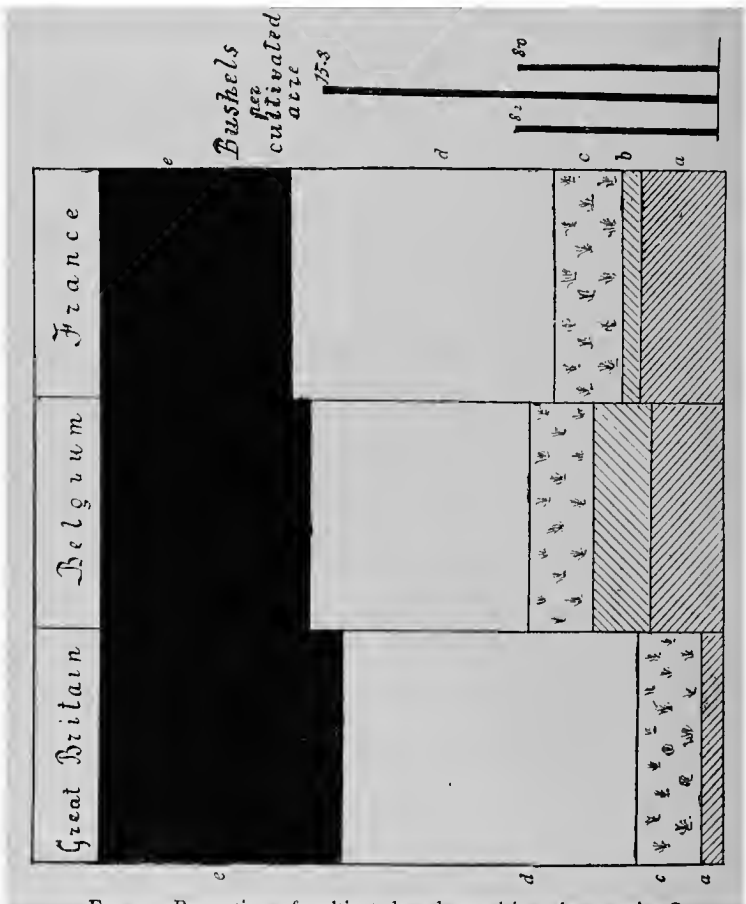

FIG. 3.—Proportion of cultivated and uncultivated areas in Great Britain, Belgium and France. *a*, Wheat; *b*, wheat and rye mixed; *c*, other cereals; *d*, green crops and permanent pasture; *e*, uncultivated.

every year to Great Britain. Besides, it must not be forgotten that Belgium is a manufacturing country

which exports home-made goods to the value of £9 per head of population (£56,000,000, on the average, in 1886-92), while the total exports from the United Kingdom attain only £6 7s. per inhabitant. As to separate parts of the Belgian territory, the small and naturally unfertile province of West Flanders not only grows the food of its 580 inhabitants on the square mile, but exports agricultural produce to the value of 25s. per head of its population. And yet no one can read Laveleye's masterly work without coming to the conclusion that Flemish agriculture would have realised still better results were it not hampered in its growth by the steady and heavy increase of rent. In the face of the rent being increased each nine years, many farmers have lately abstained from further improvements.

Without going as far as China, I might quote similar examples from elsewhere, especially from Lombardy. But the above will be enough to caution the reader against hasty conclusions as to the impossibility of feeding 39,000,000 people from 78,000,000 acres. They also will enable me to draw the following conclusions: (1) If the soil of the United Kingdom were cultivated only as it *was* thirty-five years ago, 24,000,000 people, instead of 17,000,000, could live on home-grown food; and that culture, while giving occupation to an additional 750,000 men, would give nearly 3,000,000 wealthy home customers to the British manufactures. (2) If the cultivable area of the United Kingdom were cultivated as the soil is cultivated *on the average* in Belgium, the United Kingdom would have food for at least 37,000,000 inhabitants; and it might export agricultural produce without ceasing to manufacture so as freely to supply all the needs of a wealthy population. And finally (3), if the population of this country came to be doubled, all that would be required for producing the food for 80,000,000 inhabitants would be to cultivate the soil as it is cultivated in the best farms of this country,

in Lombardy, and in Flanders, and to utilise some meadows, which at present lie almost unproductive, in the same way as the neighbourhoods of the big cities in France are utilised for market-gardening. All these are not fancy dreams, but mere realities; nothing but modest conclusions from what we see round about us, without any allusion to the agriculture of the future.

If we want, however, to know what agriculture *can be*, and what can be grown on a given amount of soil, we must apply for information to such regions as the district of Saffelare in East Flanders, the island of Jersey, or the irrigated meadows of Lombardy, which are mentioned in the next chapter. Or else we may apply to the market-gardeners in this country, or in the neighbourhoods of Paris or in Holland, to the "truck farms" in America, and so on.

While science devotes its chief attention to industrial pursuits, a limited number of lovers of nature and a legion of workers whose very names will remain unknown to posterity have created of late a quite new agriculture, as superior to modern farming as modern farming is superior to the old three-fields system of our ancestors. Science seldom guided them, and sometimes misguided—as was the case with Liebig's theories, developed to the extreme by his followers, who induced us to treat plants as glass recipients of chemical drugs, and who forgot that the only science capable of dealing with life and growth is physiology, not chemistry. Science seldom has guided them: they proceeded in the empirical way; but, like the cattle-growers who opened new horizons to biology, they have opened a new field of experimental research for the physiology of plants. They have created a totally new agriculture. They smile when we boast about the rotation system, having permitted us to take from the field one crop every year, or four crops each three years, because their ambition

is to have six and nine crops from the very same plot of land during the twelve months. They do not understand our talk about good and bad soils, because they make the soil themselves, and make it in such quantities as to be compelled yearly to sell some of it: otherwise it would raise up the level of their gardens by half an inch every year. They aim at cropping, not five or six tons of grass on the acre, as we do, but from fifty to 100 tons of various vegetables on the same space; not £5 worth of hay but £100 worth of vegetables, of the plainest description, cabbage and carrots. That is where agriculture is going now.

We know that the dearest of all varieties of our staple food is meat; and those who are not vegetarians, either by persuasion or by necessity, consume on the average 225 lb. of meat—that is, roughly speaking, a little less than the third part of an ox—every year. And we have seen that, even in this country and Belgium, two to three acres are wanted for keeping one head of horned cattle; so that a community of, say, 1,000,000 inhabitants would have to reserve somewhere about 3,000,000 acres of land for supplying it with meat. But if we go to the farm of M. Goppart—one of the promoters of *ensilage* in France—we shall see him growing, on a drained and well-manured field, no less than an average of 120,000 lb. of corn-grass in the acre, which gives 30,000 lb. of dry hay—that is, the food of one horned beast per acre. The produce is thus trebled. As to beetroot, which is used also for feeding cattle, Mr. Champion, at Whitby, succeeds, with the help of sewage, in growing 100,000 lb. of beet on each acre, and occasionally 150,000 and 200,000 lb. He thus grows on each acre the food of, at least, two or three head of cattle. And such crops are not isolated facts: thus, M. Gros, at Autun, succeeds in cropping 600,000 lb. of beet and carrots, which crop would permit him to keep four horned cattle on each acre. As to crops of 100,000

lb. of beet, they occur in numbers in the French competitions, and the success depends entirely upon good culture and appropriate manuring. It thus appears that while under ordinary high farming we need from 2,000,000 acres to keep 1,000,000 horned cattle, double that amount could be kept on one-half of that area; and if the density of population required it, the amount of cattle could be doubled again, and the area required to keep it might still be one-half, or even one-third of what it is now.*

The above examples are striking enough, and yet those afforded by the market-gardening culture are still more striking. I mean the culture carried on in the neighbourhood of big cities, and more especially the *culture maraîchère* round Paris. In that culture each plant is treated according to its age. The seeds germinate and the seedlings develop their first four leaflets in especially favourable conditions of soil and temperature; then the best seedlings are picked out and transplanted into a bed of fine loam, under a frame or in the open air, where they freely develop their rootlets and, gathered on a limited space, receive more than usual care; and only after that preliminary training are they bedded in the open ground, where they grow till ripe.

* Assuming that 9000 lb. of dry hay are necessary for keeping one head of horned cattle every year, the following figures (taken from Toubeau's *Répartition métrique des impôts*) will show what we obtain now under usual and under intensive culture:—

	Crop per acre. Eng. lb.	Equivalent in dry hay. Eng. lb.	Number of cattle fed from each 100 acres.
Pasture . . .	—	1,200	13
Unirrigated meadows .	—	2,400	26
Clover, cut twice .	—	4,800	52
Swedish turnips . .	38,500	10,000	108
Rye-grass . . .	64,000	18,000	180
Beet, high farming .	64,000	21,000	210
Indian corn, ensilage .	120,000	30,000	330

In such a culture the primitive condition of the soil is of little account, because loam is made out of the old forcing beds. The seeds are carefully tried, the seedlings receive proper attention, and there is no fear of drought, because of the variety of crops, the liberal watering with the help of a steam engine, and the stock of plants always kept ready to replace the weakest individuals. Almost each plant is treated individually.

There prevails, however, with regard to market-gardening, a misunderstanding which it would be well to remove. It is generally supposed that what chiefly attracts market-gardening to the great centres of population is the market. It must have been so; and so it may be still, but to some extent only. A great number of the Paris *maraîchers*, even of those who have their gardens within the walls of the city and whose main crop consists of vegetables in season, export the whole of their produce to England. What chiefly attracts the gardener to the great cities is stable manure; and this is not wanted so much for increasing the richness of the soil—one-tenth part of the manure used by the French gardeners would do for that purpose—but for keeping the soil at a certain temperature. Early vegetables pay best, and in order to obtain early produce not only the air but the soil as well must be warmed; and that is done by putting great quantities of properly mixed manure into the soil; its fermentation heats it. But it is evident that with the present development of industrial skill, the heating of the soil could be obtained more economically and more easily by hot-water pipes. Consequently, the French gardeners begin more and more to make use of portable pipes, or *thermosiphons*, provisionally established in the cool frames. This new improvement becomes of general use, and we have the authority of Barral's *Dictionnaire d'Agriculture* to affirm that it gives excellent results.

As to the different degrees of fertility of the soil—

always the stumbling-block of those who write about agriculture—the fact is that in market-gardening the soil is always *made*, whatever it originally may have been. Consequently—we are told by Prof. Dybowski, in the article "Maraîchers" in Barral's *Dictionnaire d'Agriculture*—it is now a usual stipulation of the renting contracts of the Paris *maraîchers* that the gardener may carry away his soil, down to a certain depth, when he quits his tenancy. He himself makes it, and when he moves to another plot he carts his soil away, together with his frames, his water-pipes, and his other belongings.*

I could not relate here all the marvels achieved in market-gardening; so that I must refer the reader to works—most interesting works—especially devoted to the subject, and give only a few illustrations.† Let us take, for instance, the orchard—the *marais*—of M. Ponce, the author of a well-known work on the *culture maraîchère*. His orchard covered only two and seven-tenths acres. The outlay for the establishment, including a steam engine for watering purposes, reached £1136. Eight persons, M. Ponce included, cultivated the orchard

* "Portable soil" is not the latest departure in agriculture. The last one is the watering of the soil with special liquids containing special microbes. It is a fact that chemical manures, without organic manure, seldom prove to be sufficient. On the other hand, it was discovered lately that certain microbes in the soil are a necessary condition for the growth of plants. Hence the idea of *sowing* the beneficent microbes, which rapidly develop in the soil and fertilise it. We certainly shall soon hear more of this new method, which is experimented upon on a large scale in Germany, in order to transform peat-bogs and heavy soils into rich meadows and fields. See "Recent Science" in *Nineteenth Century*, October, 1897.

† Ponce, *La culture maraîchère*, 1869; Gressent, *Le potager moderne*, 7th edit., 1886; Courtois-Gérard, *Manuel pratique de culture maraîchère*, 1863; Vilmorin, *Le bon jardinier* (almanac). The general reader who cares to know about the productivity of the soil will find plenty of examples, well classified, in the most interesting work *La Répartition métrique des impôts*, by A. Toubeau, 2 vols., 1880. I do not quote many excellent English manuals, but I must remark that the market-gardening culture in this country has also obtained results very highly prized by the Continental gardeners, and that the chief reproach to be addressed to it is its relatively small extension.

and carried the vegetables to the market, for which purpose one horse was kept; when returning from Paris they brought in manure, for which £100 was spent every year. Another £100 was spent in rent and taxes. But how to enumerate all that was gathered every year on this plot of less than three acres, without filling two pages or more with the most wonderful figures? One must read them in M. Ponce's work, but here are the chief items: more than 20,000 lb. of carrots; more than 20,000 lb. of onions, radishes and other vegetables sold by weight; 6000 heads of cabbage; 3000 of cauliflower; 5000 baskets of tomatoes; 5000 dozen of choice fruit; and 154,000 heads of salad; in short, a total of 250,000 lb. of vegetables. The soil was made to such an amount out of forcing beds that every year 250 cubic yards of loam had to be sold. Similar examples could be given by the dozen, and the best evidence against any possible exaggeration of the results is the very high rent paid by the gardeners, which reaches in the suburbs of London from £10 to £15 per acre, and in the suburbs of Paris attains as much as £32 per acre. No less than 2125 acres are cultivated round Paris in that way by 5000 persons, and thus not only the 2,000,000 Parisians are supplied with vegetables, but the surplus is also sent to London.

The above results are obtained with the help of warm frames, thousands of glass bells, and so on. But even without such costly things, with only thirty-six yards of frames for seedlings, vegetables are grown *in the open air* to the value of £200 per acre.* It is obvious, however, that in such cases the high selling prices of the crops are not due to the high prices fetched by early vegetables in winter; they are entirely due to the high crops of the plainest ones. Let me add also that all this wonderful culture is a yesterday's growth. Fifty

* *Manuel pratique de culture maraîchère*, by Courtois-Gérard, 4th edit., 1863.

years ago the *culture maraîchère* was quite primitive. But now the Paris gardener not only defies the soil—he would grow the same crops on an asphalt pavement—he defies climate. His walls, which are built to reflect light and to protect the wall-trees from the northern winds, his wall-tree shades and glass protectors, his frames and *pépinières* have made a real garden, a rich Southern garden, out of the suburbs of Paris. He has given to Paris the "two degrees less of latitude" after which a French scientific writer was longing; he supplies his city with mountains of grapes and fruit at any season; and in the early spring he inundates and perfumes it with flowers. But he does not only grow articles of luxury. The culture of plain vegetables on a large scale is spreading every year; and the results are so good that there are now practical *maraîchers* who venture to maintain that if all the food, animal and vegetable, necessary for 3,500,000 inhabitants of the departments of Seine and Seine-et-Oise had to be grown on their own territory (3250 square miles), it could be grown without resorting to any other methods of culture than those already in use—methods already tested on a large scale and proved to be successful.

And yet the Paris gardener is not our ideal of an agriculturist. In the painful work of civilisation he has shown us the way to follow; but the ideal of modern civilisation is elsewhere. He toils, with but a short interruption, from three in the morning till late in the night. He knows no leisure; he has no time to live the life of a human being; the commonwealth does not exist for him; his world is his garden, more than his family. He cannot be our ideal; neither he nor his system of agriculture. Our ambition is, that he should produce even *more* than he does with *less* labour, and should enjoy all the joys of human life. And this is fully possible.

As a matter of fact, if we put aside those gardeners who chiefly cultivate the so-called *primeurs*—strawberries ripened in January, and the like—if we take only those who grow their crops in the open field, and resort to frames exclusively for the earlier days of the life of the plant, and if we analyse their system, we see that its very essence is, first, to create for the plant a nutritive and porous soil, which contains both the necessary decaying organic matter and the inorganic compounds; and then to keep that soil and the surrounding atmosphere at a temperature and moisture superior to those of the open air. The whole system is summed up in these few words. If the French *maraîcher* spends prodigies of labour, intelligence, and imagination in combining different kinds of manure, so as to make them ferment at a given speed, he does so for no purpose but the above: a nourishing soil, and a desired equal temperature and moisture of the air and the soil. All his empirical art is devoted to the achievement of these two aims. But both can also be achieved in another and much easier way. The soil can be *improved* by hand, but it need not be *made* by hand. Any soil, of any desired composition, can be made by machinery. We already have manufactures of manure, engines for pulverising the phosphorites, and even the granites of the Vosges; and we shall see manufactures of loam as soon as there is a demand for them.

It is obvious that at present, when fraud and adulteration are exercised on such an immense scale in the manufacture of artificial manure, and the manufacture of manure is considered as a chemical process, while it ought to be considered as a physiological one, the gardener prefers to spend an unimaginable amount of labour rather than risk his crop by the use of a pompously labelled and unworthy drug. But that is a social obstacle which depends upon a want of knowledge and a bad social organisation, not upon physical

causes.* As to the necessity of creating for the earlier life of the plant a warm soil and atmosphere, forty years ago Léonce de Lavergne foretold that the next step in culture would be to warm the soil. Heating pipes give the same results as the fermenting manures, but at a much smaller expense of human labour. And already the system works on a large scale, as will be seen from the next chapter. Through it the productive powers of a given area of land are increased more than a hundred times.

Of course now, when the capitalist system makes us pay for everything four or five times its labour value, we often spend about £1 for each square yard of a heated conservatory. But how many middlemen are making fortunes on the wooden sashes imported from Drontheim? If we only could reckon our expenses in labour, we should discover to our amazement that, thanks to the use of machinery, the square yard of a conservatory does not cost more than half a day of human labour; and we will see presently that the Jersey and Guernsey average for cultivating one acre under glass is only three men working ten hours a day. Therefore the conservatory, which formerly was a luxury, is rapidly entering into the domain of high culture. And we may foresee the day when the glass conservatory will be considered as a necessary appendix to the field, both for the growth of those fruits and vegetables which cannot succeed in the open air, and for the preliminary

* Already it is partly removed in France and Belgium, owing to the public laboratories where analyses of seeds and manure are made free. The falsifications discovered by these laboratories exceed all that could have been imagined. Manures, containing only one-fifth part of the nutritious elements they were supposed to contain, were found to be quite common; while manures containing injurious matters, and no nutritious parts whatever, were not unfrequently supplied by firms of "respectable" repute. With seeds, things stand even worse. Samples of grass seeds which contained 20 per cent. of injurious grasses, or 20 per cent. of grains of sand, so coloured as to deceive the buyer, or even 10 per cent. of a deadly poisonous grass, passed through the Ghent laboratory.

training of most cultural plants during the earlier stages of their life.

Home-grown fruit is always preferable to the half-ripe produce which is imported from abroad, and the additional work required for keeping a young plant under glass is largely repaid by the incomparable superiority of the crops. As to the question of labour, when we remember the really incredible amount of labour which has been spent on the Rhine and in Switzerland for making the vineyards, their terraces, and stone walls, and for carrying the soil up the stony crags, as also the amount of labour which is spent every year for the culture of those vineyards and fruit gardens, we are inclined to ask, which of the two, all taken, requires less of human labour—a vinery (I mean the cold vinery) in a London suburb, or a vineyard on the Rhine, or on Lake Leman? And when we compare the prices realised by the grower of grapes round London (not those which are paid in the West-end fruit shops, but those received by the grower for his grapes in September and October) with those current in Switzerland or on the Rhine during the same months, we are inclined to maintain that nowhere in Europe, beyond the forty-fifth degree of latitude, are grapes grown at less expense of human labour, both for capital outlay and yearly work, than in the vineries of the London and Brussels suburbs. As to the always overrated productivity of the exporting countries, let us remember that the vine-growers of Southern Europe drink themselves an abominable *piquette;* that Marseilles fabricates wine for home use out of dry raisins brought from Asia; and that the Normandy peasant who sends his apples to London, drinks real cider only on great festivities. Such a state of things will not last for ever; and the day is not far when we shall be compelled to look to our own resources to provide many of the things which we now import. And we shall not be the worse

for that. The resources of science, both in enlarging the circle of our production and in new discoveries, are inexhaustible. And each new branch of activity calls into existence more and more new branches, which steadily increase the power of man over the forces of nature. If we take all into consideration; if we realise the progress made of late in the gardening culture, and the tendency towards spreading its methods to the open field; if we watch the cultural experiments which are being made now—experiments to-day and realities to-morrow—and ponder over the resources kept in store by science, we are bound to say that it is utterly impossible to foresee at the present moment the limits as to the *maximum* number of human beings who could draw their means of subsistence from a given area of land, or as to what a variety of produce they could advantageously grow in any latitude. Each day widens former limits, and opens new and wide horizons. All we can say now is, that 600 persons could easily live on a square mile; and that, with cultural methods already used on a large scale, 1000 human beings—not idlers—living on 1000 acres could easily, without any kind of overwork, obtain from that area a luxurious vegetable and animal food, as well as the flax, wool, silk, and hides necessary for their clothing. As to what may be obtained under still more perfect methods—also known but not yet tested on a large scale—it is better to abstain from any forecast: so unexpected are the recent achievements of intensive culture.

We thus see that the over-population fallacy does not stand the very first attempt at submitting it to a closer examination. Those only can be horror-stricken at seeing the population of this country increase by one individual every 1000 seconds who think of a human being as a mere claimant upon the stock of material wealth of mankind, without being at the same time a contributor to that stock. But we, who see in each new-

born babe a future *worker* capable of producing much more than his own share of the common stock—we greet his appearance. We know that a crowded population is a necessary condition for permitting man to increase the productive powers of his labour. We know that highly productive labour is impossible so long as men are scattered, few in numbers, over wide territories, and are thus unable to combine together for the higher achievements of civilisation. We know what an amount of labour must be spent to scratch the soil with a primitive plough, to spin and weave by hand; and we know also how much less labour it costs to grow the same amount of food and weave the same cloth with the help of modern machinery. We also see that it is infinitely easier to grow 200,000 lb. of food on one acre than to grow them on ten acres. It is all very well to imagine that wheat grows by itself on the Russian steppes; but those who have seen how the peasant toils in the "fertile" black-earth region will have one desire: that the increase of population may permit the use of the steam-digger and gardening culture in the steppes; that it may permit those who are now the beasts of burden of humanity to raise their backs and to become at last men.

We must, however, recognise that there are a few economists fully aware of the above truths. They gladly admit that Western Europe could grow much more food than it does; but they see no necessity nor advantage in doing so, as long as there are nations which can supply food in exchange for manufactured goods. Let us then examine how far this view is correct.

It is obvious that if we are satisfied with merely stating that it is cheaper to bring wheat from Riga than to grow it in Lincolnshire, the whole question is settled in a moment. But is it so in reality? Is it really cheaper to have food from abroad? And, supposing it

is, are we not yet bound to analyse that compound result which we call price, rather than to accept it as a supreme and blind ruler of our actions?

We know, for instance, how French agriculture is burdened by taxation. And yet, if we compare the prices of articles of food in France, which herself grows most of them, with the prices in this country, which imports them, we find no difference in favour of the importing country. On the contrary, the balance is rather in favour of France, and it decidedly was so for wheat until the new protective tariff was introduced. As soon as one goes out of Paris (where the prices are swollen by a heavy *octroi*), one finds that every *home produce* is cheaper in France than it is in England, and that the prices decrease further when we go farther East on the Continent.

There is, however, another feature still more unfavourable for this country: namely, the enormous development of the class of middlemen who stand between the importer and the home producer on the one side and the consumer on the other. We have lately heard a good deal about the quite disproportionate part of the prices we pay which goes into the middleman's pockets. We have all heard of the East-end clergyman who was compelled to become butcher in order to save his parishioners from the greedy middleman. We read in the papers that many farmers of the midland counties do not realise more than 9d. for a pound of butter, while the customer pays from 1s. 6d. to 1s. 8d.; and that from 1½d. to 2d. for the quart of milk is all that the Cheshire farmers can get, while we pay 4d. for the adulterated, and 5d. for the unadulterated milk. An analysis of the Covent Garden prices and a comparison of the same with retail prices, which was made some years ago in the *Daily News*, proved that the customer pays for vegetables at the rate of 6d. to 1s., and sometimes more, for each penny realised by the grower. But in a

country of imported food it *must* be so: the grower who himself sells his own produce disappears from its markets, and in his place appears the middleman.* If we move, however, towards the East, and go to Belgium, Germany, and Russia, we find that the cost of living is more and more reduced, so that finally we find that in Russia, which remains still agricultural, wheat costs one-half or two-thirds of its London prices, and meat is sold throughout the provinces at from five to ten farthings (kopecks) the pound. And we may therefore hold that it is not yet proved at all that it is cheaper to live on imported food than to grow it ourselves.

But if we analyse *price*, and make a distinction between its different elements, the disadvantage becomes still more apparent. If we compare, for instance, the costs of growing wheat in this country and in Russia, we are told that in the United Kingdom the hundredweight of wheat cannot be grown at less than 8s. 7d.; while in Russia the costs of production of the same hundredweight are estimated at from 3s. 6d. to 4s. 9d.† The difference is enormous, and it would still remain very great even if we admit that there is some exaggeration in the former figure. But why this difference? Are the Russian labourers paid so much less for their

* A few winters ago, a friend of mine, who lived in a London suburb, used to get his butter from Bavaria *per parcel post*. It cost him 10s. the eleven pounds in Bavaria, parcel post inclusive (2s. 2d.), 6d. the money order, and 2½d. the letter; total, less than 11s. Butter of an inferior quality (out of comparison), with 10 to 15 per cent. of water inclusive, was sold in London at 1s. 6d. the lb. at the same time.

† The data for the calculation of the cost of production of wheat in this country are those given by the *Mark Lane Express;* they will be found in a digestible form in an article on wheat-growing in the *Quarterly Review* for April, 1887, and in W. E. Bear's book, *The British Farmer and his Competitors*, London (Cassell), 1888. Although they are a little above the average, the crop taken for the calculations is also above the average. A similar inquiry has been made on a large scale by the Russian Provincial Assemblies, and the whole is summed up in an elaborate paper, in the *Vyestnik Promyshlennosti*, No. 49, 1887. To compare the paper kopecks with pence I took the rouble at $\frac{63}{100}$ of its nominal value: such was its average quotation during the year 1886. I took 475 English lb. in the quarter of wheat.

work? Their money wages surely are much lower, but the difference is equalised as soon as we reckon their wages in produce. The twelve shillings a week of the British agricultural labourer represents the same amount of wheat in Britain as the six shillings a week of the Russian labourer represents in Russia,* not to say a word about the cheapness of meat in Russia and the low house rent. The Russian labourer is thus paid the same amount of the produce grown as he is paid here. As to the supposed prodigious fertility of the soil in the Russian prairies, it is a fallacy. Crops of from sixteen to twenty-three bushels per acre are considered good crops in Russia, while the average hardly reaches thirteen bushels, even in the corn-exporting parts of the empire. Besides, the amount of labour which is necessary to grow wheat in Russia with no thrashing-machines, with a plough dragged by a horse hardly worth the name, with no roads for transport, and so on, is certainly much greater than the amount of labour which is necessary to grow the same amount of wheat in Western Europe.

When brought to the London market, Russian wheat was sold in 1887 at 31s. the quarter, while it appeared from the same *Mark Lane Express* figures that the quarter of wheat could not be grown in this country at less than 36s. 8d., even if the straw be sold, which is not always the case. But the difference of the land rent in both countries would alone account for the difference of prices. In the wheat belt of Russia, where the

* It results from the detailed figures given by the Agricultural Department (*The Year 1885 with regard to Agriculture*, vol. ii.), that the average wages of the agricultural labourers were from 180 kopecks a week in middle Russia to 330 kopecks in the wheat-exporting belt (from 3s. 9d. to 6s. 6d.), and from 5s. 6d. to 10s. 5d. during the harvest. Since 1885 the wages went up in both countries; the average wages of the English labourer were given for 1896 at 13s. 7d. If the Russian labourer is so miserable in comparison with the English, it is due chiefly to the exceedingly high personal taxation and several other causes which cannot be here treated incidentally.

average rent stands at about 12s. per acre, and the crop is from fifteen to twenty bushels, the rent amounts to from 3s. 6d. to 5s. 8d. in the costs of production of each quarter of Russian wheat; while in this country, where the rent and taxes are valued (in the *Mark Lane Express* figures) at no less than 40s. per each wheat-growing acre, and the crop is taken at thirty bushels, the rent amounts to 10s. in the costs of production of each quarter.* But even if we take only 30s. per acre of rent and taxes, and an average crop of twenty-eight bushels, we still have 8s. 8d. out of the sale price of each quarter of wheat, which goes to the landlord and the State. If it costs so much more in money to grow wheat in this country while the amount of labour is so much less in this country than in Russia, it is due to the very great height of the land rents attained during the years 1860-1880. But this growth itself was due to the facilities for realising large profits on the sale of manufactured goods abroad. The false condition of British rural economy, not the infertility of the soil, is thus the chief cause of the Russian competition.

Much more ought to be said with regard to the American competition, and therefore I must refer the reader to the remarkable series of articles dealing with the whole of the subject which Schaeffle published in 1886 in the *Zeitschrift für die gesammte Staatswissenschaft*, and to a most elaborate article on the costs of growing wheat all over the world which appeared in April, 1887, in the *Quarterly Review*. The conclusions of these two writers are fully corroborated by the yearly reports of the American Board of Agriculture, and Schaeffle's previsions were fully supported by the subse-

* The rents have declined since 1887, but the prices of wheat also went down. It must not be forgotten that as the best acres only are selected for wheat-growing, the rent for each acre upon which wheat is grown must be taken higher than the average rent per acre in a farm of from 200 to 300 acres.

quent reports of Mr. J. R. Dodge. It appears from these works that the fertility of the American soil had been grossly exaggerated, as the masses of wheat which America sends to Europe from its north-western farms are grown on a soil the natural fertility of which is not higher, and often lower, than the average fertility of the unmanured European soil. The Casselton farm in Dakota, with its twenty bushels per acre, is an exception; while the average crop of the chief wheat-growing States in the West is only from eleven to twelve bushels. If we wish to find a fertile soil in America, and crops of from thirty to forty bushels, we must go to the old Eastern States, where the soil is made by man's hands.* But we shall not find it in the Territories, which are satisfied with crops of from eight to nine bushels. The same is true with regard to the American supplies of meat. Schaeffle has pointed out that the great mass of live stock which we see in the census of cattle in the States is not reared in the prairies, but in the stables of the farms, in the same way as in Europe; as to the prairies, we find on them only one-eleventh part of the American horned cattle, one-fifth of the sheep and one-twenty-first of the pigs.† "Natural fertility" being thus out of question, we must look for social causes; and we have them, for the Western States, in the cheapness of land and a proper organisation of production; and for the Eastern States in the rapid progress of *intensive* high farming.

It is evident that the methods of culture must vary according to different conditions. In the vast prairies

* L. de Lavergne pointed out as far back as forty years ago that the States are the chief importers of guano. In 1854 they imported it almost to the same amount as this country, and they had, moreover, sixty-two manufactories of guano which supplied it to the amount of sixteen times the imports. Compare also Ronna's *L'agriculture aux Etats Unis*, 1881; Lecouteux, *Le blé;* and J. R. Dodge's *Annual Report of the American Department of Agriculture* for 1885 and 1886. Schaeffle's work is also summed up in Schmoller's *Jahrbuch*.

† See also J. R. Dodge's *Farm and Factory*, New York, 1884.

of North America, where land could be *bought* from 8s. to 40s. the acre, and where spaces of from 100 to 150 square miles in one block could be given to wheat culture, special methods of culture were applied and the results were excellent. Land was bought—not rented. In the autumn, whole studs of horses were brought, and the tilling and sowing were done with the aid of formidable ploughs and sowing machines. Then the horses were sent to graze in the mountains; the men were dismissed, and one man, occasionally two or three, remained to winter on the farm. In the spring the owners' agents began to beat the inns for hundreds of miles round, and engaged labourers and tramps, both freely supplied by Europe, for the crop. Battalions of men were marched to the wheat fields, and were camped there; the horses were brought from the mountains, and in a week or two the crop was cut, thrashed, winnowed, put in sacks, by specially invented machines, and sent to the next elevator, or directly to the ships which carried it to Europe. Whereupon the men were disbanded again, the horses were sent back to the grazing grounds, or sold, and again only a couple of men remained on the farm.

The crop from each acre was small, but the machinery was so perfected that in this way 300 days of one man's labour produced from 200 to 300 quarters of wheat; in other words—the area of land being of no account—every man produced in one day his yearly bread food (eight and a half bushels of wheat); and taking into account all subsequent labour, it was calculated that the work of 300 men in one single day delivered to the consumer at Chicago the flour that is required for the yearly food of 250 persons. Twelve hours and a half of work are thus required in Chicago to supply one man with his yearly provision of wheat-flour.

Under the special conditions offered in the Far West this certainly was an appropriate method for increasing

all of a sudden the wheat supplies of mankind. It answered its purpose when large territories of unoccupied land were opened to enterprise. But it could not answer for ever. Under such a system of culture the soil was soon exhausted, the crop declined, and *intensive* agriculture (which aims at high crops on a limited area) had soon to be resorted to. Such was the case in Iowa in the year 1878. Up till then, Iowa was an emporium for wheat-growing on the lines just indicated. But the soil was already exhausted, and when a disease came the wheat plants had no force to resist it. In a few weeks nearly all the wheat crop, which was expected to beat all previous records, was lost; eight to ten bushels per acre of bad wheat were all that could be cropped. The result was that "mammoth farms" had to be broken up into small farms, and that the Iowa farmers (after a terrible crisis of short duration—everything is rapid in America) took to a more intensive culture. Now, they are not behind France in wheat culture, as they already grow an average of sixteen and a half bushels per acre on an area of more than 2,000,000 acres, and they will soon win ground. Somehow, with the aid of manure and improved methods of farming they compete admirably with the mammoth farms of the Far West.

In fact, over and over again it was pointed out, by Schaeffle, Semler, Oetken, and many other writers, that the force of "American competition" is not in its mammoth farms, but in the countless small farms upon which wheat is grown in the same way as it is grown in Europe, *i.e.*, with manuring, but with a better organised production and facilities for sale, and without being compelled to pay to the landlord a toll of one-third part, or more, of the selling price of each quarter of wheat. However, it was only after I had myself made a tour in the prairies of Manitoba that I could realise the full truth of the just-mentioned views. The 15,000,000 to 20,000,000 bushels of wheat, which are exported every

year from Manitoba, are grown almost entirely in farms of one or two "quarter-sections," *i.e.*, of 160 and 320 acres. The ploughing is made in the usual way, and in an immense majority of cases the farmers buy the reaping and binding machines (the "binders") by associating in groups of four. The thrashing machine is rented by the farmer for one or two days, and the farmer carts his wheat to the elevator with his own horses, either to sell it immediately or to keep it at the elevator if he is in no immediate need of money and hopes to get a higher price in one month or two. In short, in Manitoba one is especially struck with the fact that, even under a system of keen competition, the middle-size farm admirably well competes with the mammoth farm, and that it is not manufacturing wheat on a grand scale which pays best. It is also most interesting to note that thousands and thousands of farmers produce mountains of wheat in the Canadian province of Toronto and in the Eastern States, although the land is not prairie-land at all, and the farms are, as a rule, small.

The force of "American competition" is thus not in the possibility of having hundreds of acres of wheat in one block. It lies in the ownership of the land, in a system of culture which is appropriate to the character of the country, in a widely developed spirit of association, and, finally, in a number of institutions and customs intended to lift the agriculturist and his profession to a high level which is unknown in Europe.

In Europe we do not realise at all what is done in the States and Canada in the interests of agriculture. In every American State, and in every distinct region of Canada, there is an experimental farm, and all the work of preliminary experiment upon new varieties of wheat, oats, barley, fodder and fruit, which the farmer has mostly to make himself in Europe, is made under the best scientific conditions at the experimental farms, on a small scale first and on a large scale next. The

results of all these researches and experiments are not merely rendered accessible to the farmer who would like to know them, but they are brought to his knowledge, and, so to speak, are forced upon his attention by every possible means. The "Bulletins" of the experimental stations are distributed in hundreds of thousands of copies; visits to the farms are organised in such a way that thousands of farmers should inspect the stations every year, and be shown by specialists the results obtained, either with new varieties of plants or under various new methods of treatment. Correspondence is carried on with the farmers on such a scale that, for instance, at Ottawa, the experimental farm sends out every year a hundred thousand letters and packets. Every farmer can get, free of charge and postage, three pounds of seed of any variety of cereals, out of which he can get next year the necessary seed for sowing several acres. And, finally, in every small and remote township there are held farmers' meetings, at which special lecturers, who are sent out by the experimental farms or the local agricultural societies, discuss with the farmers in an informal way the results of last year's experiments and discoveries relative to every branch of agriculture, horticulture, cattle-breeding, dairying and agricultural co-operation.*

American agriculture really offers an imposing sight. Not in the wheat fields of the far West, which soon will become a thing of the past, but in the development of rational agriculture and the forces which promote it. Read the description of an agricultural exhibition, "the State's fair," in some small town of Iowa, with its 70,000 farmers camping with their families in tents during the fair's week, studying, learning, buying and selling, and enjoying life. You see a *national* fête, and

* Some additional information on this subject will be found in the articles of mine: "Some Resources of Canada," and "Recent Science," in *The Nineteenth Century*, January, 1898, and October, 1897.

you feel that you deal with a nation in which agriculture is in respect. Or read the publications of the scores of experimental stations, whose reports are distributed broadcast over the country, and are read by the farmers and discussed at countless "farmers' meetings". Consult the "Transactions" and "Bulletins" of the countless agricultural societies, not royal but popular; study the grand enterprises for irrigation; and you will feel that American agriculture is a real force, imbued with life, which no longer fears mammoth farms, and needs not to cry like a child for protection.

"Intensive" agriculture and gardening are already by this time as much a feature of the treatment of the soil in America as they are in Belgium. As far back as the year 1880, nine States, among which were Georgia, Virginia and the two Carolinas, bought £5,750,000 worth of artificial manures; and we are told that by this time the use of artificial manure has immensely spread towards the West. In Iowa, where mammoth farms used to exist twenty years ago, sown grass is already in use, and it is highly recommended by both the Iowa Agricultural Institute and the numerous local agricultural papers; while at the agricultural competitions the highest awards are given, not for extensive farming, but for high crops on small areas. Thus, at a recent competition in which hundreds of farmers took part, the first ten prizes were awarded to ten farmers who had grown, on three acres each, from 262 to 346¾ bushels of Indian corn, in other words *from 87 to 115 bushels to the acre.* This shows where the ambition of the Iowa farmer goes. In Minnesota the prizes were given two years ago for crops of 300 to 1120 bushels of potatoes to the acre, *i.e.*, from eight and a quarter to thirty-one tons to the acre, while the average potato crop in Great Britain is only six tons.

At the same time market-gardening is immensely extending in America. In the market-gardens of Florida

we see such crops as 445 to 600 bushels of onions per acre, 400 bushels of tomatoes, 700 bushels of sweet potatoes, which testify to a high development of culture. As to the "truck farms" (market-gardening for export by steamer and rail), they covered, in 1892, 400,000 acres, and the fruit farms in the suburbs of Norfolk, in Virginia, were described by Prof. Ch. Baltet * as real *models* of that sort of culture—a very high testimony in the mouth of a French gardener who himself comes from the model *marais* of Troyes.

And while people in London continue to pay almost all the year round twopence for a lettuce (very often imported from Paris), they have at Chicago and Boston those unique establishments in the world where lettuces are grown in immense greenhouses with the aid of electric light; and we must not forget that although the discovery of "electric" growth is European (it is due to Siemens), it was at the Cornell University that it was proved by a series of experiments that electric light is an admirable aid for forwarding the growth of the *green* parts of the plant.

In short, America, which formerly took the lead in bringing "extensive" agriculture to perfection, now takes the lead in "intensive," or forced, agriculture as well. In this adaptability lies the real force of American competition.

* *L'Horticulture dans les cinq Parties du Monde.* Paris, 1895.

CHAPTER IV.

THE POSSIBILITIES OF AGRICULTURE—(*continued*).

The doctrine of Malthus—Progress in wheat-growing—East Flanders—Jersey—Potato crops, past and present—Irrigation—Major Hallet's experiments—Planted wheat.

FEW books have exercised so pernicious an influence upon the general development of economic thought as Malthus's *Essay on the Principle of Population* exercised for three consecutive generations. It appeared at the right time, like all books which have had any influence at all, and it summed up ideas already current in the minds of the wealth-possessing minority. It was precisely when the ideas of equality and liberty, awakened by the French and American revolutions, were still permeating the minds of the poor, while the richer classes had become tired of their amateur excursions into the same domains, that Malthus came to assert, in reply to Godwin, that no equality is possible; that the poverty of the many is not due to institutions, but is a natural *law*. Population, he wrote, grows too rapidly and the new-comers find no room at the feast of nature; and that law cannot be altered by any change of institutions. He thus gave to the rich a kind of scientific argument against the ideas of equality; and we know that though all dominion is based upon force, force itself begins to totter as soon as it is no longer supported by a firm belief in its own rightfulness.

As to the poorer classes—who always resent the influence of ideas circulating at a given time amid the wealthier classes—it deprived them of the very hope of improvement; it made them sceptical as to the promises of the social reformers; and to this day the most advanced reformers entertain doubts as to the possibility of satisfying the needs of all, in case there should be a claim for their satisfaction, and a temporary welfare of the labourers resulted in a sudden increase of population.

Science, down to the present day, remains permeated with Malthus's teachings. Political economy continues to base its reasoning upon a tacit admission of the impossibility of rapidly increasing the productive powers of a nation, and of thus giving satisfaction to all wants. That postulate stands, undiscussed, in the background of whatever political economy, classical or socialist, has to say about exchange value, wages, sale of labour force, rent, exchange, and consumption. Political economy never rises above the hypothesis of *a limited and insufficient supply of the necessaries of life;* it takes it for granted. And all theories connected with political economy retain the same erroneous principle. Nearly all socialists, too, admit the postulate. Nay, even in biology (so deeply interwoven now with sociology) we have recently seen the theory of variability of species borrowing a quite unexpected support from its having been connected by Darwin and Wallace with Malthus's fundamental idea, that the natural resources must inevitably fail to supply the means of existence for the rapidly multiplying animals and plants. In short, we may say that Malthus's theory, by shaping into a pseudo-scientific form the secret desires of the wealth-possessing classes, became the foundation of a whole system of practical philosophy, which permeates the minds of both the educated and uneducated, and reacts (as practical

philosophy always does) upon the theoretical philosophy of our century.

True, the formidable growth of the productive powers of man in the industrial field, since he tamed steam and electricity, has somewhat shaken Malthus's doctrine. Industrial wealth *has* grown at a rate which no possible increase of population could attain, and it *can* grow with still greater speed. But agriculture is still considered a stronghold of the Malthusian pseudo-philosophy. The recent achievements of agriculture and horticulture are not sufficiently well known; and while our gardeners defy climate and latitude, acclimatise sub-tropical plants, raise several crops a year instead of one, and themselves make the soil they want for each special culture, the economists nevertheless continue saying that the surface of the soil is limited, and still more its productive powers; they still maintain that a population which should double each thirty years would soon be confronted by a lack of the necessaries of life!

A few data to illustrate what *can* be obtained from the soil were given in the preceding chapter. But the deeper one goes into the subject the more new and striking data does he discover, and the more Malthus's fears appear groundless.

To begin with an instance taken from culture in the open field—namely, that of wheat—we come upon the following interesting fact. While we are so often told that wheat-growing does not pay, and England consequently reduces from year to year the area of its wheat fields, the French peasants steadily increase the area under wheat, and the greatest increase is due to those peasant families which themselves cultivate the land they own. Since the end of the last century they have nearly doubled both the area under wheat, as well as the returns from each acre, so as to increase almost fourfold

the amount of wheat grown in France.* At the same time the population has only increased by 41 per cent., so that the ratio of increase of the wheat crop has been six times greater than the ratio of increase of population, although agriculture has been hampered all the time by a series of serious obstacles—taxation, military service, poverty of the peasantry, and even, up to 1884, a severe prohibition of all sorts of association among the peasants. It must also be remarked that during the same hundred years, and even within the last fifty years, market-gardening, fruit-culture and culture for industrial purposes have immensely developed in France, so that there would be no exaggeration in saying that the French obtain now from their soil at least six or seven times more than they obtained a hundred years ago. The "means of existence" drawn from the soil have thus grown about fifteen times quicker than the population.

But the ratio of progress in agriculture is still better seen from the rise of the standard of requirement as regards cultivation of land. Some thirty years ago the French considered a crop quite good when it yielded twenty-two bushels to the acre; but with the same soil the present requirement is at least thirty-three bushels, while in the best soils the crop is good only when it yields from forty-three to forty-eight bushels, and occasionally the product is as much as fifty-five bushels to the acre.† There are whole countries—Hesse, for example

* The researches of Tisserand may be summed up as follows:—

Year.	Population in millions.	Acres under wheat.	Average crop in bushels per acre.	Wheat crop in bushels.
1789	27·0	9,884,000	9	87,980,000
1831-41	33·4	13,224,000	15	194,225,000
1882-88	38·2	17,198,000	18	311,619,000

† Grandeau, *Etudes agronomiques*, 2e série. Paris, 1888.

—which are satisfied only when the *average* crop attains thirty-seven bushels; while the experimental farms of Central France produce from year to year, over large areas, forty-one bushels to the acre, and a number of farms in Northern France regularly yield, year after year, from fifty-five to sixty-eight bushels to the acre. Occasionally even so much as eighty bushels have been obtained upon limited areas under special care.* In fact, Prof. Grandeau considers it proved that by combining a series of such operations as the selection of seeds, sowing in rows, and proper manuring, the crops can be largely increased over the best present average, while the cost of production can be reduced by 50 per cent. by the use of inexpensive machinery; to say nothing of costly machines like the steam digger, or the pulverisers which make the soil required for each special culture. They are now occasionally resorted to here and there, and they surely will come into general use as soon as humanity feels the need of largely increasing its agricultural product.

When we bear in mind the very unfavourable conditions in which agriculture stands now all over the world, we must not expect to find considerable progress in its methods realised over wide regions; we must be satisfied with noting the advance accomplished in separate, especially favoured spots, where, for one cause or another, the tribute levied upon the agriculturist was not so heavy as to stop all possibility of progress.

One such example may be seen in the district of Saffelare in East Flanders. On a territory of 37,000 acres, all taken, a population of 30,000 inhabitants, all peasants, not only finds its food, but manages, moreover, to keep

* Risler, *Physiologie et Culture du Blé*. Paris, 1886. Taking the whole of the wheat crop in France, we see that the following progress has been realised. In 1872-1881 the average crop was 14·8 quintaux per hectare. In 1882-1890 it attained 16·9 quintaux per hectare. Increase by 14 per cent. in ten years (Prof. C. V. Garola, *Les Céréales*, p. 70 *seq.*).

no less than 10,720 horned cattle, 3800 sheep, 1815 horses and 6550 swine, to grow flax, and to export various agricultural produce.*

Another illustration of this sort may be taken from the Channel Islands, whose inhabitants have happily not known the blessings of Roman law and landlordism, as they still live under the common law of Normandy. The small island of Jersey, eight miles long and less than six miles wide, still remains a land of open-field culture; but, although it comprises only 28,707 acres, rocks included, it nourishes a population of about two inhabitants to each acre, or 1300 inhabitants to the square mile, and there is not one writer on agriculture who, after having paid a visit to this island, does not praise the well-being of the Jersey peasants and the admirable results which they obtain in their small farms of from five to twenty acres,—very often less than five acres—by means of a rational and intensive culture.

Most of my readers will probably be astonished to learn that the soil of Jersey, which consists of decomposed granite, with no organic matter in it, is not at all of astonishing fertility, and that its climate, though more sunny than the climate of these isles, offers many drawbacks on account of the small amount of sun-heat during the summer and of the cold winds in spring. But so it is in reality, and at the beginning of this century the inhabitants of Jersey lived chiefly on imported food. (See Appendix J.) The successes accomplished lately in Jersey are entirely due to the amount of labour which a dense population is putting in the land; to a system of land-tenure, land-transference and inheritance very different from those which prevail elsewhere; to freedom from State taxation; and to the fact that communal institutions have been maintained down to quite a recent period, while a number

* O. de Kerchove de Denterghen, *La petite Culture des Flandres belges* Gand, 1878.

of communal habits and customs of mutual support, derived therefrom, are alive to the present time. As to the fertility of the soil, it is made partly by the sea-weeds gathered free on the sea-coast, but chiefly at Blaydon-on-Tyne, out of all sorts of refuse—inclusive of bones shipped from Plevna and mummies of cats shipped from Egypt.

It is well known that for the last thirty years the Jersey peasants and farmers have been growing early potatoes on a great scale, and that in this line they have attained most satisfactory results. Their chief aim being to have the potatoes out as early as possible, when they fetch at the Jersey Weigh-Bridge as much as £17 and £20 the ton, the digging out of potatoes begins, in the best sheltered places, as early as the first days of May, or even at the end of April. Quite a system of potato-culture, beginning with the selection of tubers, the arrangements for making them germinate, the selection of properly sheltered and well situated plots of ground, the choice of proper manure, and ending with the box in which the potatoes germinate and which has so many other useful applications,—quite a system of culture has been worked out in the island for that purpose by the collective intelligence of the peasants.*

In the last weeks of May and in June, when the export is at its height, quite a fleet of steamers runs between this small island and various ports of England and Scotland. Every day eight to ten steamers

* One could not insist too much on the collective character of the development of that branch of husbandry. In many places of the south coast early potatoes can also be grown—to say nothing of Cornwall and South Devon, where potatoes are obtained by separate labourers in small quantities as early as they are obtained in Jersey. But so long as this culture remains the work of isolated growers, its results must necessarily be inferior to what the Jersey peasants obtain through their collective experience. For the technical details concerning potato-culture in Jersey, see a paper by a Jersey grower, in the *Journal of Horticulture*, 22nd and 29th May, 1890.

enter the harbour of St. Hélier, and in twenty-four hours they are loaded with potatoes and steer for London, Southampton, Liverpool, Newcastle, and Scotland. From 50,000 to 60,000 tons of potatoes, valued at from £260,000 to £500,000, according to the year, are thus exported every summer; and, if the local consumption be taken into account, we have at least 60,000 to 70,000 tons that are obtained, although no more than from 6500 to 7500 acres are given to all potato crops, early and late—early potatoes, as is well known, never giving as heavy crops as the later ones, Ten to eleven tons per acre is thus the average, while in this country the average is only six tons per acre.

As soon as the potatoes are out the second crop of mangold or of "three months' wheat" (a special variety of rapidly growing wheat) is sown. Not one day is lost in putting it in. The potato-field may consist of one or two acres only, but as soon as one-fourth part of it is cleared of the potatoes it is sown with the second crop. One may thus see a small field divided into four plots, three of which are sown with wheat at five or six days' distance from each other, while on the fourth plot the potatoes are being dug out.

The admirable condition of the meadows and the grazing land in the Channel Islands has often been described, and although the aggregate area which is given in Jersey to green crops, grasses under rotation, and permanent pasture—both for hay and grazing—is less than 11,000 acres, they keep in Jersey over 12,300 head of cattle and over 2300 horses solely used for agriculture and breeding.

Moreover, about 100 bulls and 1600 cows and heifers are exported every year,* so that by this time, as was remarked in an American paper, there are more Jersey cows in America than in Jersey Island. Jersey milk

* See Appendix J.

and butter have a wide renown, as also the pears which are grown in the open air, but each of which is protected on the tree by a separate cap, and still more the fruit and vegetables which are grown in the hothouses. In a word, it will suffice to say that on the whole they obtain agricultural produce to the value of £50 to each acre of the aggregate surface of the island.

Fifty pounds' worth of agricultural produce from each acre of the land is sufficiently good. But the more we study the modern achievements of agriculture the more we see that the limits of productivity of the soil are not attained, even in Jersey. New horizons are continually unveiled. For the last fifty years science—especially chemistry—and mechanical skill have been widening and extending the industrial powers of man upon organic and inorganic dead matter. Prodigies have been achieved in that direction. Now comes the turn of similar achievements with living plants. Human skill in the treatment of living matter, and science—in its branch dealing with living organisms—step in with the intention of doing for the art of food-growing what mechanical and chemical skill have done in the art of fashioning and shaping metals, wood and dead fibres of plants. Almost every new year brings some new, often unexpected improvement in the art of agriculture, which for so many centuries had been dormant.

We just saw that while the average potato crop in the country is six tons per acre, in Jersey it is nearly twice as big. But Mr. Knight, whose name is well known to every horticulturist in this country, has once dug out of his fields no less than 1284 bushels of potatoes, or thirty-four tons and nine cwts. in weight, on one single acre; and at a recent competition in Minnesota 1120 bushels, or thirty tons, could be ascertained as having been grown on one acre.

These are undoubtedly extraordinary crops, but quite

recently the French Professor Aimé Girard undertook a series of experiments in order to find out the best conditions for growing potatoes in his country.* He did not care for show-crops obtained by means of extravagant manuring, but carefully studied all conditions: the best variety, the depth of tilling and planting, the distance between the plants. Then he entered into correspondence with some 350 growers in different parts of France, advised them by letters, and finally induced them to experiment. Strictly following his instructions, several of his correspondents made experiments on a small scale, and they obtained—instead of the three tons which they were accustomed to grow—such crops as would correspond to twenty and thirty-six tons to the acre.† Moreover, ninety growers experimented on fields more than one-quarter of an acre in size, and more than twenty growers made their experiments on larger areas of from three to twenty-eight acres. The result was that *none of them obtained less than twelve tons* to the acre, while some obtained twenty tons, and the average was, for the 110 growers, fourteen and a half tons per acre.

However, industry requires still heavier crops. Potatoes are largely used in Germany and Belgium for distilleries; consequently, the distillery owners try to obtain the greatest possible amounts of starch from the acre. Extensive experiments have lately been made for that purpose in Germany, and the crops were: nine tons per acre for the poor sorts, fourteen tons for the better ones, and thirty-two and four-tenths tons for the best varieties of potatoes.

Three tons to the acre and more than thirty tons to the acre are thus the ascertained limits; and one necessarily asks oneself: Which of the two requires *less*

* See the *Annales agronomiques* for 1892 and 1893; also *Journal des Economistes*, février, 1893, p. 215.

† Fifty to ninety tons per hectare.

labour in tilling, planting, cultivating and digging, and less expenditure in manure—thirty tons grown on ten acres, or the same thirty tons grown on one acre or two? If labour is of no consideration, while every penny spent in seeds and manure is of great importance, as is unhappily very often the case with the peasant—he will perforce choose the first method. But is it the most economic?

Again, I just mentioned that in the Saffelare district and Jersey they succeed in keeping one head of horned cattle to each acre of green crops, meadows and pasture land, while elsewhere two or three acres are required for the same purpose. But better results still can be obtained by means of irrigation, either with sewage or even with pure water. In England, farmers are contented with one and a half and two tons of hay per acre, and in the part of Flanders just mentioned, two and a half tons of hay to the acre are considered a fair crop. But on the irrigated fields of the Vosges, the Vaucluse, etc., in France, six tons of dry hay become the rule, even upon ungrateful soil; and this means considerably more than the annual food of one milch cow (which can be taken at a little less than five tons) grown on each acre. All taken, the results of irrigation have proved so satisfactory in France that during the years 1862-82 no less than 1,355,000 acres of meadows have been irrigated,* which means that the annual meat-food of at least 1,500,000 full-grown persons, or more, has been added to the yearly income of the country; home-grown, not imported. In fact, in the valley of the Seine, the value of the land was doubled by irrigation; in the Saône valley it was increased five times, and ten times in certain *landes* of Britanny.†

* Barral in *Journal d'Agriculture pratique*, 2 février, 1889; Boitel, *Herbages et Prairies naturelles*, Paris, 1887.

† The increase of the crops due to irrigation is most instructive. In the most unproductive Sologne, irrigation has increased the hay crop

The example of the Campine district, in Belgium, is classical. It was a most unproductive territory—mere sand from the sea, blown into irregular mounds which were only kept together by the roots of the heath; the acre of it used to be sold, not rented, at from 5s. to 7s. (15 to 20 francs per hectare). But now it is capable, thanks to the work of the Flemish peasants and to irrigation, to produce the food of one milch cow per acre—the dung of the cattle being utilised for further improvements.

The irrigated meadows round Milan are another well-known example. Nearly 22,000 acres are irrigated there with water derived from the sewers of the city, and they yield crops of from eight to ten tons of hay as a rule; occasionally some separate meadows will yield the fabulous amount—fabulous to-day, but no longer fabulous to-morrow—of eighteen tons of hay per acre, that is, the food of nearly four cows to the acre, and nine times the yield of good meadows in this country.* However, English readers need not go so far as Milan for ascertaining the results of irrigation by sewer water. They have several such examples in this country, in the experiments of Sir John Lawes, and especially at Craigentinny, near Edinburgh, where, to use Ronna's words, "the growth of rye grass is so activated that it attains its full development in one year instead of in three to four years. Sown in August, it gives a first crop in autumn, and then, beginning with next spring, a crop of four tons to the acre is taken every month; which

from two tons per hectare (two and a half acres) to eight tons; in the Vendée, from four tons of bad hay to ten tons of excellent hay. In the Ain, M. Puris, having spent 19,000 francs for irrigating ninety-two and a half hectares (about £2 10s. per acre), obtained an increase of 207 tons of excellent hay. In the south of France, a net increase of over four bushels of wheat per acre is easily obtained by irrigation; while for market-gardening the increase was found to attain £30 to £40 per acre. (See H. Sagnier, "Irrigation," in Barral's *Dictionnaire d'Agriculture*, vol. iii., p. 339.)

* *Dictionnaire d'Agriculture*, same article. See also Appendix I.

represents in the fourteen months more than fifty-six tons (of green fodder) to the acre." * At Lodge Farm they grow forty to fifty-two tons of green crops per acre, after the cereals, without new manuring. At Aldershot they obtain excellent potato crops; and at Romford (Breton's Farm) Colonel Hope obtained, in 1871-2, quite extravagant crops of various roots and potatoes.†

It can thus be said that while at the present time we give two and three acres for keeping one head of horned cattle, and only in a few places one head of cattle is kept on each acre given to green crops, meadows and pasture, man has already in irrigation (which very soon repays when it is properly made) the possibility of keeping twice and even thrice as many head of cattle to the acre over parts of his territory. Moreover, the very heavy crops of roots which are now obtained (seventy-five of 110 tons of beetroot to the acre are not infrequent) give another powerful means for increasing the number of cattle without taking the land from what is now given to the culture of cereals.

Another new departure in agriculture, which is full of promises and probably will upset many a current notion, must be mentioned in this place. I mean the almost horticultural treatment of our corn crops, which is widely practised in the far East, and begins to claim our attention in Western Europe as well.

At the First International Exhibition, in 1851, Major Hallett, of Manor House, Brighton, had a series of very interesting exhibits which he described as "pedigree cereals". By picking out the best plants of his fields, and by submitting their descendants to a careful selec-

* Ronna, *Les Irrigations*, vol. iii., p. 67. Paris, 1890.

† Prof. Ronna gives the following figures of crops per acre: twenty-eight tons of potatoes, sixteen tons of marigolds, 105 tons of beet, 110 tons of carrots, nine to twenty tons of various cabbage, and so on. Most remarkable results seem also to have been obtained by M. Goppart, by growing green fodder for ensilage. See his work, *Manuel de la Culture des Maïs et autres Fourrages verts*, Paris, 1877.

tion from year to year, he had succeeded in producing new prolific varieties of wheat and barley. Each grain of these cereals, instead of giving only two to four ears, as is the usual average in a corn-field, gave ten to twenty-five ears, and the best ears, instead of carrying from sixty to sixty-eight grains, had an average of nearly twice that number of grains.

In order to obtain such prolific varieties Major Hallett naturally could not sow his picked grains broadcast; he planted them, each separately, in rows, at distances of from ten to twelve inches from each other. In this way he found that each grain, having full room for what is called "tillering" (*tallage* in French *), would produce ten, fifteen, twenty-five, and even up to ninety and 100 ears, as the case may be; and as each ear would contain from 60 to 120 grains, crops of 500 to 2500 grains, or more, could be obtained from each separately planted grain. He even exhibited at the Exeter meeting of the British Association three plants of wheat, barley and oats, each from a single grain, which had the following number of stems; wheat, ninety-four stems; barley, 110 stems; oats, eighty-seven stems.† The barley plant which had 110 stems thus gave something like 5000 to 6000 grains from one single grain. A careful drawing of that wonderful stubble was made by Major Hallett's daughter and circulated with his pamphlets.‡

* "Shortly after the plant appears above ground it commences to throw out new and distinct stems, upon the first appearance of which a correspondent root-bud is developed for its support; and while the new stems grow out flat over the surface of the soil, their respective roots assume a corresponding development beneath it. This process, called 'tillering,' will continue until the season arrives for the stems to assume an upright growth." The less the roots have been interfered with by overcrowding the better will be the ears (Major Hallett, "Thin Seeding," etc.).

† Paper on "Thin Seeding and the Selection of Seed," read before the Midland Farmers' Club, 4th June, 1874.

‡ "Pedigree Cereals," 1889. Paper on "Thin Seeding," etc., just mentioned. Abstracts from *The Times*, etc., 1862. Major Hallett contributed, moreover, several papers to the *Journal of the Royal Agricultural Society*, and one to *The Nineteenth Century*. By the courtesy of the Co-operative Wholesale Society, I am enabled to reproduce that drawing from a paper I contributed to the Society's *Annual* for 1897.

Again, in 1876, a wheat plant, with "105 heads growing on one root, on which more than 8000 grains were growing at once," was exhibited at the Maidstone Farmers' Club.*

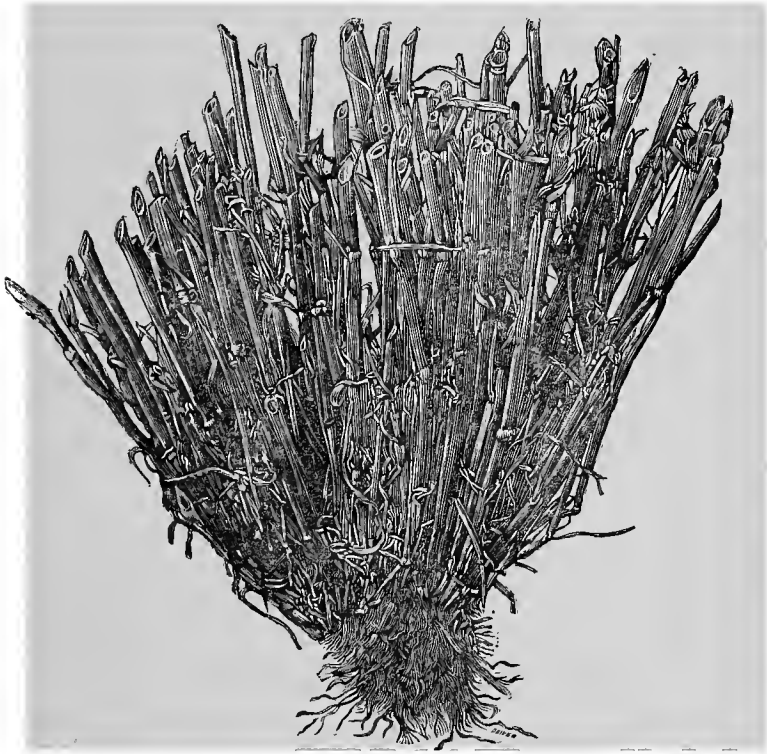

FIG. 4.—Plant of barley, with 110 stems, obtained by Major Hallett from one single planted grain.

Two different processes were thus involved in Hallett's experiments: a process of selection, in order to create new varieties of cereals, similar to the breeding of new

* *Agricultural Gazette*, 3rd January, 1876. Ninety ears, some of which contained as many as 132 grains each, were also obtained in New Zealand.

varieties of cattle; and a method of immensely increasing the crop from each grain and from a given area, by planting each seed separately and wide apart, so as to have room for the full development of the young plant, which is usually suffocated by its neighbours in our corn-fields.*

The double character of Major Hallett's method—the breeding of *new prolific varieties*, and the method of culture by *planting the seeds wide apart*—seems, however, so far as I am entitled to judge, to have been overlooked until quite lately. The method was mostly judged upon its results; and when a farmer had experimented upon "Hallett's Wheat," and found out that it was late in ripening in his own locality, or gave a less perfect grain than some other variety, he usually did not care more about the method.† However, Major Hallett's successes or non-successes in breeding such or such varieties are quite distinct from what is to be said about the method itself of selection, or the method of planting wheat seeds wide apart. Varieties which were bred on the windy downs of Brighton may be, or may not be, suitable to this or that locality. Latest physiological researches give such an importance to evaporation in the bringing of cereals to maturity that where evaporation is not so rapid as it is on the Brighton Downs, other varieties must be resorted to and bred on purpose.‡ I should also suggest that quite different

* It appears from many different experiments (mentioned in Prof. Garola's excellent work, *Les Céréales*, Paris, 1892) that when tested seeds (of which no more than 6 per cent. are lost on sowing) are sown broadcast, to the amount of 500 seeds per square metre (a little more than one square yard), *only 148 of them give plants*. Each plant gives in such case from two to four stems and from two to four ears; but nearly 360 seeds are entirely lost. When sown in rows, the loss is not so great, but it is still considerable.

† See Prof. Garola's remarks on "Hallett's Wheat," which, by the way, seem to be well known to farmers in France and Germany (*Les Céréales*, p. 337).

‡ Besides, Hallett's wheat must not be sown later than the first week of September. Those who may try experiments with planted wheat must be especially careful to make the experiments in open fields, not in a back garden, and to sow early.

wheats than the English ought to be experimented upon for obtaining prolific varieties; namely, the quickly-growing Norwegian wheat, the Jersey "three months' wheat," or even Yakutsk barley, which matures with an astonishing rapidity. And now that horticulturists, so experienced in "breeding" and "crossing" as Vilmorin, Carter, Sherif, W. Saunders in Canada and many others are, have taken the matter in hand, we may feel sure that future progress will be made. But breeding is one thing; and the planting wide apart of seeds of an appropriate variety of wheat is quite another thing.

This last method was lately experimented upon by M. Grandeau, Director of the Station Agronomique de l'Est, and by M. Florimond Desprèz at the experimental station of Capelle; and in both cases the results were most remarkable. At this last station a method which is in use in France for the choice of seeds was applied. Already now some French farmers go over their wheat-fields before the crop begins, choose the soundest plants which bear two or three equally strong stems, adorned with long ears, well stocked with grains, and take these ears. Then they crop off with scissors the top and the bottom of each ear and keep its middle part only, which contains the biggest seeds. With a dozen quarts of such selected grains they obtain next year the required quantity of seeds of a superior quality.*

The same was done by M. Desprèz. Then each seed was planted separately, eight inches apart in a row, by means of a specially devised tool, similar to the *rayonneur* which is used for planting potatoes; and the rows, also eight inches apart, were alternately given to the big and to the smaller seeds. One-fourth part of an acre having been planted in this way, with seeds obtained from both early and late ears, crops corresponding to 83.8 bushels per acre for the first series, and 90.4

* Upon this method of selecting seeds opinions are, however, at variance amongst agriculturists.

bushels for the second series, were obtained; even the small grains gave in this experiment as much as 70.2 and 62 bushels respectively.*

The crop was thus more than doubled by the choice of seeds and by planting them separately eight inches apart. It corresponded in Dessprèz's experiments to *600 grains obtained on the average from each grain sown;* and one-tenth or one-eleventh part of an acre was sufficient in such case to grow the eight and a half bushels

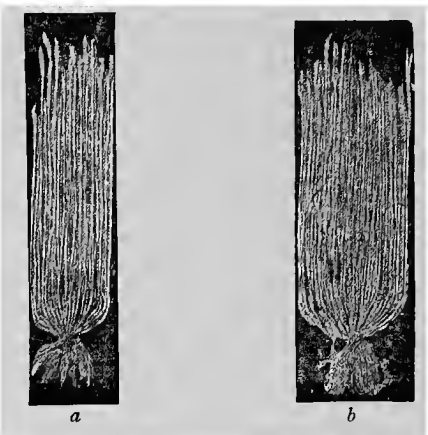

FIG. 5.—Wheat Plants.—*a*, Has given 17 ears from each planted grain. Soil manured with chemical manure only. *b*, Has given 25 ears from each planted grain. Soil manured with both stable and chemical manure.

of wheat which are required on the average for the annual bread food per head of a population which would chiefly live on bread.

Prof. Grandeau, Director of the French Station Agronomique de l'Est, has also made, since 1886, ex-

* The straw was eighty-three and seventy-seven cwts. per acre in the first case; fifty-nine and forty-nine cwts. in the second case (Garola, *Les Céréales*). In his above-mentioned paper on "Thin Seeding," Major Hallett mentions a crop at the rate of 198 bushels to the acre, obtained by planting nine inches apart.

periments on Major Hallett's method, and he obtained similar results. "In a proper soil," he wrote, "one single grain of wheat can give as much as fifty stems (and ears), and even more, and thus cover a circle thirteen inches in diameter." * But as he seems to know how difficult it often is to convince people of the plainest facts, he published the photographs of separate wheat plants grown in different soils, differently manured, including pure river sand enriched by manure.† He

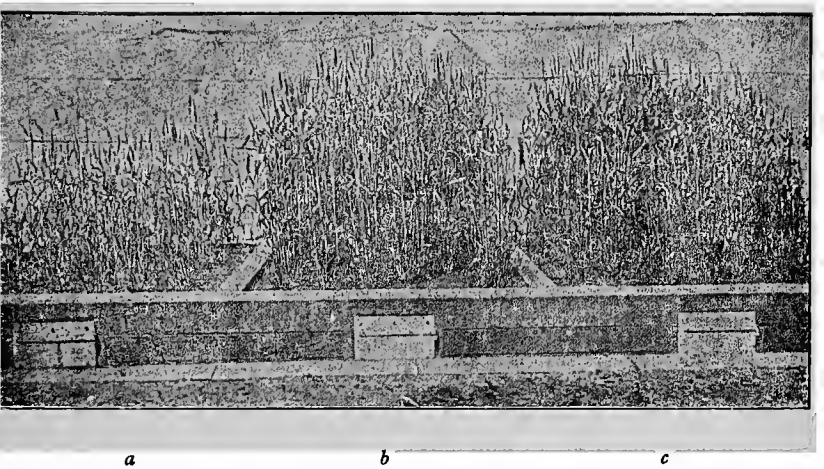

FIG. 6.—Squares at Professor Grandeau's experimental station, planted with grains of wheat, in three different soils; *a*, pure sand; *b* and *c*, manured arable soil; each grain 12 inches apart.

concluded that under proper treatment 2000 and even 4000 grains could be easily obtained from each planted grain. The seedlings, growing from grains planted ten inches apart, cover the whole space, and the experiment

* L. Grandeau, *Etudes agronomiques*, 3e série, 1887-8, p. 43. This series is still continued by one volume every year.

† On one of these photographs one sees that in a soil improved by chemical manure only, seventeen stems from each grain are obtained; with organic manure added to the former, twenty-five stems were obtained. Reproduced by the courtesy of the Co-operative Wholesale Society.

plot takes the aspect of an excellent corn-field, as may be seen from a photograph given by Grandeau in his *Etudes agronomiques.*

In fact, the eight and a half bushels required for one man's annual food were actually grown at the Tomblaine station on a surface of 2250 square feet, or forty-seven feet square, *i.e.*, on very nearly one-twentieth part of an acre.

Again, we may thus say, that where we require now three acres, one acre would be sufficient for growing the same amount of food, if planting wide apart were resorted to. And there is, surely, no more objection to planting wheat than there is to sowing in rows, which is now in general use, although at the time when the system was first introduced, *in lieu* of the formerly usual mode of sowing broadcast, it certainly was met with great distrust. While the Chinese and the Japanese used for centuries to sow wheat in rows, by means of a bamboo tube adapted to the plough, European writers objected, of course, to this method under the pretext that it would require too much labour. It is the same now with planting each seed apart. Professional writers sneer at it, although all the rice that is grown in Japan is planted *and even replanted.* Every one, however, who will think of the labour which must be spent for ploughing, harrowing, fencing, and keeping free of weeds three acres instead of one and who will calculate the corresponding expenditure in manure, will surely admit that all advantages are in favour of the one acre as against the three acres, to say nothing of the possibilities of irrigation, or of the planting machine-tool, which will be devised as soon as there is a demand for it.*

More than that, there is full reason to believe that even this method is liable to further improvement by means of *replanting.* Cereals in such cases would be

* See Appendix K.

treated as vegetables are treated in horticulture. Such is, at least, the idea which began to germinate since the methods of cereal culture that are resorted to in China and Japan became better known in Europe. (See Appendix L.)

The future—a near future, I hope—will show what practical importance such a method of treating cereals may have. But we need not speculate about that future. We have already, in the facts mentioned in this chapter, an experimental basis for quite a number of means of improving our present methods of culture and of largely increasing the crops. It is evident that in a book which is not intended to be a manual of agriculture, all I can do is to give only a few hints to set people thinking for themselves upon this subject. But the little that has been said is sufficient to show that we have no right to complain of over-population, and no need to fear it in the future. Our means of obtaining from the soil whatever we want, under *any* climate and upon *any* soil, have lately been improved at such a rate that we cannot foresee yet what is the limit of productivity of a few acres of land. The limit vanishes in proportion to our better study of the subject, and every year makes it vanish farther and farther from our sight.

CHAPTER V.

THE POSSIBILITIES OF AGRICULTURE—(*continued*).

Extension of market gardening and fruit growing: in France; in the United States—Culture under glass—Kitchen gardens under glass—Hothouse culture: in Guernsey; in Belgium—Conclusion.

ONE of the most interesting features of the present evolution of agriculture is the extension lately taken by intensive market gardening of the same sort as has been described in the third chapter. What formerly was limited to a few hundreds of small gardens, is now spreading with an astonishing rapidity. In this country the area given to market gardens has more than doubled within the last sixteen years, and attained, in 1894, 88,210 acres, as against 40,582 acres in 1879.* But it is especially in France, Belgium and America that this branch of culture has lately taken a great development. (See Appendix M.)

At the present time no less than 1,075,000 acres are given in France to market-gardening and intensive fruit culture, and a few years ago it was estimated that the *average* yield of every acre given to these cultures attains £33 10s.† Their character, as well as the amount of skill displayed in, and labour given to, these cultures, will best appear from the following illustrations.

* Charles Whitehead, *Hints on Vegetable and Fruit Farming*, London (J. Murray), 1890. *The Gardener's Chronicle*, 20th April, 1895.

† Charles Baltet, *L'Horticulture dans les cinq Parties du Monde. Ouvrage couronné par la Société Nationale d'Horticulture.* Paris (Hachette), 1895.

About Roscoff, which is a great centre in Brittany for the export to England of such potatoes as will keep till late in summer, and of all sorts of vegetables, a territory, twenty-six miles in diameter, is entirely given to these cultures, and the rents attain and exceed £5 per acre. Nearly 300 steamers call at Roscoff to ship potatoes, onions and other vegetables to London and different English ports, as far north as Newcastle. Moreover, as much as 4000 tons of vegetables are sent every year to Paris.* And although the Roscoff peninsula enjoys a specially warm climate, small stone walls are erected everywhere, and rushes are grown on their tops in order to give still more protection and heat to the vegetables.† The climate is improved as well as the soil.

In the neighbourhoods of Cherbourg it is upon land conquered from the sea that the best vegetables are grown—more than 800 acres of that land being given to potatoes exported to London; another 500 acres are given to cauliflower; 125 acres to Brussels sprouts; and so on. Potatoes grown under glass are also sent to the London market from the middle of April, and the total export of vegetables from Cherbourg to England attains 300,000 cwts., while from the small port of Barfleur another 100,000 cwts. are sent to this country, and about 60,000 cwts. to Paris. Nay, in a quite small commune, Surtainville, near Cherbourg, £2800 are made out of 180 acres of market gardens, three crops being taken every year: cabbage in February, early potatoes next, and various crops in the autumn—to say nothing of the catch crops. At Ploustagel one hardly believes that he is in Brittany. Melons used to be grown at that spot, long since, in the open fields, with glass frames to protect them from the spring frosts, and green peas were grown under the protection of rows of furze which

* Charles Baltet, *loc. cit.*
† Ardouin Dumazet, *Voyage en France*, vol. v., p. 10.

sheltered them from the northern winds. Now, whole fields are covered with strawberries, roses, violets, cherries and plums, down to the very sea beach.* Even the *landes* are reclaimed, and we are told that in five years or so there will be no more *landes* in that district (p. 265). Nay, the marshes of the Dol—"The Holland of Brittany"—protected from the sea by a wall (5050 acres), have been turned into market gardens, covered with cauliflowers, onions, radishes, haricot beans and so on, the acre of that land being rented at from £2 10s. to £4.

About Paris no less than 50,000 acres are given to the field culture of vegetables and 25,000 acres to the forced culture of the same. Already fifty years ago the yearly rent paid by market gardeners attained as much as £18 and £24 per acre, and yet it has been increased since, as well as the gross receipts, which were valued by Courtois Gérard at £240 per acre for the larger market gardens, and twice as much for the smaller ones in which early vegetables are grown in frames.

The fruit culture in the neighbourhoods of Paris is equally wonderful. At Montreuil, for instance, 750 acres, belonging to 400 gardeners, are literally covered with stone walls, specially erected for growing fruit, and having an aggregate length of 400 miles. Upon these walls, peach trees, pear trees and vines are spread, and every year something like 12,000,000 peaches are gathered, as well as a considerable amount of the finest pears and grapes. The acre in such conditions brings in £56. This is how a "warmer climate" was made, at a time when the greenhouse was still a costly luxury. All taken, 1250 acres are given to peaches (25,000,000 peaches every year) in the close neighbourhood of Paris. Acres and acres are also covered with pear trees which yield three to five tons

* Ardouin Dumazet, *Voyage en France*, vol. v., p. 200.

of fruit per acre, such crop being sold at from £50 to £60. Nay, at Angers, on the Loire, where pears are eight days in advance of the suburbs of Paris, Baltet knows an orchard of five acres, covered with pears (low trees), which brings in £400 every year; and at a distance of thirty-three miles from Paris one pear plantation brings in £24 per acre—the costs of package, transport and selling being deducted. Likewise, the plantations of plums, of which 80,000 cwts. are consumed every year at Paris alone, give an annual money income of from £29 to £48 per acre every year; and yet, pears, plums and cherries are sold at Paris, fresh and juicy, at such a price that the poor, too, can eat fresh home-grown fruit.

In the province of Anjou one may see how a heavy clay, improved with sand taken from the Loire and with manure, has been turned, in the neighbourhoods of Angers, and especially at Saint Laud, into a soil which is rented at from £2 10s. to £5 the acre, and upon that soil fruit is grown which a few years ago was exported to America.* At Bennecour, a quite small village of 850 inhabitants, near Paris, one sees what man can make out of the most unproductive soil. Quite recently the steep slopes of its hills were only *mergers* from which stone was extracted for the pavements of Paris. Now these slopes are entirely covered with apricot and cherry trees, black-currant shrubs, and plantations of asparagus, green peas and the like. In 1881, £5600 worth of apricots alone was sold out of this village, and it must be borne in mind that competition is so acute in the neighbourhoods of Paris that a delay of twenty-four hours in the sending of apricots to the market will often mean a loss of 8s.—one-seventh of the sale price on each hundredweight.†

* Baudrillart, *Les Populations agricoles de la France: Anjou*, pp. 70-71.

† The total production of dessert fruit as well as dried or preserved fruit in France was estimated, in 1876, at 84,000 tons, and its value was

At Perpignan, green artichokes—a favourite vegetable in France—are grown, from October till June, on an area covering 2500 acres, and the net revenue is estimated at £32 per acre. In Central France, artichokes are even cultivated in the open fields, and nevertheless the crops are valued (by Baltet) at from £48 to £100 per acre. In the Loiret, 1500 gardeners, who occasionally employ 5000 workmen, obtain from £400,000 to £480,000 worth of vegetables, and their yearly expenditure for manure is £60,000. This figure alone is the best answer to those who are fond of talking about the extraordinary fertility of the soil, each time they are told of some success in agriculture. At Lyons, a population of 430,000 inhabitants is entirely supplied with vegetables by the local gardeners. The same is in Amiens, which is another big industrial city. The districts surrounding Orléans form another great centre for market-gardening, and it is especially worthy of notice that the shrubberies of Orléans supply even America with large quantities of young trees.*

It would take, however, a volume to describe the chief centres of market-gardening and fruit-growing in France; and I will mention only one region more, where vegetables and fruit-growing go hand in hand. It lies on the banks of the Rhône, about Vienne, where we find a narrow strip of land, partly composed of granite rocks, which has now become a garden of an incredible richness. The origin of that wealth, we are told by Ardouin Dumazet, dates from some thirty years ago, when the vineyards, ravaged by phylloxera, had to be destroyed and some new culture had to be found. The village of Ampuis became then renowned for its apricots. At the present time, for a full 100 miles along the

taken at about 3,000,000,000 fr. (£120,000,000)—more than one-half of the war contribution levied by Germany. It must have largely increased since 1876. (See Appendix M.)

* Ardouin Dumazet, i., 204.

Rhône, and in the lateral valleys of the Ardèche and the Drôme, the country is an admirable orchard, from which millions' worth of fruit is exported, and the land attains the selling price of from £325 to £400 the acre.* Small plots of land are continually reclaimed for culture upon every crag. On both sides of the roads one sees the plantations of apricot and cherry trees, while between the rows of trees early beans and peas, strawberries, and all sorts of early vegetables are grown. In the spring the fine perfume of the apricot trees in bloom floats over the whole valley. Strawberries, cherries, apricots, peaches and grapes follow each other in rapid succession, and at the same time cartloads of French beans, salads, cabbages, leeks, and potatoes are sent towards the industrial cities of the region. It would be impossible to estimate the quantity and value of all that is grown in that region. Suffice it to say that a tiny commune, Saint Désirat, exported during Ardouin Dumazet's visit about 2000 cwts. of cherries every day.

I must refer the reader to the work of Charles Baltet if he will know more about the extension taken by market-gardening in different countries, and will only mention Belgium and America.

The exports of vegetables from Belgium have increased twofold within the last twenty years, and whole regions, like Flanders, claim to be now the market-garden of England, even seeds of the vegetables preferred in this country being distributed free by one horticultural society in order to increase the export. Not only the best lands are appropriated for that purpose, but even the sand deserts of the Ardennes and peat-bogs are turned into rich market-gardens, while large plains (namely at Haeren) are irrigated for the same purpose. Scores of schools, experimental farms, and small experimental stations, evening lectures, and

* Ardouin Dumazet, vol. vii., p. 125.

so on, are opened by the communes, the private societies, and the State, in order to promote horticulture, and hundreds of acres of land are covered with thousands of greenhouses. Here we see one small commune exporting 5500 tons of potatoes and £4000 worth of pears, to Stratford and Scotland, and keeping for that purpose its own line of steamers. Another commune supplies the north of France and the Rhenish provinces with strawberries, and occasionally sends some of them to Covent Garden as well. Elsewhere early carrots, which are grown amidst flax, barley and white poppies, give a considerable addition to the farmer's income. In another place we learn that land is rented at £24 and £27 the acre, not for grapes or melon-growing but for the modest culture of onions; or that the gardeners have done away with such a nuisance as natural soil in their frames, and prefer to make their loam out of wood sawings, tannery refuse and hemp dust, "animalised" by various composts.* In short, Belgium, which is one of the chief manufacturing countries of Europe, is now becoming one of the chief centres of horticulture. (See Appendix N.)

The other country which must especially be recommended to the attention of horticulturists is America. When we see the mountains of fruit imported from America we are inclined to think that fruit in that country grows by itself. "Beautiful climate," "virgin soil," "immeasurable spaces"—these words continually recur in the papers. The reality, however, is that horticulture—*i.e.*, both market-gardening and fruit culture—has been brought in America to a high degree of perfection. Prof. Baltet, a practical gardener himself, originally from the classical *marais* (market-gardens) of Troyes, describes the "truck farms" of Norfolk in Vir-

* Charles Baltet, *L'Horticulture*, etc.

ginia as real "model farms". A highly complimentary appreciation from the lips of a practical *maraîcher* who has learned from his infancy that only in fairyland do the golden apples grow by the fairies' magic wand. As to the perfection to which apple-growing has been brought in Canada, the aid which the apple-growers receive from the Canadian experimental farms, and the means which are resorted to, on a truly American scale, to spread information amongst the farmers and to supply them with new varieties of fruit trees—all this ought to be carefully studied in this country, instead of inducing Englishmen to believe that the American supremacy is due to the golden fairies' hands. If one-tenth part of what is done in the States and in Canada for favouring agriculture and horticulture were done in this country, English fruit would not have been so shamefully driven out of the market as it is at the present time.

The extension given to horticulture in America is immense. The "truck farms" alone—*i.e.*, the farms which work for export by rail or steam—covered in the States in 1892 no less than 400,000 acres. At the very doors of Chicago one single market-gardening farm covers 500 acres, and out of these, 150 acres are given to cucumbers, 50 acres to early peas, and so on. During the Chicago Exhibition a special "strawberry express," composed of thirty waggons, brought in every day 324,000 quarts of the freshly gathered fruit, and there are days that over 10,000 bushels of strawberries are imported in New York—three-fourths of that amount coming from the "truck farms" of Virginia by steamer.*

This is what can be achieved by an intelligent combination of agriculture with industry, and undoubtedly will be applied on a still larger scale in the future.

However, a further advance is being made in order

* Ch. Baltet, *L'Horticulture*, etc.

to emancipate horticulture from climate. I mean the glasshouse culture of fruit and vegetables.

Formerly the greenhouse was the luxury of the rich mansion. It was kept at a high temperature, and was made use of for growing, under cold skies, the golden fruit and the bewitching flowers of the South. Now, and especially since the progress of technics allows of making cheap glass and of having all the woodwork, sashes and bars of a greenhouse made by machinery, the glasshouse becomes appropriated for growing fruit for the million, as well as for the culture of common vegetables. The aristocratic hothouse, stocked with the rarest fruit trees and flowers, remains; nay, it spreads more and more for growing luxuries which become more and more accessible to the great number. But by its side we have the plebeian greenhouse, which is heated for only a couple of months in winter, and the still more economically built "cool greenhouse," which is a simple glass shelter—a big "cool frame"—and is stuffed with the humble vegetables of the kitchen garden: the potatoes, the carrots, the French beans, the peas and the like. The heat of the sun, passing through the glass, but prevented by the same glass from escaping by radiation, is sufficient to keep it at a very high temperature during spring and early summer. A new system of horticulture—the market-garden under glass—is thus rapidly gaining ground.

The greenhouse for commercial purposes is essentially of British, or perhaps Scottish, origin. Already in 1851, Mr. Th. Rivers had published a book, *The Orchard Houses and the Cultivation of Fruit Trees in Pots under Glass.* And we are told by Mr. D. Thomson, in the *Journal of Horticulture* (31st January, 1889), that nearly fifty years ago grapes in February were sold at 25s. the pound by a grower in the north of England, and that part of them was sent by the buyer to Paris, for Napoleon III.'s table, at 50s. the pound. "Now,"

Mr. Thomson adds, "they are sold at the tenth or twentieth part of the above prices. Cheap coal—cheap grapes; that is the whole secret."

Large vineries and immense establishments for growing flowers under glass are of an old standing in this country, and new ones are continually built on a grand scale. Entire fields are covered with glass at Cheshunt, at Broxburn (fifty acres), at Finchley, at Bexley, at Swanley, at Whetstone, and so on, to say nothing of Scotland. Worthing is also a well-known centre for growing grapes and tomatoes; while the greenhouses given to flowers and ferns at Upper Edmonton, at Chelsea, at Orpington, and so on, have a world-wide reputation. And the tendency is, on the one side, to bring grape culture to the highest degree of perfection, and, on the other side, to cover acres and acres with glass for growing tomatoes, French beans and peas, which undoubtedly will soon be followed by the culture of still plainer vegetables.

At the present time the Channel Islands and Belgium take the lead in the development of glasshouse culture. The glory of Jersey is, of course, Mr. Bashford's establishment. When I visited it in 1890, it contained 490,000 square feet under glass—that is, nearly thirteen acres, but seven more acres under glass have been added to it since. A long row of glasshouses, interspersed with high chimneys, covers the ground—the largest of the houses being 900 feet long and forty-six feet wide; this means that about one acre of land, in one piece, is under glass. The whole is built most substantially: granite walls, great height, thick "twenty-seven oz. glass" (of the thickness of three pennies),* ventilators which open upon a length of 200 and 300 feet by working one single handle; and so on. And yet the most luxurious of these greenhouses was said by the owners

* "Twenty-one oz." and even "fifteen oz." glass is used in the cheaper greenhouses.

to have cost less than 1s. the square foot of glass (13d. the square foot of ground), while the other houses have cost much less than that. From 5d. to 9d. the square foot of glass * is the habitual cost, without the heating apparatus—6d. being a current price for the ordinary glasshouses.

But it would be hardly possible to give an idea of all that is grown in such glasshouses, without producing photographs of their insides. In 1890, on the 3rd of May, exquisite grapes began to be cut in Mr. Bashford's vineries, and the crop was continued till October. In other houses, cartloads of peas had already been gathered, and tomatoes were going to take their place after a thorough cleaning of the house. The 20,000 tomato plants, which were going to be planted, had to yield no less than eighty tons of excellent fruit (eight to ten pounds per plant). In other houses melons were grown instead of the tomatoes. Thirty tons of early potatoes, six tons of early peas, and two tons of early French beans had already been sent away in April. As to the vineries, they yielded no less than twenty-five tons of grapes every year. Besides, very many other things were grown in the open air, or as catch crops, and all that amount of fruit and vegetables was the result of the labour of thirty-six men and boys only, under the supervision of one single gardener—the owner himself; true that in Jersey, and especially in Guernsey, every one is a gardener. About 1000 tons of coke were burnt to heat these houses. Mr. W. Bear, who has visited the same establishment in 1886, was quite right to say that from these thirteen acres they obtained money returns equivalent to what a farmer would obtain from 1300 acres of land.

However, it is in the small "vineries" that one sees, perhaps, the most admirable results. As I walked

* It is reckoned by measuring the height of the front and back walls and the length of the two slopes of the roof.

through such glass-roofed kitchen gardens, I could not but admire this recent conquest of man. I saw, for instance, three-fourths of an acre heated for the first three months of the year, from which about eight tons of tomatoes and about 200 lb. of French beans had been taken as a first crop in April, to be followed by two crops more. In these houses one gardener was employed with two assistants, a small amount of coke was consumed, and there was a gas engine for watering purposes, consuming only 13s. worth of gas during the quarter. I saw again, in cool greenhouses—simple plank and glass shelters—pea plants covering the walls, for the length of one quarter of a mile, which already had yielded by the end of April 3200 lb. of exquisite peas and were yet as full of pods as if not one had been taken off. I saw potatoes dug from the soil in a cool greenhouse, in April, to the amount of five bushels to the twenty-one feet square. And when chance brought me, in 1896, in company with a local gardener, to a tiny, retired "vinery" of a veteran grower, I could see there, and admire, what a lover of gardening can obtain from so small a space as the two-thirds of an acre. Two small "houses" about forty feet long and twelve feet wide, and a third—formerly a pigsty, twenty feet by twelve—contained vine trees which many a professional gardener would be happy to have a look at; especially the whilom pigsty, fitted with "Muscats"! Some grapes (in June) were already in full beauty, and one fully understands that the owner could get in 1895, from a local dealer, £4 for three bunches of grapes (one of them was a "Colmar," 13¾ lb. weight). The tomatoes and strawberries in the open air, as well as the fruit trees, all on tiny spaces, were equal to the grapes; and when one is shown on what a space half a ton of strawberries can be gathered under proper culture, it is hardly believable.

It is especially in Guernsey that the simplification of the greenhouse must be studied. Every house in

the suburbs of St. Peter has some sort of greenhouse, big or small. All over the island, especially in the north, wherever you look, you see greenhouses. They rise amid the fields and from behind the trees; they are piled upon one another on the steep crags facing the harbour of St. Peter; and with them a whole generation of practical gardeners has grown up. Every farmer is more or less of a gardener, and he gives free scope to his inventive powers for devising some cheap type of greenhouses. Some of them have almost no front and back walls—the glass roofs coming low down and the two or three feet of glass in front simply reaching the ground; in some houses the lower sheet of glass was simply plunged into a wooden trough standing on the ground and filled with sand. Many houses have only two or three planks, laid horizontally, instead of the usual stone wall, in the front of the greenhouse. The large houses of one big company are built close to each other, and have no partitions between. As to the extensive cool greenhouses on the Grande Maison estate, which are built by a company and are rented to gardeners for so much the 100 feet, they are simply made of thin deal board and glass. They are on the "lean to" or "one roof" system, and the back wall, ten feet high, and the two side walls are in simple grooved boards, standing upright. The whole is supported by uprights inserted into concrete pillars. They are said to cost not more than 5d. the square foot, of glass-covered ground. And yet, even such plain and cheap houses yield excellent results. The potato crop which had been grown in some of them was excellent, as also the green peas.*

In Jersey I even saw a row of five houses, the walls of which were made of corrugated iron, for the sake of cheapness. Of course, the owner himself was not oversanguine about his houses. "They are too cold in

* Growing peas along the wall seems, however, to be a bad system. It requires too much work in attaching the plants to the wall.

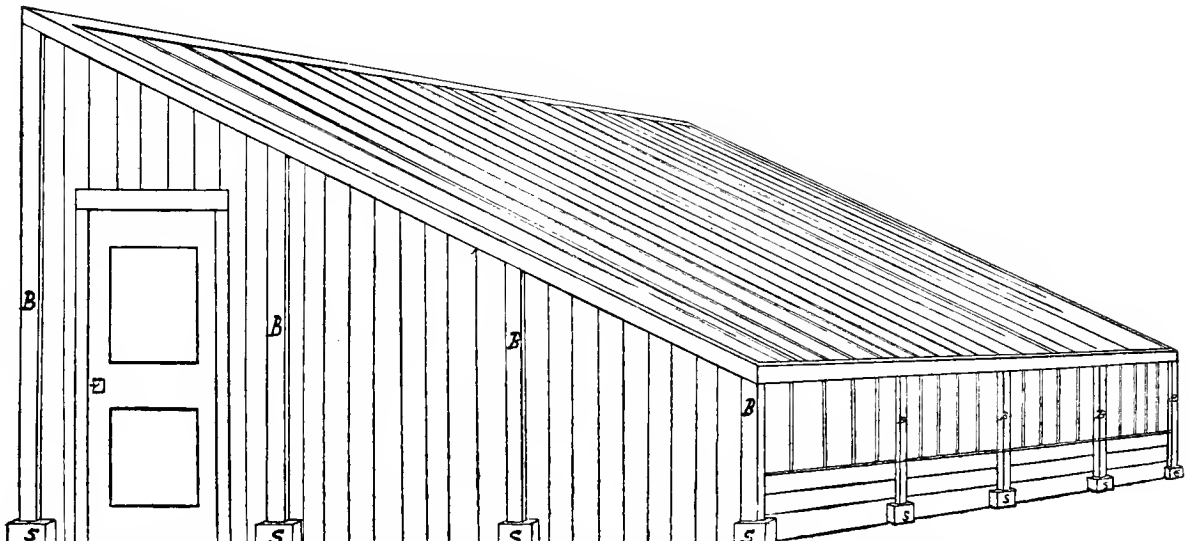

FIG. 7.—Cool Greenhouse of the plainest description in Guernsey. *s*, Concrete stones mounted on purpose to receive the standards *b*, *b*; the spaces between them being fitted with matching-boards, which enter a groove in the stone *s*.

winter and too hot in summer." But although the five houses cover only less than one-fifth of an acre, 2000 lb. of green peas had already been sold as a first crop; and, in the first days of June, the second crop (about 1500 plants of tomatoes) was already in good progress.

It is always difficult, of course, to know what are the money returns of the growers, first of all because Thorold Rogers' complaint about modern farmers keeping no accounts holds good, even for the best gardening establishments, and next because when the returns are known to me in all details it would not be right for me to publish them. Roughly speaking, I can confirm Mr. Bear's estimate to the effect that under proper management even a cool greenhouse, which covers 4050 square feet, can give a gross return of £180. "Don't prove too much; beware of the landlord!" a practical gardener once wrote to me.

As a rule, the Guernsey and Jersey growers have only three crops every year from their greenhouses. They will start, for instance, potatoes in December. The house will, of course, not be heated, fires being made only when a sharp frost is expected at night; and the potato crop (from eight to ten tons per acre) will be ready in April or May before the open-air potatoes begin to be dug out. Tomatoes will be planted next and be ready by the end of the summer. Various catch crops of peas, radishes, lettuce and other small things will be taken in the meantime. Or else the house will be "started" in November with melons, which will be ready in April. They will be followed by tomatoes, either in pots, or trained as vines, and the last crop of tomatoes will be in October. Beans may follow and be ready for Christmas. I need not say that every grower has his preference method for utilising his houses, and it entirely depends upon his skill and watchfulness to have all sorts of small catch crops. These last begin to have a greater and greater importance, and one can

already foresee that the growers under glass will be forced to accept the methods of the French *maraîchers*, so as to have five and six crops every year, so far as it can be done without spoiling the present high quality of the produce.

All this industry is of very recent origin. One may see it still working out its methods. And yet the exports from Guernsey alone are already represented by quite extraordinary figures. It was estimated a few years ago that they were as follows: Grapes, 502 tons, £37,500 worth at the average price of 9d. the pound; tomatoes, 1000 tons, about £30,000; early potatoes (chiefly in the fields), £20,000; radishes and broccoli, £9250; cut flowers, £3000; mushrooms, £200; total, £99,950—to which total the local consumption in the houses and hotels, which have to feed nearly 30,000 tourists, must be added. But now these figures must have grown considerably. In June, 1896, I saw the Southampton steamers taking every day from 9000 to 12,000, and occasionally more, baskets of fruit (grapes, tomatoes, French beans and peas), each basket representing from twelve to fourteen pounds of fruit. Taking into account what was sent by other channels, we may thus say that from 400 to 500 tons of tomatoes, grapes, beans and peas, worth from £20,000 to £25,000, are exported every week in June.

All this is obtained from an island whose total area, rocks and barren hill-tops included, is only 16,000 acres, of which only 9884 acres are under culture, and 5189 acres are given to green crops and meadows. An island, moreover, on which 1480 horses, 7260 head of cattle and 900 sheep find their existence. How many men's food is, then, grown on these 10,000 acres?

Belgium has also made, within the last few years, an immense progress in the same direction. While no more than 250 acres, all taken, were covered with glass some twenty years ago, more than 800 acres are under

glass by this time.* In the village of Hoeilaert, which is perched upon a stony hill, nearly 200 acres are under glass, given up to grape-growing. One single establishment, Baltet remarks, has 200 greenhouses and consumes 1500 tons of coal for the vineries.† "Cheap coals—cheap grapes," as the editor of the *Journal of Horticulture* wrote. Grapes in Brussels are certainly not dearer in the beginning of the summer than they are in Switzerland in October. Even *in March*, Belgian grapes are sold in Covent Garden at from 4d. and 6d. the pound.‡ This price alone shows sufficiently how small are the amounts of labour which are required to grow grapes in our latitudes with the aid of glass. *It certainly costs less labour to grow grapes in Belgium than to grow them on the coasts of Lake Leman.*

The various data which have been brought together on the preceding pages make short work of the over-population fallacy. It is precisely in the most densely populated parts of the world that agriculture has lately made such strides as hardly could have been guessed twenty years ago. A dense population, a high development of industry, and a high development of agriculture and horticulture, go hand in hand: they are inseparable. As to the future, the possibilities of agriculture are such that, in truth, we cannot yet foretell what would be the limit of the population which could live from the produce of a given area. Recent progress, already tested on a great scale, has widened the limits of agricultural pro-

* I take these figures from the notes which a Belgium professor of agriculture was kind enough to send me. The greenhouses in Belgium are mostly with iron frames.

† A friend, who has studied practical horticulture in the Channel Islands, writes me of the vineries about Brussels: "You have no idea to what an extent it is done there. Bashford is nothing against it."

‡ A quotation which I took at random, in 1895, from a London daily, was: "Covent Garden, 19th March, 1895. Quotations: Belgian grapes, 4d. to 6d.; Jersey ditto, 6d. to 10d.; Muscats, 1s. 6d. to 2s., and tomatoes, 3d. to 5d. per lb."

duction to a quite unforeseen extent; and recent discoveries, now tested on a small scale, promise to widen those limits still farther to a quite unknown degree.

The present tendency of economical development in the world is—we have seen—to induce more and more every nation, or rather every region, taken in its geographical sense, to rely chiefly upon a home production of all the chief necessaries of life. Not to reduce, I mean, the world-exchange: it may still grow in bulk; but to limit it to the exchange of what really *must* be exchanged, and, at the same time, immensely to increase the exchange of novelties, produce of local or national art, new discoveries and inventions, knowledge and ideas. Such being the tendency of present development, there is not the slightest ground to be alarmed by it. There is not one nation in the world which, being armed with the present powers of agriculture, could not grow on its cultivable area all the food and most of the raw materials derived from agriculture which are required for its population, even if the requirements of that population were rapidly increased as they certainly ought to be. Taking the powers of man over the land and over the forces of nature—*such as they are at the present day*—we can maintain that two to three inhabitants to each cultivable acre of land would not yet be too much. But neither in this densely populated country nor in Belgium are we yet in such numbers. In this country we have, roughly speaking, one acre of the cultivable area per inhabitant.

Supposing, then, that each inhabitant of Great Britain were compelled to live on the produce of his own land, all he would have to do would be, first, to consider the land of this country as a common inheritance, which must be disposed of to the best advantage of each and all—this is, evidently, an absolutely necessary condition. And next, he would have to cultivate his soil, not in some extravagant way, but no better than land is already

cultivated upon thousands and thousands of acres in Europe and America. He would not be bound to invent some new methods, but could simply generalise and widely apply those which have stood the test of experience. He can do it; and in so doing he would save an immense quantity of the work which is now given for buying his food abroad, and for paying all the intermediaries who live upon this trade. Under a rational çulture, those necessaries and those luxuries which must be obtained from the soil, undoubtedly *can* be obtained with much less work than is required now for buying these commodities. I have made elsewhere (in *La Conquête du Pain*) approximate calculations to that effect, but with the data given in this book every one can himself easily test the truth of this assertion. If we take, indeed, the masses of produce which are obtained under rational culture, and compare them with the amount of labour which must be spent for obtaining them under an irrational culture, for collecting them abroad, for transporting them, and for keeping armies of middlemen, we see at once how few days and hours need be given, under proper culture, for growing man's food.

For improving our methods of culture to that extent, we surely need not divide the land into one-acre plots, and attempt to grow what we are in need of by every one's separate individual exertions, on every one's separate plot with no better tools than the spade; under such conditions we inevitably should fail. Those who have been so much struck with the wonderful results obtained in the *petite culture*, that they go about representing the small culture of the French peasant, or *maraîcher*, as an ideal for mankind, are evidently mistaken. They are as much mistaken as those other extremists who would like to turn every country into a small number of huge Bonanza farms, worked by militarily organised "labour battalions". In Bonanza farms

human labour is reduced, but the crops taken from the soil are far too small, and the whole system is robbery-culture taking no heed of the exhaustion of the soil; while in the *petite culture*, on isolated small plots, by isolated men or families, too much of human labour is wasted even though the crops are heavy. Real economy, of both space and labour, requires quite different methods, representing a combination of machinery work with hand work.

In agriculture, as in everything else, associated labour is the only reasonable solution. Two hundred families of five persons each, owning five acres per family, having no common ties between the families, and compelled to find their living, each family on its five acres, almost certainly would be an economical failure. Even leaving aside all *personal* difficulties resulting from different education and tastes and from the want of knowledge as to what has to be done with the land, and admitting for the sake of argument that these causes do not interfere, the experiment would end in a failure, merely for *economical*, for *agricultural* reasons. Whatever improvement upon the present conditions such an organisation might be, that improvement would not last; it would have to undergo a further transformation or disappear.

But the same two hundred families, if they consider themselves, say, as tenants of the nation, and treat the thousand acres as a common tenancy—again leaving aside the *personal* conditions—would have, economically speaking, from the point of view of the agriculturist, every chance of succeeding, *if they know what is the best use to make of that land.*

In such case they probably would first of all associate for permanently improving the land which required immediate improvement, and would consider it necessary to improve more of it every year, until they had brought it all into a perfect condition. On an area of 340 acres they could most easily grow all the cereals—wheat, oats

etc.—required for both the thousand inhabitants and their live stock—without resorting for that purpose to replanted or planted cereals. They could grow on 400 acres, properly cultivated, and irrigated if necessary and possible, all the green crops and fodder required to keep the thirty to forty milch cows which would supply them with milk and butter, and, let us say, the 300 head of cattle required to supply them with meat. On twenty acres, two of which would be under glass, they would grow more vegetables, fruit and luxuries than they could consume. And supposing that half an acre of land is attached to each house—for hobbies and amusement (poultry-keeping, or any fancy culture, flowers, and the like)—they would still have some 140 acres for all sorts of purposes: public gardens, squares, manufactures and so on. The labour that would be required for such an intensive culture would not be the hard labour of the serf or slave. It would be accessible to every one, strong or weak, town bred or country born; it would also have many charms besides. And its total amount would be far smaller than the amount of labour which every thousand persons, taken from this or from any other nation, have now to spend in getting their present food, much smaller in quantity and of worse quality. I mean, of course, the technically necessary labour, without even considering the labour which we now have to give in order to maintain all our middlemen, armies, and the like. The amount of labour required to grow food under a rational culture is so small, indeed, that our hypothetical inhabitants would be led necessarily to employ their leisure in manufacturing, artistic, scientific, and other pursuits.

From the technical point of view there is no obstacle whatever for such an organisation being started to-morrow with full success. The obstacles against it are not in the imperfection of the agricultural art, or in the infertility of the soil, or in climate. They are entirely

in our institutions, in our inheritances and survivals from the past—in the "Ghosts" which oppress us. But to some extent they lie also—taking society as a whole—in our phenomenal ignorance. We civilised men and women know everything, we have settled opinions upon everything, we take an interest in everything. We only know nothing about whence the bread comes which we eat—even though we pretend to know something about that subject as well—we do not know how it is grown, what pains it costs to those who grow it, what is being done to reduce their pains, what sort of men those feeders of our grand selves are . . . we are more ignorant than savages in this respect, and we prevent our children from obtaining this sort of knowledge—even those of our children who would prefer it to the heaps of useless stuff with which they are crammed at school.

CHAPTER VI.

SMALL INDUSTRIES AND INDUSTRIAL VILLAGES.

Industry and agriculture—The small industries—Different types—*Petty trades in Great Britain:* Sheffield; Lake District; Birmingham—*Petty trades in France*—Weaving and various others—The Lyons region—Paris, emporium of petty trades.

THE two sister arts of agriculture and industry were not always so estranged from one another as they are now. There was a time, and that time is not so far back, when both were thoroughly combined: the villages were then the seats of a variety of industries, and the artisans in the cities did not abandon agriculture; many towns were nothing else but industrial villages. If the mediæval city was the cradle of those industries which bordered upon art and were intended to supply the wants of the richer classes, still it was the rural manufacture which supplied the wants of the million, as it does until the present day in Russia, and to a very great extent in Germany and France. But then came the water-motors, steam, the development of machinery, and they broke the link which formerly connected the farm with the workshop. Factories grew up and they abandoned the fields. They gathered where the sale of their produce was easiest, or the raw materials and fuel could be obtained with the greatest advantage. New cities rose, and the old ones rapidly enlarged; the fields were deserted. Millions of labourers, driven away by sheer force from the land, gathered in the cities in search of labour, and

soon forgot the bonds which formerly attached them to the soil. And we, in our admiration of the prodigies achieved under the new factory system, overlooked the advantages of the old system under which the tiller of the soil was an industrial worker at the same time. We doomed to disappearance all those branches of industry which formerly used to prosper in the villages; we condemned as industry all that was not a big factory.

True, the results were grand as regards the increase of the productive powers of man. But they proved terrible as regards the millions of human beings who were plunged into misery and had to rely upon precarious means of living in our cities. Moreover, the system, as a whole, brought about those abnormal conditions which I have endeavoured to sketch in the two first chapters. We are thus driven into a corner; and while a thorough change in the present relations between labour and capital is becoming an imperious necessity, a thorough remodelling of the whole of our industrial organisation has also become unavoidable. The industrial nations are bound to revert to agriculture, they are compelled to find out the best means of combining it with industry, and they must do so without loss of time.

To examine the special question as to the possibility of such a combination is the aim of the following pages. Is it possible, from a technical point of view? Is it desirable? Are there, in our present industrial life, such features as might lead us to presume that a change in the above direction would find the necessary elements for its accomplishment? Such are the questions which rise before the mind. And to answer them, there is, I suppose, no better means than to study that immense but overlooked and underrated branch of industries which are described under the names of rural industries, domestic trades, and petty trades: to study them, not in the works of the economists who are too much inclined

to consider them as obsolete types of industry, but in their life itself, in their struggles, their failures and achievements.

The variety of forms of organisation which prevails in the small industries is hardly suspected by those who have not made them a subject of special study. There are, first, two broad categories: those industries which are carried on in the villages, in connection with agriculture; and those which are carried on in towns or in villages, with no connection with the land—the workers depending for their earnings exclusively upon their industrial work. In Russia, in France, in Germany, in Austria, and so on, millions and millions of workers are in the first case. They are owners or occupiers of the land, they keep one or two cows, very often horses, and they cultivate their fields, or their orchards, or gardens, considering industrial work as a by-occupation. In those regions, especially, where the winter is long and no work on the land is possible for several months every year, this form of small industries is widely spread. In this country, on the contrary, we find the opposite extreme. Few small industries have survived in England in connection with land-culture; but hundreds of petty trades are found in the suburbs and the slums of the big cities, and large portions of the populations of several towns, such as Sheffield and Birmingham, find their living in a variety of petty trades. Between these two extremes there is evidently a mass of intermediate forms, according to the more or less close ties which continue to exist with the land. Large villages, and even towns, are thus peopled with workers who are engaged in small trades, but most of whom have a small garden, or an orchard, or a field, or only retain some rights of pasture on the commons, while part of them live exclusively upon their industrial earnings.

With regard to the sale of the produce, the small industries offer the same variety of organisation. Here

again there are two great branches. In one of them the worker sells his produce directly to the wholesale dealer; cabinet-makers and part of the workers in the toy trade are in this case. In the other great division the worker works for a "master" who either sells the produce to a wholesale dealer, or simply acts as a middleman who himself receives his orders from some big concern. This is the "sweating system," properly speaking, under which we find a mass of small trades: part of the toy trade, the tailors who work for big clothing establishments—very often for those of the State—the women who sew and embroider the "uppers" for the boot and shoe factories, and who as often deal with the factory as with an intermediary "sweater," and so on. All possible gradations of feudalisation and sub-feudalisation of labour are evidently found in that organisation of the sale of the produce.

Again, when the industrial, or rather technical aspects of the small industries are considered, the same variety of types is soon discovered. Here also there are two great branches: those trades, on the one side, which are purely domestic—that is, those which are carried on in the house of the worker, with the aid of his family, or of a couple of wage-workers; and those which are carried on in separate workshops—all the just-mentioned varieties, as regards connection with land and the divers modes of disposing of the produce, being met with in both these branches. All possible trades—weaving, workers in wood, in metals, in bone, in india-rubber, and so on—may be found under the category of purely domestic trades, with all possible gradations between the purely domestic form of production and the workshop and the factory.

Thus, by the side of the trades which are carried on entirely at home by one or more members of the family, there are the trades in which the master keeps a small workshop attached to his house, where he works

with his family, or with a few "assistants," *i.e.*, wage-workers. Or else the artisan has a separate workshop, supplied with wheel-power, as is the case with the Sheffield cutlers. Or several workers come together in a small factory which they maintain themselves, or hire in association, or where they are allowed to work for a certain weekly rent. And in each of these cases they work either directly for the dealer or for a small master, or for a middleman. A further development of this system is the big factory, especially of ready-made cloth, in which hundreds of women pay so much for the sewing-machine, the gas, the gas-heated irons, and so on, and are paid themselves so much for each piece of the ready-made cloth they sew, or each part of it. Immense factories of this kind exist in England, and it appeared from testimony given before the "Sweating Committee" that women are fearfully "sweated" in such workshops —the full price of each slightly spoiled piece of clothing being deducted from their very low piecework wages. And, finally, there is the small workshop (often with hired wheel-power) in which a master employs three to ten workers, who are paid in wages, and sells his produce to a bigger employer or merchant—there being all possible gradations between such a workshop and the small factory in which a few time workers (five, ten to twenty) are employed by an independent producer. Moreover, in the textile trades, weaving is often done either by the family or by a master who employs one boy only, or several weavers, and after having received the yarn from a big employer, pays a skilled workman to put the yarn in the loom, invents what is necessary for weaving a given, sometimes very complicated pattern, and after having woven the cloth or the ribbons in his own loom or in a loom which he hires himself, he is paid for the piece of cloth according to a very complicated scale of wages agreed to between masters and workers. This last form, we shall see presently, is widely spread

until now, especially in the woollen and silk trades, by the side of big factories in which 50, 100, or 5000 wage-workers, as the case may be, are working with the employers' machinery and are paid in time-wages so much the day or the week.

The small industries are thus quite a world, which, remarkable enough, continues to exist even in the most industrial countries, side by side with the big factories. Into this world we must now penetrate to cast a glimpse upon it: a glimpse only, because it would take volumes to describe its infinite variety of pursuits and organisation, and its infinitely varied connection, with agriculture as well as with other industries.

Most of the petty trades, except some of those which are connected with agriculture, are, we must admit, in a very precarious position. The earnings are very low, and the employment is often uncertain. The day of labour is by two, three, or four hours longer than it is in well-organised factories, and at certain seasons it reaches an almost incredible length. The crises are frequent and last for years. Altogether, the worker is much more at the mercy of the dealer, or the employer, and the employer is at the mercy of the wholesale dealer. Both are liable to become enslaved to the latter, running into debt to him. In some of the petty trades, especially in the fabrication of the plain textiles, the workers are in dreadful misery. But those who pretend that such misery is the rule are totally wrong. Any one who has lived among, let us say, the watchmakers in Switzerland and knows their inner family life, will recognise that the condition of these workers is out of all comparison superior, in every respect, material and moral, to the conditions of millions of factory hands. Even during such a crisis in the watch trade as was lived through in 1876-80, their condition was preferable to the condition of factory hands during a crisis in the woollen

or cotton trade; and the workers perfectly well knew it themselves.

Whenever a crisis breaks out in some branch of the petty trades there is no lack of writers to predict that that trade is going to disappear. During the crisis which I witnessed in 1877 amidst the Swiss watchmakers, the impossibility of a recovery of the trade in the face of the competition of machine-made watches was a current topic in the press. The same was said in 1882 with regard to the silk trade of Lyons, and, in fact, wherever a crisis has broken out in the petty trades. And yet, notwithstanding the gloomy predictions, and the still gloomier prospects of the workers, that form of industry does not disappear. Nay, we find it endowed with an astonishing vitality. It undergoes various modifications, it adapts itself to new conditions, it struggles without losing hope of better times to come. Anyhow, it has not the characteristics of a decaying institution. In some industries the factory is undoubtedly victorious; but there are other branches in which the petty trades hold their own position. Even in the textile industries, which offer so many advantages for the factory system, the hand-loom still competes with the power-loom.

As a whole, the transformation of the petty trades into great industries goes on with a slowness which cannot fail to astonish even those who are convinced of its necessity. Nay, sometimes we may even see the reverse movement going on—occasionally, of course, and only for a time. I cannot forget my amazement when I saw at Verviers, some twenty years ago, that most of the woollen cloth factories—immense barracks facing the streets by more than a hundred windows each—were silent, and their costly machinery was rusting, while cloth was woven in hand-looms in the weavers' houses, for the owners of those very same factories. Here we have, of course, but a temporary fact, fully explained by the spasmodic character of the trade and the heavy

losses sustained by the owners of the factories when they cannot run their mills all the year round. But it illustrates the obstacles which the transformation has to comply with. As to the silk trade, it continues to spread over Europe in its rural industry shape; while hundreds of new petty trades appear every year, and when they find nobody to carry them on in the villages —as is the case in this country—they shelter themselves in the suburbs of the great cities, as we have lately learned from the inquiry into the "sweating system".

Now, the advantages offered by a large factory in comparison with hand work are self-evident as regards the economy of labour, and especially the facilities both for sale and for having the raw produce at a lower price. How can we then explain the persistence of the petty trades? Many causes, however, most of which cannot be valued in shillings and pence, are at work in favour of the petty trades, and these causes will be best seen from the following illustrations. I must say, however, that even a brief sketch of the countless industries which are carried on on a small scale in this country, and on the Continent, would be far beyond the scope of this chapter. When I began to study the subject some fifteen years ago, I never guessed, from the little attention devoted to it by the orthodox economists, what a wide, complex, important, and interesting organisation would appear at the end of a closer inquiry. So I see myself compelled to give here only a few typical illustrations, and to indicate the chief lines only of the subject.

Petty Trades in Great Britain.

As far as I know, there are in this country no statistics as to the exact numbers of workers engaged in the domestic trades, the rural industries, and the petty trades. The whole subject has never received the

attention bestowed upon it in Germany, and especially in Russia. And yet we can guess that even in this country of great industries, the numbers of those who earn their livelihood in the petty trades most probably equal, if they do not surpass, the numbers of those employed in the factories.* We know, at any rate, that the suburbs of London, Glasgow, and other great cities swarm with small workshops, and there are regions where the petty trades are as developed as they are in Switzerland or in Germany. Sheffield is a well-known example in point. The Sheffield cutlery—one of the glories of England—is *not* made by machinery: it is chiefly made by hand. There are at Sheffield a few firms which manufacture cutlery right through from the making of steel to the finishing of tools, and employ wage-workers; and yet even these firms—I am told by Edward Carpenter, who kindly collected for me information about the Sheffield trade—let out some part of their work to the "small masters". But by far the greatest number of the cutlers work in their homes with their relatives, or in small workshops supplied with wheel-power, which they rent for a few shillings a week. Immense yards are covered with buildings, which are subdivided into numbers of small workshops. Some of these cover but a few square yards, and there I saw smiths hammering, all the day long, blades of knives on a small anvil, close by the blaze of their fires; occasionally the smith may have one helper, or two. In the upper storeys scores of small workshops are supplied with wheel-power, and in each of them, three, four, or five workers and a "master" fabricate, with the occasional aid of a few plain machines, every description of tools: files, saws,

* We find it stated in various economic works that there are nearly 1,000,000 workers employed in the big factories of England alone, and 1,047,000 employed in the petty trades—the various trades connected with food (bakers, butchers, and so on) and the building trades being included in the last figure. But I do not know how far these figures are reliable.

blades of knives, razors, and so on. Grinding and glazing are done in other small workshops, and even steel is cast in a small foundry, the working staff of which consists only of five or six men. When walking through these workshops I easily imagined myself in a Russian cutlery village, like Pavlovo or Vorsma. The Sheffield cutlery has thus maintained its olden organisation, and the fact is the more remarkable as the earnings of the cutlers are low as a rule; but, even when reduced to a few shillings a week, the cutler prefers to vegetate on his small earnings than to enter as a waged labourer in a "house". The spirit of the old trade organisations, which were so much spoken of five-and-twenty years ago, is thus still alive.

Until lately, Leeds and its environs were also the seat of extensive domestic industries. When Edward Baines wrote, in 1857, his first account of the Yorkshire industries (in Th. Baines's *Yorkshire, Past and Present*), most of the woollen cloth which was made in that region was woven by hand.* Twice a week the hand-made cloth was brought to the Clothiers' Hall, and by noon it was sold to the merchants, who had it dressed in their factories. Joint-stock mills were run by combined clothiers in order to prepare and spin the wool, but it was woven in the hand-looms by the clothiers and the members of their families. Twelve years later the hand-loom was superseded to a great extent by the power-loom; but the clothiers, who were anxious to maintain their independence, resorted to a peculiar organisation: they rented a room, or part of a room, and sometimes also the power-looms in a workshop, and they worked independently—a characteristic organisation partly maintained until now, and well adapted to illustrate the

* Nearly one-half of the 43,000 operatives who were employed at that time in the woollen trade of this country were weaving in hand-looms. So also one-fifth of the 79,000 persons employed in the worsted trade.

efforts of the petty traders to keep their ground, notwithstanding the competition of the factory. And it must be said that the triumphs of the factory were too often achieved only by means of the most fraudulent adulteration and the underpaid labour of the children. Cotton warp became quite usual in goods labelled "pure wool," and "shoddy"—*i.e.*, wool combed out of old rags gathered all over the Continent and formerly used only for blankets fabricated for the Indians in America—became of general use. In these kinds of goods the factories excelled. And yet there are branches of the woollen trade where hand-work is still the rule, especially in the fancy goods which continually require new adaptations for temporary demands. Thus, not farther than in 1881 the hand-looms of Leeds were pretty well occupied with the fabrication of woollen imitations of sealskins.

The variety of domestic industries carried on in the Lake District is much greater than might be expected, but they still wait for careful explorers. I will only mention the hoop-makers, the basket trade, the charcoal-burners, the bobbin-makers, the small iron furnaces working with charcoal at Backbarrow, and so on.* As a whole, we do not well know the petty trades of this country, and therefore we sometimes come across quite unexpected facts. Few continental writers on industrial topics would guess, indeed, that nails are still made by hand by thousands of men, women, and children in the Black Country of South Staffordshire, as also in Derbyshire,† or that the best needles are made by hand at Redditch. Chains are also made by hand at Dudley and Cradley, and although the press is periodically moved to speak of the wretched condition of the chain-makers, men and women, the trade still maintains itself; while nearly 7000 men are busy in their small workshops in

* E. Roscoe's notes in the *English Illustrated Magazine*, May, 1884.
† Bevan's *Guide to English Industries*.

making locks, even of the plainest description, at Walsall, Wolverhampton, and Willenhall. The various ironmongeries connected with horse-clothing—bits, spurs, bridles, and so on—are also largely made by hand at Walsall.

The Birmingham gun and rifle trades, which also belong to the same domain of small industries, are well known. As to the various branches of dress, there are still important divisions of the United Kingdom where a variety of domestic trades connected with dress is carried on on a large scale. I need only mention the cottage industries of Ireland, as also some of them which have survived in the shires of Buckingham, Oxford, and Bedford; hosiery is a common occupation in the villages of the counties of Nottingham and Derby; and several great London firms send out cloth to be made into dress in the villages of Sussex and Hampshire. Woollen hosiery is at home in the villages of Leicester, and especially in Scotland; straw-plaiting and hat-making in many parts of the country; while at Northampton, Leicester, Ipswich, and Stafford shoe-making was, till quite lately, a widely spread domestic occupation, or was carried on in small workshops; even at Norwich it remains a petty trade to some extent, notwithstanding the competition of the factories. It must also be said that the recent appearance of large boot and shoe factories has considerably increased the numbers of girls and women who sew the "uppers," either in their own houses or in sweaters' workshops.

The petty trades are thus an important factor of industrial life even in Great Britain, although many of them have gathered into the towns. But if we find in this country so many fewer rural industries than on the Continent, we must not imagine that their disappearance is due only to a keener competition of the factories. The chief cause was the compulsory exodus from the villages.

As every one knows from Thorold Roger's work, or, at least, from Toynbee's lectures, the growth of the factory system in England was intimately connected with that enforced exodus. Whole industries, which prospered in the country, were killed downright by the forced clearing of estates.* The workshops, much more even than the factories, multiply wherever they find cheap labour; and the specific feature of this country is, that the cheapest labour—that is, the greatest number of destitute people—is to be found in the great cities. The agitation raised (with no result) in connection with the "Dwellings of the Poor," the "Unemployed," and the "Sweating System," has fully disclosed that characteristic feature of the economic life of England and Scotland; and the painstaking researches made by Mr. Charles Booth have shown that one-quarter of the population of London—that is, 1,000,000 out of 3,800,000—would be happy if the heads of their families could have regular earnings of something like £1 a week all the year round. Half of them would be satisfied with even less than that. Cheap labour is offered in such quantities at Whitechapel and Southwark, and in the suburbs of all the great cities of Great Britain, that the petty and domestic trades which are scattered on the Continent in the villages, gather in this country in the cities. Exact figures as to the small industries are wanting, but a simple walk through the suburbs of London would do much to realise the variety of petty trades which swarm in the metropolis, and, in fact, in all chief urban agglomerations. The evidence given before the "Sweating System Committee" has shown how far the furniture and ready-made clothing palaces and the "Bonheur des Dames" bazaars of London are often mere exhibitions of samples, or markets for the sale of the produce of the small industries. Thou-

* Thorold Rogers, *The Economic Interpretation of History;* Arn. Toynbee, *Lectures on the Industrial Revolution in England.*

sands of sweaters, some of them having their own workshops, and others merely distributing work to sub-sweaters who distribute it again amidst the destitute, supply those palaces and bazaars with goods made in the slums or in very small workshops. The commerce *is* centralised in those bazaars—not the industry. The furniture palaces and bazaars are thus merely playing the part which the feudal castle formerly played in agriculture: they centralise the profits—not the production.

In reality the extension of the petty trades, side by side with the great factories, is nothing to be wondered at. It is an economic necessity. The absorption of the small industries by bigger concerns is a fact, but there is another process which is going on parallel with the former, and which consists in the continuous creation of new industries, usually making their start on a small scale. Each new factory calls into existence a number of small workshops, partly to supply its own needs and partly to submit its produce to a further transformation. Thus, to quote but one instance, the cotton mills have created an immense demand for wooden bobbins and reels, and thousands of men in the Lake District set to manufacture them—by hand first, and later on with the aid of some plain machinery. Only quite recently, after years had been spent in inventing and improving the machinery, the bobbins began to be made on a larger scale in factories. And even yet, as the machines are very costly, a great quantity of bobbins are made in small workshops, with but little aid from machines, while the factories themselves are relatively small, and seldom employ more than fifty operatives—chiefly children. As to the reels of irregular shape, they are still made by hand, or partly in small machines continually invented by the workers. New industries thus grow up to supplant the old ones; each of them passes through a preliminary stage on a small scale before reaching

the factory stage; and the more active the inventive genius of a nation is, the more it has of these budding industries. The countless small bicycle works which have lately grown up in this country, and are supplied with ready-made parts of the bicycle by the larger factories, are an instance in point. As also the domestic fabrication of boxes for matches, boots, hats, confectionery, and so on.

Besides, the factory stimulates the birth of new petty trades by creating new wants. The cheapness of cottons and woollens, of paper and brass, has created hundreds of new small industries. Our households are full of their produce—mostly things of quite modern invention. And while some of them already are turned out by the million in the factory, all have passed through the small workshop stage before the demand was great enough to require the factory organisation. The more we may have of new inventions, the more shall we have of such small industries; and again, the more we have of them, the more shall we have of the inventive genius, the want of which is so justly complained of in this country (by W. Armstrong, amongst many others). We must not wonder, therefore, if we see so many small trades in this country; but we must regret that the great number have abandoned the villages in consequence of the bad conditions of land tenure, and that they have migrated in such numbers to the cities, to the detriment of agriculture.

Petty Trades in France.

Small industries are met with in France in a very great variety, and they represent a most important feature of national economy. It is estimated, in fact, that while one-half of the population of France live upon agriculture, and one-fourth upon industry, this fourth part is equally distributed between the great

industry and the small ones, which last would thus occupy about 1,500,000 workers and support 4,000,000 to 5,000,000 persons. A considerable number of peasants who resort to small industries without abandoning agriculture would have to be added to the just-mentioned items, and the additional earnings which these peasants find in industry are so important that in several parts of France peasant proprietorship could not be maintained without the aid derived from the rural industries.

The small peasants know what they have to expect the day they become factory hands in a town; and so long as they have not been dispossessed by the money-lender of their lands and houses, and so long as the village rights in the communal grazing grounds or woods have not been lost, they cling to a combination of industry with agriculture. Having, in most cases, no horses to plough the land, they resort to an arrangement which is widely spread, if not universal, among small French landholders, even in purely rural districts (I saw it even in Haute-Savoie). One of the peasants who keeps a plough and a team of horses, tills all the fields in turn. At the same time, owing to a wide maintenance of the communal spirit, which I have described elsewhere,* further support is found in the communal shepherd, the communal wine-press, and various forms of "aids" amongst the peasants. And wherever the village-community spirit is maintained the small industries persist, while no effort is spared to bring the small plots under higher culture.

Market-gardening and fruit culture often go hand in hand with small industries. And wherever well-being is found on a relatively unproductive soil, it is nearly always due to a combination of the two sister arts.

* *Nineteenth Century*, March, 1896.

The most wonderful adaptations of the small industries to new requirements, and substantial technical progress in the methods of production, can be noted at the same time. It may even be said of France, as it has been said of Russia, that when a rural industry dies out, the cause of its decay is found much less in the competition of rival factories—in hundreds of localities the small industry undergoes a complete modification, or it changes its character in such cases—than in the decay of the population *as agriculturists.* Continually we see that only when the small landholders have been ruined, as such, by a group of causes—the loss of communal meadows, or abnormally high rents, or the havoc made in some locality by the *marchands de biens* (swindlers enticing the peasants to buy land for credit), or the bankruptcy of some shareholders' company whose shares had been eagerly taken by the peasants *—do they abandon both the land and the rural industry and emigrate towards the towns. Otherwise, a new industry always grows up when the competition of the factory becomes too acute—a wonderful, hardly suspected adaptability being displayed by the small industries; or else the rural artisans resort to some form of intensive farming, gardening, etc., and in the meantime some other industry makes its appearance.

It is evident that in most textile industries the power-loom supersedes the hand-loom, and the factory takes, or has taken already, the place of the cottage industry. Cottons, plain linen, and machine-made lace are now produced at such a low cost by machinery, that hand-weaving evidently becomes an anachronism for the plainest descriptions of such goods. Consequently, though there were in France, in the year 1876, 328,300 hand-looms as against 121,340 power-looms, it may safely be taken that the number of the former has been

* See Baudrillart's *Les Populations agricoles de la France: Normandie.*

considerably reduced within the last twenty years. However, the slowness with which this change is being accomplished is one of the most striking features of the present industrial organisation of the textile trades of France.

The causes of this power of resistance of hand-loom-weaving become especially apparent when one consults such works as Reybaud's *Le Coton*, which was written in 1863, more than thirty years ago—that is, at a time when the cottage industries were still fully alive. Though an ardent admirer himself of the great industries, Reybaud faithfully noted the striking superiority of well-being in the weavers' cottages, as compared with the misery of the factory hands in the cities. Already, then, the cities of St. Quentin, Lille, Roubaix and Amiens were great centres for cotton-spinning mills and cotton-weaving factories. But, at the same time, all sorts of cottons were woven in hand-looms, in the very suburbs of St. Quentin and in a hundred villages and hamlets around it, to be sold for finishing in the city. And Reybaud remarked that the horrible dwellings in town, and the general condition of the factory hands, stood in a wonderful contrast with the relative welfare of the rural weavers. Nearly every one of these last had his own house and a small field which he continued to cultivate.*

Even in such a branch as the fabrication of plain cotton velvets, in which the competition of the factories was especially keenly felt, home-weaving was widely spread, in 1863 and even in 1878, in the villages round Amiens. Although the earnings of the rural weavers were small, as a rule, the weavers preferred to keep to their own cottages, to their own crops and to their own cattle; and only repeated commercial crises, as well as several of the above-mentioned causes, hostile to the

* *Le Coton*, p. 170.

small peasant, compelled most of them to give up the struggle, and to seek employment in the factories, while part of them have, by this time, again returned to agriculture or taken to market-gardening.

Another important centre for rural industries was in the neighbourhood of Rouen, where no less than 110,000 persons were employed, in 1863, in weaving cottons for the finishing factories of that city. In the valley of the Andelle, in the department of Eure, each village was at that time an industrial bee-hive; each streamlet was utilised for setting into work a small factory. Reybaud described the condition of the peasants who combined agriculture with work at the rural factory as most satisfactory, especially in comparison with the condition of the slum-dwellers at Rouen, and he even mentioned a case or two in which the village factories belonged to the village communities.

Seventeen years later, Baudrillart * depicted the same region in very much the same words; and although the rural factories had had to yield to a great extent before the big factories, the rural industry was still valued as showing a yearly production of 85,000,000 francs (£2,400,000).

At the present time, the factories must have made further progress; but we still see from the excellent descriptions of M. Ardouin Dumazet, whose work will have in the future almost the same value as Arthur Young's *Travels*,† that a considerable portion of the rural weavers has still survived; while at the same time one invariably meets, even nowadays, with the remark that relative well-being is prominent in the villages in which weaving is connected with agriculture. All taken, we must, however, say that in northern France, where cottons are fabricated on a large scale in factory

* *Les Populations agricoles de la France: Normandie.*

† *Voyage en France*, Paris, 1893-7 (Berget-Levreau, publishers), 10 vols.

towns, hand-weaving in the villages is nearly gone. But things have a different aspect when we take other regions of France, where other industries prevail.

Taking the region situated between Rouen in the north-east, Orléans in the south-east, Rennes in the north-west, and Nantes in the south-west, that is, the old provinces of Normandy, Perche and Maine, and partly Touraine and Anjou, as they were seen by Ardouin Dumazet in 1895, we find there quite a variety of domestic and petty industries, both in the villages and in the towns.

At Laval (to the south-east of Rennes), where drills (*coutils*) were formerly woven out of flax in hand-looms, and at Alençon, formerly a great centre for the cottage-weaving of linen, as well as for hand-made lace, Ardouin Dumazet found both the house and the factory linen industry in a lingering state. Cotton takes the lead. Drills are now made out of cotton in the factories, and the demand for flax goods is very small. Both domestic and factory weaving of flax goods are accordingly in a poor condition. The cottagers abandon that branch of weaving, and the large factories which had been erected at Alençon, with the intention of creating a flax and hemp-cloth industry, had to be closed. Only one factory, occupying 250 hands, remains; while nearly 23,000 weavers who found occupation at Mans, Fresnay and Alençon in hemp cloths and fine linen had to abandon that industry. Those who worked in factories have emigrated to other towns, while those who had not broken with agriculture reverted to it. In this struggle of cotton *versus* flax and hemp, the former was victorious.

As to lace, it is made in such quantities by machinery at Calais, Caudry, St. Quentin and Tarare that only high-class artistic lace-making continues on a small scale at Alençon itself, but it still remains a by-occupation in the surrounding country. Besides, at Flers, and at Ferté Macé (a small town to the south of the former),

hand-weaving is still carried on in about 5400 hand-looms, although the whole trade, in factories and villages alike, is in a piteous state since the Spanish markets have been lost. Spain has now plenty of her own cotton mills. Twelve big spinning mills at Coudé (where 4000 tons of cotton were spun in 1883) were abandoned in 1893, and the workers were thrown into a most miserable condition.*

On the contrary, in an industry which supplies the home market, namely in the fabrication of linen hand-kerchiefs, which itself is of a quite recent growth, we see that cottage-weaving is, even now, in full prosperity. Cholet (in Maine-et-Loire, south-west of Angers) is the centre of that trade. It has one spinning mill and one weaving mill, but both employ considerably fewer hands than domestic weaving, which is spread in no less than 200 villages of the surrounding region.† Neither at Rouen nor in the industrial cities of Northern France are so many linen handkerchiefs fabricated as in this region in hand-looms, we are told by Ardouin Dumazet.

Within the curve made by the Loire as it flows past Orléans we find another prosperous centre of domestic industries connected with cottons. "From Romorantin [in Loire-et-Cher, south of Orléans] to Argenton and Le Blanc," the same writer says, "we have one immense workshop where handkerchiefs are embroidered, and shirts, cuffs, collars and all sorts of ladies' linen are sewn or embroidered. There is not one house, even in the tiniest hamlets, where the women would not be occupied in that trade . . . and if this work is a mere *passe-temps* in vine-growing regions, here it has become the chief resource of the population." ‡ Even at Romorantin itself, where 400 women and girls are employed in one factory, there are more than 1000 women who sew

* Ardouin Dumazet, vol. ii., p. 167.
† In Maine-et-Loire, la Vendée, Loire Inférieure, and Deux-Sèvres.
‡ Ardouin Dumazet, vol. i., p. 117 *et seq.*

linen in their houses. The same must be said of a group of industrial villages, peopled with clothiers in the neighbourhood of another Normandy city, Elbœuf. When Baudrillart visited them in 1878-80, he was struck with the undoubted advantages offered by a combination of agriculture with industry. Clean houses, clean dresses, and a general stamp of well-being were characteristic of these villages.

Happily enough, weaving is not the only small industry of both this region and Brittany. On the contrary, scores of other small industries enliven the villages and burgs. At Fougères (in Ille-et-Vilaine, to the north-east of Reims) one sees how the factory has contributed to the development of various small and domestic trades. In 1830 this town was a great centre for the domestic fabrication of the so-called *chaussons de tresse*. The competition of the prisons killed, however, this primitive industry; but it was soon substituted by the fabrication of soft socks in felt (*chaussons de feutre*). This last industry also went down, and then the fabrication of boots and shoes was introduced, this last giving origin, in its turn, to the boot and shoe factories, of which there are now thirty-three at Fougères, employing 8000 workers (yearly production about 5,000,000 pairs). But at the same time domestic industries took a new development. Thousands of women are employed now in their houses in sewing the "uppers" and in embroidering fancy shoes. Moreover, quite a number of smaller workshops grew up in the neighbourhood, for the fabrication of cardboard boxes, wooden heels, and so on, as well as a number of tanneries, big and small. And M. Ardouin Dumazet's remark is, that one is struck to find owing to these industries an undoubtedly higher level of well-being in the villages—quite unforeseen in the centre of this purely agricultural region.*

* Vol. v., p. 270.

In Brittany, in the neighbourhood of Quimperlé, a great number of small workshops for the fabrication of the felt hats which are worn by the peasants is scattered in the villages; and rapidly improving agriculture goes hand in hand with that trade. Well-being is a distinctive feature of these villages.* At Hennebout (on the southern coast of Brittany) 1400 workers are employed in an immense factory in the fabrication of tins for preserves, and every year twenty-two to twenty-three tons of iron are transformed into steel, and next into tins, which are sent to Paris, Bordeaux, Nantes, and so on. But the factory has created "quite a world of tiny workshops" in this purely agricultural region: small tin-ware workshops, tanneries, potteries, and so on, while the slags are transformed in small workshops into manure. Agriculture and industry go here hand in hand, the importance of not severing the union being perhaps best seen at Loudéac, a small town in the midst of Brittany (department of Côtes-du-Nord). Formerly the villages in this neighbourhood were industrial, all hamlets being peopled with weavers who fabricated the well-known Brittany linen. Now, this industry having very much gone down, the weavers have simply returned to the soil. Out of an industrial town, Loudéac has become an agricultural market town;† and, what is most interesting, these populations conquer new lands for agriculture and turn the formerly quite unproductive *landes* into rich corn fields; while on the northern coast of Brittany, around Dol, on land which began to be conquered from the sea in the twelfth century, market-gardening is now carried on to a very great extent for export to England. Altogether, it is striking to observe, on perusing M. Ardouin Dumazet's little volumes, how domestic industries go hand in hand with all sorts of small industries in agriculture—gardening, poultry-farming,

* Ardouin Dumazet, vol. v., p. 215.
† *Ibid.*, vol. v., pp. 259-266.

fabrication of fruit preserves, and so on, and how all sorts of associations for sale and export are easily introduced. Mans is, as known, a great centre for the export of geese and all sorts of poultry to England.

Part of Normandy (namely, the departments of Eure and Orne) is dotted with small workshops where all sorts of small brass goods and hardware are still fabricated in the villages. Of course, the domestic fabrication of pins is nearly gone, and as for needles, polishing only, in a very primitive form, has been maintained in the villages. But all sorts of small hardware, including nails, lockets, etc., in great variety, are fabricated in the villages, especially round Laigle. Stays are also sewn in small workshops in many villages, notwithstanding the competition of prison work.*

Tinchebrai (to the west of Flers) is a real centre for a great variety of smaller goods in iron, mother-of-pearl and horn. All sorts of hardware and locks are fabricated by the peasants during the time they can spare from agriculture, and real works of art, some of which were much admired at the exhibition of 1889, are produced by these humble peasant sculptors in horn, mother-of-pearl and iron. Farther south, the polishing of marble goods is carried on in numbers of small workshops scattered round Solesmes and grouped round one central establishment where marble pieces are roughly shaped with the aid of steam, to be finished in the small village workshops. At Sablé the workers in that branch, who all own their houses and gardens, enjoy a real well-being especially noticed by our traveller.†

In the woody regions of the Perche and the Maine we find all sorts of wooden industries which evidently could only be maintained owing to the communal possession of the woods. Near the forest of Perseigne there

* I gave, a few years ago, some information about French prison work in a book, *In Russian and French Prisons*, London, 1888.

† Ardouin Dumazet, vol. ii., p. 51.

is a small burg, Fresnaye, which is entirely peopled with workers in wood.

"There is not one house," Ardouin Dumazet writes, "in which wooden goods would not be fabricated. Some years ago there was little variety in their produce; spoons, salt-boxes, shepherds' boxes, scales, various wooden pieces for weavers, flutes and hautboys, spindles, wooden measures, funnels, and wooden bowls were only made. But Paris wanted to have a thousand things in which wood was combined with iron: mouse-traps, cloak-pegs, spoons for jam, brooms. . . . And now every house has a workshop containing either a turning-lathe, or some machine-tools for chopping wood, for making lattice-work, and so on. . . . Quite a new industry was born, and the most coquettish things are now fabricated. Owing to this industry the population is happy. The earnings are not high, but each worker owns his house and garden, and occasionally a bit of field." *

At Neufchâtel wooden shoes are made, and the hamlet, we are told, has a most smiling aspect. To every house a garden is attached, and none of the misery of big cities is to be seen. At Jupilles and in the surrounding country other varieties of wooden goods are produced: tapes, boxes of different kinds, together with wooden shoes; while at the forest of Vibraye two workshops have been erected for turning out umbrella handles by the million for all France. One of these workshops having been founded by a worker sculptor, he has invented and introduced in his workshop the most ingenious machine-tools. About 150 men work at this factory; but it is evident that half a dozen smaller workshops, scattered in the villages, would have answered equally well.

Going now over to a quite different region—the Nièvre, in the centre of France, and Haute Marne, in the east—we find that both regions are great centres for a variety of small industries, some of which are maintained by associations of workers, while others have grown up in the shadow of factories. The small iron workshops which formerly covered the country have not disappeared: they have undergone a transformation;

* Vol. i., pp. 305, 306.

and now the country is covered with small workshops where agricultural machinery, chemical produce, and pottery are fabricated; "one ought to go as far as Guérigny and Fourchambault to find the great industry;" * while a number of small workshops for the fabrication of a variety of hardware flourish by the side of, and owing to the proximity of, the industrial centres. Pottery makes the fortune of the valley of the Loire about Nevers. High-class art pottery is made in this town, while in the villages plain pottery is fabricated and exported by merchants who go about with their boats, selling it. At Gien a large factory of china buttons (made out of felspar-powder cemented with milk) has lately been established, and employs 1500 workmen, who produce from 3500 to 4500 lb. of buttons every day. And, as is often the case, part of the work is done in the villages. For many miles on both banks of the Loire, in all villages, old people, women and children sew the buttons to the cardboard pieces. Of course, that sort of work is wretchedly paid; but it is resorted to only because there is no other sort of industry in the neighbourhood to which the peasants could give their leisure time.

In the same region of the Haute Marne, especially in the neighbourhood of Nogent, we find cutlery as a by-occupation to agriculture. Landed property is very much subdivided in that part of France, and great numbers of peasants own but from two to three acres per family, or even less. Consequently, in thirty villages round Nogent, about 5000 men are engaged in cutlery, chiefly of the highest sort (artistic knives are occasionally sold at as much as £20 a piece), while the lower sorts are fabricated in the neighbourhoods of Thiers, in Puy-de-Dôme (Auvergne). The Nogent industry has developed spontaneously without any aid from without,

* Ardouin Dumazet, vol. i., p. 52.

and in its technical part it shows considerable progress;* while at Thiers, where the cheapest sorts of cutlery are made, the division of labour, the cheapness of rent for small workshops supplied with motive power from the Durolle river, or from small gas motors, the aid of a great variety of specially invented machine-tools, and the existing combination of machine-work with hand-work have resulted in such a perfection of the technical part of the trade that it is considered doubtful whether the factory system could further economise labour.† For twelve miles round Thiers, in each direction, all the streamlets are dotted with small workshops, in which peasants, who continue to cultivate their fields, are at work.

Basket-making is again an important cottage industry in several parts of France, namely in Aisne and in Haute Marne. In this last department, at Villaines, every one is a basket-maker, "and all the basket-makers belong to a co-operative society," Ardouin Dumazet remarks.‡ "There are no employers; all the produce is brought once a fortnight to the co-operative stores and there it is sold for the association. About 150 families belong to it, and each owns a house and some vineyards." At Fays-Billot, also in Haute Marne, 1500 basket-makers also belong to an association; while at Thiérache, where several thousand men are engaged in the same trade, no association has been formed, the earnings being in consequence extremely low.

Another very important centre of petty trades is the French Jura, or the French part of the Jura Mountains, where the watch trade has attained, as known, a high development. When I visited these villages

* Prof. Issaieff in the Russian *Memoirs of the Petty Trades Commission* (*Trudy Kustarnoi Kommissii*), vol. v.

† Knives are sold at from 6s. 4d. to 8s. per gross, and razors at 3s. 3d. per gross—"for export".

‡ Ardouin Dumazet, vol. i., p. 213 *et seq.*

between the Swiss frontier and Besançon in the year 1878, I was struck by the high degree of relative well-being which I could observe, even though I was perfectly well acquainted with the Swiss villages in the Val de Saint Imier. It is very probable that the machine-made watches have brought about a crisis in French watch-making as they have in Switzerland. But it is known that part, at least, of the Swiss watch-makers have strenuously fought against the necessity of being enrolled in the factories, and that while watch factories grew up at Geneva and elsewhere, considerable numbers of the watch-makers have taken to divers other trades which continue to be carried on as domestic or small industries. I must only add that in the French Jura great numbers of watch-makers were at the same time owners of their houses and gardens, very often of bits of fields, and especially of communal meadows, and that the communal *fruitières*, or creameries for the common sale of butter and cheese, are widely spread in that part of France.

So far as I could ascertain, the development of the machine-made watch industry has not destroyed the small industries of the Jura hills. The watch-makers have taken to new branches, and, as in Switzerland, they have created various new industries. From Ardouin Dumazet's travels we can, at any rate, borrow an insight into the present state of the southern part of this region. In the neighbourhoods of Nantua and Cluse silks are woven in nearly all villages, the peasants giving to weaving their spare time from agriculture, while quite a number of small workshops (mostly less than twenty looms, one of 100 looms) are scattered in the little villages, on the streamlets running from the hills. Scores of small saw-mills have also been built along the streamlet Merloz, for the fabrication of all sorts of little pretty things in wood. At Oyonnax, a small town on the Ain, we have a big centre for the fabrication of combs, an industry more than 200 years old, which took

a new development since the last war through the invention of celluloid. No less than 100 or 120 "masters" employ from two to fifteen workers each, while over 1200 persons work in their houses, making combs out of Irish horn and French celluloid. Wheel-power was formerly rented in small workshops, but electricity, generated by a waterfall, has lately been introduced, and is now distributed in the houses for bringing into motion small motors of from one-quarter to twelve horse-power. And it is remarkable to notice that as soon as electricity gave the possibility to return to domestic work 300 workers left at once the small workshops and took to work in their houses. Most of these workers have their own cottages and gardens, and they show a very interesting spirit of association. They have also erected four workshops for making cardboard boxes, and their production is valued at 2,000,000 fr. every year.*

At St. Claude, which is a great centre for briar pipes (sold in large quantities in London with English trade-marks, and therefore eagerly bought by those Frenchmen who visit London, as a *souvenir* from the other side of the Channel), big and small workshops, both supplied by motive force from the Tacon streamlet, prosper by the side of each other. Over 4000 men and women are employed in this trade, while all sorts of small by-trades have grown by its side (amber and horn mouth-pieces, sheaths, etc.). Countless small workshops are busy besides, on the banks of the two streams, with the fabrication of all sorts of wooden things: match-boxes, beads, sheaths for spectacles, small things in horn, and so on, to say nothing of a large factory (200 workers) where metric measures are fabricated for the whole world. At the same time thousands of persons in St. Claude, in the neighbouring villages and in the smallest mountain hamlets, are busy in cutting diamonds (an industry only

* Ardouin Dumazet, vol. viii., p. 40.

fifteen years old in this region), and other thousands are busy in cutting various less precious stones. All this is done in quite small workshops supplied by water-power. The extraction of ice from some lakes and the gathering of oak-bark for tanneries complete the picture of these busy villages, where industry joins hands with agriculture, and modern machines and appliances are so well put in the service of the small workshops.

Finally, omitting a mass of small trades, I will only name the hat-makers of the Loire, the stationery of the Ardèche, the fabrication of hardware in the Doubs, the glove-makers of the Isère, the broom and brush-makers of the Oise (valued at £800,000 per annum), and the house machine-knitting in the neighbourhoods of Troyes. But I must say a few words more about two important centres of small industries: the Lyons region and Paris.

At the present time the industrial region of which Lyons is the centre * includes the departments of Rhône, Loire, Drôme, Saône-et-Loire, Ain, the southern part of the Jura department, and the western part of Savoy, as far as Annecy, while the silkworm is reared as far as the Alps, the Cévennes Mountains, and the neighbourhoods of Mâcon. It contains, besides fertile plains, large hilly tracts, also very fertile as a rule, but covered with snow during part of the winter, and the rural populations are therefore bound to resort to some industrial occupation in addition to agriculture; they find it in silk-weaving and various small industries. Altogether it may be said that the *région lyonnaise* is characterised as a separate centre of French civilisation and art, and that a remarkable spirit of research, discovery and invention has developed there in all directions—scientific and industrial.

The Croix Rousse at Lyons, where the silk-weavers

* For further details see Appendix O.

(*canuts*) have their chief quarters, is the centre of that industry, and in 1895 the whole of that hill, thickly covered with houses, five, six, eight and ten storeys high, resounded with the noise of the looms which were busily going in every apartment of that big agglomeration. Electricity has lately been brought into the service of this domestic industry, supplying motive power to the looms.

To the south of Lyons, in the city of Vienne, hand-weaving is disappearing. "Shoddy" is now the leading produce, and twenty-eight concerns only remain out of the 120 *fabriques* which existed thirty years ago. Old woollen rags, rags of carpets, and all the dust from the carding and spinning in the wool and cotton factories of Northern France, with a small addition of cotton, are transformed here into cloth which flows from Vienne to all the big cities of France—20,000 yards of "shoddy" every day—to supply the ready-made clothing factories. Hand-weaving has evidently nothing to do in that industry, and only 1300 hand-looms are now at work out of the 4000 which were in motion ten years ago. Large factories, employing a total of 1800 workers, have taken the place of these hand-weavers, while "shoddy" has taken the place of cloth. All sorts of flannels, felt hats, tissues of horse-hair, and so on, are fabricated at the same time. But while the great factory thus conquered the city of Vienne, its suburbs and its nearest surroundings became the centre of a prosperous gardening and fruit culture, which has already been mentioned in chapter iv. The banks of the Rhône, between Ampuis and Condrieu, are one of the wealthiest parts of all France, owing to the shrubberies and nurseries, market-gardening, fruit-growing, vine-growing and cheese-making out of goats' milk. House industries go there hand in hand with an intelligent culture of the soil; Condrieu, for instance, is a famous centre for embroidery, which is made partly by hand, as of old, and partly by machinery.

In the west of Lyons, at l'Arbresles, factories have grown up for making silks and velvets; but a large part of the population still continue to weave in their houses; while farther west, Panissières is the centre of quite a number of villages in which linen and silks are woven as a domestic industry. Not all these workers own their houses, but those, at least, who own or rent a small piece of land or garden, or keep a couple of cows, are said to be well off, and the land, as a rule, is said to be admirably cultivated by these weavers.

The chief industrial centre of this part of the Lyons region is certainly Tarare. Thirty years ago, when Reybaud wrote his excellent work, *Le Coton*, it was a centre for the manufacture of muslins and it occupied in this industry the same position as Leeds formerly occupied in this country in the woollen cloth trade. The spinning mills and the large finishing factories were at Tarare, while the weaving of the muslins and the embroidery of the same were made in the surrounding villages, especially in the hilly tracts of the Beaujolais and the Forez. Each peasant house, each farm and *métayerie* were small workshops at that time, and one could see, Reybaud wrote, the lad of twenty embroidering fine muslin after he had finished cleaning the farm stables, without the work suffering in its delicacy from a combination of two such varied pursuits. On the contrary, the delicacy of the work and the extreme variety of patterns were a distinctive feature of the Tarare muslins and a cause of their success. All testimonies agreed at the same time in recognising that, while agriculture found support in the industry, the agricultural population enjoyed a relative well-being.

By this time the industry has undergone a thorough transformation, but still no less than 60,000 persons, representing a population of about 250,000 souls, work for Tarare in the hilly tracts, weaving all sorts of muslins for all parts of the world, and they earn every year

£480,000 in this way. Amplepuis, notwithstanding its own factories of silks and its wonderful apricot culture, remains one of the local centres for such muslins; while close by, Thizy is a centre for a variety of linings, flannels, "peruvian serges," "oxfords," and other mixed woollen-and-cotton stuffs which are woven in the mountains by the peasants. No less than 3000 hand-looms are thus scattered in twenty-two villages, and about £600,000 worth of various stuffs are woven every year by the rural weavers in this neighbourhood alone; while 15,000 power-looms are at work in both Thizy and the great city of Roanne, in which two towns all varieties of cottons (linings, flannelettes, apron cloth) and silk blankets are woven in factories by the million yards. At Cours, 1600 workers are employed in making "blankets," chiefly of the lowest sort (even such as are sold at 2s. and even 10d. a piece, for export to Brazil); all possible and imaginable rags and sweepings from all sorts of textile factories (jute, cotton, flax, hemp, wool and silk) are used for that industry, in which the factory is, of course, fully victorious. But even at Roanne, where the fabrication of cottons has attained a great degree of perfection and 9000 power-looms are at work, producing every year more than 30,000,000 yards—even at Roanne one finds with astonishment that domestic industries are not dead, but yield every year the respectable amount of more than 10,000,000 yards of stuffs. At the same time, in the neighbourhood of that big city the industry of fancy-knitting has taken within the last thirty years a sudden development. Only 2000 women were employed in it in 1864, but their numbers are now estimated at 20,000; and, without abandoning their rural work, they find time to knit, with the aid of small knitting-machines, all sorts of fancy articles in wool, the annual value of which is estimated at £360,000.*

* Ardouin Dumazet, vol. viii., p. 266.

It must not be thought, however, that textiles and connected trades are the only small industries in this locality. Scores of various rural industries continue to exist besides, and in nearly all of them the methods of production are continually improved. Thus, when the rural making of plain chairs became unprofitable, articles of luxury and stylish chairs began to be fabricated in the villages, and similar transformations are found everywhere.

More details about this extremely interesting region will be found in the Appendix, but one remark must be made in this place. Notwithstanding its big industries and coal mines this part of France has entirely maintained its rural aspect, and is now one of the best cultivated parts of the country. What most deserves admiration is—not so much the development of the great industries, which, after all, here as elsewhere, are to a great extent international in their origins—as the creative and inventive powers and capacities of adaptation which appear amongst the great mass of these industrious populations. At every step, in the field, in the garden, in the orchard, in the dairy, in the industrial arts, in the hundreds of small inventions in these arts, one sees the creative genius of the folk. In these regions one best understands why France, taking the mass of its population, is considered the richest country of Europe.*

The chief centre for petty trades in France is, however, Paris. There we find, by the side of the large factories, the greatest variety of petty trades for the fabrication of goods of every description, both for the home market and for export. The petty trades at Paris so much prevail over the factories that the average number of workmen employed in the 98,000 factories and workshops of Paris is less than *six*, while the number of

* Some further details about the Lyons region and St. Etienne are given in Appendix O.

persons employed in workshops which have less than five operatives is almost twice as big as the number of persons employed in the larger establishments.* In fact, Paris is a great bee-hive where hundreds of thousands of men and women fabricate in small workshops all possible varieties of goods which require skill, taste and invention. These small workshops, in which artistic finish and rapidity of work are so much praised, necessarily stimulate the mental powers of the producers; and we may safely admit that if the Paris workmen are generally considered, and really are, more developed intellectually than the workers of any other European capital, this is due to a great extent to the character of the work they are engaged in—a work which implies artistic taste, skill, and especially inventiveness, always wide awake in order to invent new patterns of goods and steadily to increase and to perfect the technical methods of production. It also appears very probable that if we find a highly developed working population in Vienna and Warsaw, this depends again to a very great extent upon the very considerable development of similar small industries, which stimulate invention and so much contribute to develop the worker's intelligence.

The *Galerie du travail* at the Paris exhibitions is always a most remarkable sight. One can appreciate in it both the variety of the small industries which are carried on in French towns and the skill and inventing powers of the workers. And the question necessarily arises: Must all this skill, all this intelligence, be swept away by the factory, instead of becoming a new fertile source of progress under a better organisation of production? must all this independence and inventiveness of the worker disappear before the factory levelling?

* In 1873, out of a total population of 1,851,800 inhabiting Paris, 816,040 (404,408 men and 411,632 women) were living on industry, and out of them only 293,691 were connected with the factories (*grande industrie*), while 522,349 were living on the petty trades (*petite industrie*). —Maxime du Camp, *Paris et ses Organes*, vol. vi.

and, if it must, would such a transformation be a progress, as so many economists who have only studied figures and not human beings are ready to maintain?

At any rate, it is quite certain that even if the absorption of the French petty trades by the big factories were possible—which seems extremely doubtful—the absorption would not be accomplished so soon as that. The small industry of Paris fights hard for its maintenance, and it shows its vitality by the numberless machine-tools which are continually invented by the workers for improving and cheapening the produce.

The numbers of motors which were exhibited at the last exhibitions in the *Galerie du travail* bear a testimony to the fact that a cheap motor, for the small industry, is one of the leading problems of the day. Motors weighing only forty-five lb., including the boiler, were invented to answer that want. Small two-horse-power engines, now fabricated by the engineers of the Jura (formerly watch-makers) in their small workshops, are another attempt to solve the problem—to say nothing of the water, gas and electrical motors. The transmission of steam-power to 230 small workshops which was made by the *Société des Immeubles industriels* was another attempt in the same direction, and the increasing efforts of the French engineers for finding out the best means of transmitting and subdividing power by means of compressed air, "tele-dynamic cables," and electricity are indicative of the endeavours of the small industry to retain its ground in the face of the competition of the factories. (See Appendix P.)

CHAPTER VII.

SMALL INDUSTRIES AND INDUSTRIAL VILLAGES (*continued*).

Petty trades in Germany: Discussions upon the subject and conclusions arrived at—*Petty trades in Russia*—Conclusions.

Petty Trades in Germany.

THE various industries which still have retained in Germany the characters of petty and domestic trades have been the subject of many exhaustive explorations, especially by A. M. Thun, and Prof. Issaieff, on behalf of the Russian Petty Trades Commission, Emanuel Hans Sax, Paul Voigt, and very many others. By this time the subject has a bulky literature, and such impressive and suggestive pictures have been drawn from life for different regions and trades that I felt tempted to sum up these life-true descriptions. However, as in such a summary I should have to repeat much of what has already been said and illustrated in the preceding chapter, it will probably more interest the general reader to know something about the conclusions which can be drawn from the works of the German investigators.*

Unhappily, the discussion upon this important subject has often taken in Germany a passionate and even a personally aggressive character.† On the one hand

* The remarks of Prof. Issaieff—a thorough investigator of petty trades in Russia, Germany and France—will be for me a very valuable guide in the following. See *Works of the Commission for the Study of Petty Trades in Russia* (Russian), St. Petersburg, 1879-87, vol. i.

† See K. Buecher's Preface to the *Untersuchungen über die Lage des Handwerks in Deutschland*, vol. iv.

the ultra-conservative elements of German politics tried, and succeeded to some extent, in making of the petty trades and the domestic industries an arm for securing a return to the "olden good times". They even passed a law intended to prepare a reintroduction of the old-fashioned, closed and patriarchal corporations which could be placed under the close supervision and tutorship of the State, and they saw in such a law a weapon against social democracy. On the other hand, the social democrats, justly opposed to such measures, but themselves inclined, in their turn, to take too abstract a view of economical questions, bitterly attack all those who do not merely repeat the stereotyped phrases to the effect that "the petty trades are in decay," and "the sooner they disappear the better," as they will give room to capitalist centralisation, which, according to the social democratic creed, "will soon achieve its own ruin".* In this dislike of the small industries they are, of course, at one with the economists of the orthodox school, whom they combat on nearly all other points.

Under such conditions, the polemics about the petty

* The foundation for this creed is contained in one of the concluding chapters of Marx's *Kapital* (the last but one), in which the author spoke of the concentration of capital and saw in it the "fatality of a natural law". In the "forties," this idea was shared by nearly all socialists, and continually recurred in their writings. But Marx was too much of a thinker that he should not have taken notice of the subsequent developments of industrial life, which were not foreseen in 1848; if he had lived now he surely would not have shut his eyes to the formidable growth of the numbers of small capitalists and to the middle-class fortunes which are made in a thousand ways under the shadow of the modern "millionaires". Very likely he would have noticed also the extreme slowness with which the wrecking of small industries goes on —a slowness which could not be predicted fifty or forty years ago, because no one could foresee at that time the facilities which have been offered since for transport, the growing variety of demand, nor the cheap means which are now in use for the supply of motive power in small quantities. Being a thinker, he would have studied these facts, and very probably he would have mitigated the absoluteness of his earlier formulæ, as in fact he did once with regard to the village community in Russia. It would be most desirable that his followers should rely less upon abstract formulæ—easy as they may be as watchwords in political struggles—and try to imitate their teacher in his analysis of *concrete* economical phenomena.

trades and the domestic industries are evidently doomed to remain most unproductive. However, it is pleasant to see that a considerable amount of most conscientious work has been done for the investigation of the petty trades in Germany; and, by the side of such monographs, from which nothing can be learned but that the petty trades' workers are in a miserable condition, and nothing whatever can be gathered to explain why these workers prefer their conditions to those of factory hands —there is no lack of such detailed monographs (such as those of Thun, Emil Sax, Paul Voigt on the Berlin cabinet-makers, etc.), in which one sees the whole of the life of these classes of workers, the difficulties which they have to cope with, and the technical conditions of the trade, and finds all the elements for an independent judgment upon the matter.

It is evident that a number of petty trades are already now doomed to disappear; but there are others, on the contrary, which are endowed with a great vitality, and all chances are in favour of their continuing to exist and to take a further development for many years to come. In the fabrication of such textiles as are woven by millions of yards, and can be best produced with the aid of a complicated machinery, the competition of the hand-loom against the power-loom is evidently nothing but a survival, which may be maintained for some time by certain local conditions, but finally must die away. The same is true with regard to many branches of the iron industries, hardware fabrication, pottery, and so on. But wherever the direct intervention of taste and inventiveness are required, wherever new patterns of goods requiring a continual renewal of machinery and tools must continually be introduced in order to feed the demand, as is the case with all fancy textiles, even though they be fabricated to supply the millions; wherever a great variety of goods and the uninterrupted invention of new ones goes on, as is the case in the toy

trade, in instrument making, watch making, bicycle making and so on; and finally, wherever the artistic feeling of the individual worker makes the best part of his goods, as is the case in hundreds of branches of small articles of luxury, there is a wide field for petty trades, rural workshops, domestic industries, and the like. More fresh air, more ideas, more general conceptions are evidently required in those industries. But where the spirit of initiative has been awakened in one way or another, we see the petty industries taking a new development in Germany, as we have just seen that being done in France.

Now, in nearly all the petty trades in Germany, the position of the workers is unanimously described as most miserable, and the many admirers of centralisation which we find in Germany always insist upon this misery in order to predict, and to call for, the disappearance of "those mediæval survivals" which "capitalist centralisation" must supplant for the benefit of the worker. The reality is, however, that when we compare the miserable conditions of the workers in the petty trades with the conditions of the wage workers in the factories, in the same regions and in the same trades, we see that the very same misery prevails among the factory workers. They live upon wages of from nine to eleven shillings a week, in town slums instead of the country. They work eleven hours a day, and they also are subject to the extra misery thrown upon them during the frequently recurring crises. It is only after they have undergone all sorts of sufferings in their struggles against their employers that some factory workers succeed, more or less, here and there, to wrest from their employers a "living wage"—and this again only in certain trades.

To welcome all these sufferings, seeing in them the action of a "natural law" and a *necessary* step towards the *necessary* concentration of industry, would be simply absurd. While to maintain that the pauperisation of all

workers and the wreckage of all village industries are a *necessary* step towards a higher form of industrial organisation would be, not only to affirm much more than one is entitled to affirm under the present imperfect state of economical knowledge, but to show an absolute want of comprehension of the sense of both natural and economic laws. Every one, on the contrary, who has studied the question of the growth of great industries on its own merits, will undoubtedly agree with Thorold Rogers, who considered the sufferings inflicted upon the labouring classes for that purpose as having been of *no necessity whatever*, and simply having been inflicted to suit the temporary interests of the few—by no means those of the nation.*

Moreover, every one knows to what extent the labour of children and girls is resorted to even in the most prosperous factories—even in this country which stands foremost in industrial development. Some figures relative to this subject were given in the preceding chapter. And this fact is not an accident which might be easily removed, as Maurice Block—a great admirer, of course, of the factory system—tries to represent it.† The low wages paid to children and youths are one of the necessary elements in the cheapness of the factory produce in all textiles, and, consequently, of the very competition of the factory with the petty trades. I have mentioned besides, whilst speaking of France, what are the effects of "concentrated" industries upon village life; and in Thun's work, and in many others as well, one may find enough of ghastly instances of what are the effects of accumulations of girls in the factories. To idealise the modern factory, in order to depreciate the so-called "mediæval" forms of the small industries, is consequently—to say the least—as unreasonable as to idealise

* *The Economic Interpretation of History.*

† *Les Progrès de la Science économique depuis Adam Smith*, Paris, 1890, t. i., pp. 460, 461.

the latter and try to bring mankind back to isolated home-spinning and home-weaving in every peasant house.

One fact dominates all the investigations which have been made into the conditions of the small industries. We find it in Germany, as well as in France or in Russia. In an immense number of trades it is not the superiority of the *technical* organisation of the trade in a factory nor the economies realised on the prime-motor which militate against the small industry in favour of the factories, but the more advantageous conditions for *selling* the produce and for *buying* the raw produce which are at the disposal of big concerns. Wherever this difficulty has been overcome, either by means of association or in consequence of a market being secured for the sale of the produce, it has always been found—first, that the conditions of the workers or artisans immediately improved; and next, that a rapid progress was realised in the technical aspects of the respective industries: new processes were introduced to improve the produce or to increase the rapidity of its fabrication; new machine-tools were invented, or new motors were resorted to, or the trade was reorganised so as to diminish the costs of production. On the contrary, wherever the helpless, isolated artisans and workers continue to remain at the mercy of the wholesale buyers, who always —since Adam Smith's time—"openly or tacitly" agree to act as one man to bring down the prices almost to a starvation level—and such is the case for the immense number of the small and village industries—their condition is so bad that only the longing of the workers after a certain relative independence, and their knowledge of what awaits them in the factory, prevent them from joining the ranks of the factory hands. Knowing that in most cases the advent of the factory would mean no work at all for most men, and the taking of the children and girls to the factory, they do the utmost to prevent it from appearing at all in the village.

As to combinations in the villages, co-operation and the like, one must never forget how jealously the German, the French, the Russian and the Austrian Governments have hitherto prevented the workers, *and especially the village workers*, from entering into any sorts of combinations for economical purposes. To keep the peasant at the lowest possible level, by means of taxation, serfdom, and the like, has been, and is still, the policy of most continental states. It was only fourteen years ago that some extension of the association rights was granted in Germany, and even now a mere co-operative association for the sale of the artisans' work is soon reported as a "political association" and submitted as such to the usual limitations, such as the exclusion of women and the like. A striking example of that policy as regards a village association is given by Prof. Issaieff, who also mentions the severe measures taken by the wholesale buyers in the toy trade to prevent the workers from entering into direct intercourse with foreign buyers.

When one examines with more than a superficial attention the life of the small industries and their struggles for life, one sees that when they perish, they perish—not because "an economy can be realised by using a hundred horse-power motor, instead of a hundred small motors"—this inconveniency never fails to be mentioned, although it is easily obviated in Sheffield, in Paris, and many other places by hiring workshops with steam-power, and, still more, as was so truly observed by Prof. W. Unwin, by the electric transmission of power. They do not perish because a substantial economy can be realised in the factory production—in many more cases than is usually supposed, the fact is even the reverse—but because the capitalist who establishes a factory emancipates himself from the wholesale and retail dealers in raw materials; and especially, because he emancipates himself from the buyers of his

produce and can deal directly with the wholesale buyer and exporter; or else he concentrates in one concern the different stages of fabrication of a given produce. The pages which Schulze-Gäwernitz has given to the organisation of the cotton industry in England, and to the difficulties which the German cotton-mill owners had to contend with so long as they were dependent upon Liverpool for raw cotton, are most instructive in this direction. And what characterises the cotton trade prevails in all other industries as well. If the Sheffield cutlers who now work in their tiny workshops, in one of the above-mentioned buildings supplied with wheel-power, were incorporated in one big factory, the chief advantage which would be realised in the factory would not be an economy in the costs of production in comparison to the quality of the produce; with a shareholders' company the costs might even increase. And yet the profits (including wages) would be much greater than the aggregate earnings of the workers, in consequence of the reduced costs of purchase of iron and coal, and the facilities for the sale of the produce. The great concern would thus find its advantages—not in such factors as are imposed by the technical necessities of the trade at the time being, but in such factors as could be eliminated by co-operative organisation. All these are elementary notions among practical men. It hardly need be added that a further advantage which the factory owner has is, that he can find a sale even for produce of the most inferior quality, provided there is a considerable quantity of it to be sold. All those who are acquainted with commerce know, indeed, what an immense bulk of the world's trade consists of "shoddy," *patraque*, "Red Indians' blankets," and the like, shipped to distant countries. Whole cities—we just saw—produce nothing but "shoddy".

Altogether, it may be taken as one of the fundamental facts of the economical life of Europe that the

defeat of a number of small trades, artisan work and domestic industries came through their being incapable of organising the *sale* of their produce—not from the *production* itself. The same thing recurs at every page of economical history. The incapacity of organising the sale, without being enslaved by the merchant, was the leading feature of the mediæval cities, which gradually fell under the economical and political yoke of the Guild-Merchant, simply because they were not able to maintain the sale of their manufactures by the community as a whole, or to organise the sale of a new produce in the interest of the community. When the markets for such commodities came to be Asia on the one side and the New World on the other side, such was fatally the case. Even nowadays, when we see the co-operative societies beginning to succeed in their productive workshops, while twenty years ago they invariably failed in their capacity of producers, we may conclude that the cause of their previous failures was not in their incapacity of properly and economically organising *production*, but in their inability of acting as *sellers* and exporters of the produce they had fabricated. Their present successes, on the contrary, are fully accounted for by the network of distributive societies which they have at their command. The sale has been simplified and production has been rendered possible by first organising the market.

Such are a few conclusions which may be drawn from a study of the small industries in Germany and elsewhere. And it may be safely said, with regard to Germany, that if measures are not taken for driving the peasants from the land on the same scale as they have been taken in this country; if, on the contrary, the numbers of small landholders multiply, they necessarily will turn to various small trades, in addition to agriculture, as they have done, and are doing in France. Every step that may be taken, either for awakening

intellectual life in the villages, or for assuring the peasants' or the country's rights upon the land, will necessarily further the growth of industries in the villages.*

Petty Trades in other Countries.

If it were worth extending our inquiry to other countries, we should find a vast field for most interesting observations in Switzerland. There we should see the same vitality in a variety of petty industries, and we could mention what has been done in the different cantons for maintaining the small trades by three different sets of measures: the extension of co-operation; a wide extension of technical education in the schools and the introduction of new branches of semi-artistic production in different parts of the country; and the supply of cheap motive power in the houses by means of a hydraulic or an electric transmission of power borrowed from the waterfalls. A separate book of the greatest interest and value could be written on this subject, especially on the impulse given to a number of petty trades, old and new, by means of a cheap supply of motive power.

Belgium would offer an equal interest. Belgium is certainly a country of centralised industry, and a country in which the productivity of the worker stands at a high level, the average annual productivity of each industrial workman—men, women, and children—attaining the high figure of £226 (5660 francs) per head. Coal mines, in which more than a thousand workers are employed, are numerous, and there is a fair number of textile factories in each of which from 300 to 700 workers are occupied. And yet, if we exclude from the industrial workers' population of Belgium, which numbered

* See Appendix Q.

384,065 persons in 1880 (423,755 with the clerks, travellers, supervisors and so on), nearly 100,000 workmen (94,757) who are employed in the coal mines, we find that out of the remaining 290,308 workers very nearly one-half, *i.e.*, 132,840 persons, work in workshops in which less than fifty persons are employed, while 84,500 persons out of these last are employed in 25,959 workshops, which thus have an average of three workers per workshop.* We may thus say that—taking the mines out of account—more than one-fourth part of the Belgian industrial workers (three-tenths) are employed in small workshops which have, on the average, less than three workers each, besides the master.†

What is still more remarkable is, that the number of small workshops, in which from one to three aids only are employed by the master, attains the considerable figure of 2293 in the textile industries, notwithstanding the high concentration of these industries, the fact being, as was already mentioned on a preceding page, that factories which used to employ 500 or 600 cloth weavers are silent, while cloth is being woven by the clothiers in their houses. As to the machinery and hardware trades, the small workshops in which the master works with from two to four assistants or journeymen are very numerous, to say nothing of the gun trade which is a petty trade *par excellence* (265 workshops with less than three workers), and the furniture trade which has lately taken a great development. A highly concentrated industry, and a high productivity, as well as a considerable export trade (£9 per head of population), which all testify to a high industrial development of

* Out of this number, 16,220 workshops occupy 58,545 workers. Moreover, there are 5975 artisans.

† When shall we have for the United Kingdom a census as complete as we have it for France and Belgium? that is, a census in which the employed and the employers will be counted separately, instead of throwing into one heap the owner of the factory, the managers, the engineers and the workers.

the country, thus go hand in hand with a high development of the domestic and petty trades.

It hardly need be said that in Austria, Hungary, Italy, and even the United States, the petty trades occupy a prominent position, and play in the sum total of industrial activity an even much greater part than in France, Belgium, or Germany. But it is especially in Russia that we can fully appreciate the importance of the rural industries and the terrible sufferings which would be quite uselessly inflicted on the population if the policy of the State were to follow the advice of some arch-reactionary economists of the *Moscow Gazette* school, and to throw the tremendous weight of the State in favour of a pauperisation of the peasants and an artificial annihilation of the rural trades, in order to create a centralised great industry.

The most exhaustive inquiries into the present state, the growth, the technical development of the rural industries, and the difficulties they have to contend with, have been made in Russia. A house-to-house inquiry which embraces nearly 1,000,000 peasants' houses has been made in various provinces of Russia, and its results already represent 450 volumes, printed by different county councils (*Zemstvos*). Besides, in the fifteen volumes published by the Petty Trades Committee, and still more in the publications of the Moscow Statistical Committee, and of many provincial assemblies, we find exhaustive lists giving the name of each worker, the extent and the state of his fields, his live stock, the value of his agricultural and industrial production, his earnings from both sources, and his yearly budget; while hundreds of separate trades have been described in separate monographs from the technical, economical, and sanitary points of view.

The results obtained from these inquiries are really imposing, as it appears that out of the 80,000,000 population of European Russia no less than 7,500,000

persons are engaged in the domestic trades, and that their production reaches, at the lowest estimate, more than £150,000,000, and most probably £200,000,000 (2,000,000,000 roubles) every year.* It thus exceeds the total production of the great industry. As to the relative importance of the two for the working classes suffice it to say that even in the government of Moscow, which is the chief manufacturing region of Russia (its factories yield upwards of one-fifth in value of the aggregate industrial production of European Russia), the aggregate incomes derived by the population from the domestic industries are three times larger than the aggregate wages earned in the factories.

The most striking feature of the Russian domestic trades is that the sudden start which was made of late by the factories in Russia did not prejudice the domestic industries. On the contrary, it gave a new impulse to their extension; they grow and develop precisely in those regions where the factories are growing up fastest. Another most suggestive feature is the following: although the unfertile provinces of Central Russia have been from time immemorial the seat of all kinds of petty trades, several domestic industries of modern origin are developing in those provinces which are best favoured by soil and climate. Thus, the Stavropol government of North Caucasus, where the peasantry have plenty of fertile soil, has suddenly become the seat of a widely developed silk-weaving industry in the peasants' houses, and now it supplies Russia with cheap silks which have completely expelled from the market the plain silks formerly imported from France. In Orenburg and on

* It appears from the house-to-house inquiry, which embodies 855,000 workers, that the yearly value of the produce which they use to manufacture reaches £21,087,000 (the rouble at 24d.), that is, an average of £25 per worker. An average of £20 for the 7,500,000 persons engaged in domestic industries would already give £150,000,000 for their aggregate production; but the most authoritative investigators consider that figure as below the reality.

the Black Sea, the petty trades' fabrication of agricultural machinery, which has grown up lately, is another instance in point.

The capacities of the Russian domestic industrial workers for co-operative organisation would be worthy of more than a passing mention. As to the cheapness of the produce manufactured in the villages, which is really astonishing, it cannot be explained in full by the exceedingly long hours of labour and the starvation earnings, because overwork (twelve to sixteen hours of labour) and very low wages are characteristic of the Russian factories as well. It depends also upon the circumstance that the peasant who grows his own food, but suffers from a constant want of money, sells the produce of his industrial labour at any price. Therefore, all manufactured goods used by the Russian peasantry, save the printed cottons, are the production of the rural manufactures. But many articles of luxury, too, are made in the villages, especially around Moscow, by peasants who continue to cultivate their allotments. The silk hats which are sold in the best Moscow shops, and bear the stamp of *Nouveautés Parisiennes*, are made by the Moscow peasants; so also the "Vienna" furniture of the best "Vienna" shops, even if it goes to supply the palaces. And what is most to be wondered at is not the skill of the peasants—agricultural work is no obstacle to acquiring industrial skill—but the rapidity with which the fabrication of fine goods has spread in such villages as formerly manufactured only goods of the roughest description.*

As to the relations between agriculture and industry, one cannot peruse the documents accumulated by the Russian statisticians without coming to the conclusion that, far from damaging agriculture, the domestic trades, on the contrary, are the best means for improving it,

* Some of the produces of the Russian rural industries have lately been introduced in this country, and find a good sale.

and the more so, as for several months every year the Russian peasant has nothing to do in the fields. There are regions where agriculture has been totally abandoned for the industries; but these are regions where it was rendered impossible by the very small allotments granted to the liberated serfs, and especially the bad quality of, and the want of meadows in them, as by the general impoverishment of the peasants, following a very high taxation and very high redemption taxes. But wherever the allotments are reasonable and the peasants are less overtaxed, they continue to cultivate the land and their fields are kept in better order, as also the average numbers of live stock are higher where agriculture is carried on in association with the domestic trades. Even those peasants whose allotments are small find the means of renting more land if they earn some money from their industrial work. As to the relative welfare, I need hardly add that it always stands on the side of those villages which combine both kinds of work. Vorsma and Pavlovo—two cutlery villages, one of which is purely industrial, while the inhabitants of the other continue to till the soil—could be quoted as a striking instance for such a comparison.*

Much more ought to be said with regard to the rural industries of Russia, especially to show how easily the peasants associate for buying new machinery, or for avoiding the middleman in their purchases of raw produce—as soon as misery is no obstacle to the association. Belgium, and especially Switzerland, could also be quoted for similar illustrations, but the above will be enough to give a general idea of the importance, the vital powers, and the perfectibility of the rural industries.

* Prugavin, in the *Vyestnik Promyshlennosti*, June, 1884.

Conclusions.

The facts which we have briefly reviewed show, to some extent, the benefits which could be derived from a combination of agriculture with industry, if the latter could come to the village, not in its present shape of a capitalist factory, but in the shape of a socially organised industrial production, with the full aid of machinery and technical knowledge. In fact, the most prominent feature of the petty trades is that a relative well-being is found only where they are combined with agriculture: where the workers have remained in possession of the soil and continue to cultivate it. Even amidst the weavers of France or Moscow, who have to reckon with the competition of the factory, relative well-being prevails so long as they are not compelled to part with the soil. On the contrary, as soon as high taxation or the impoverishment during a crisis has compelled the domestic worker to abandon his last plot of land to the usurer, misery creeps into his house. The sweater becomes all-powerful, frightful overwork is resorted to, and the whole trade often falls into decay.

Such facts, as well as the pronounced tendency of the factories towards migrating to the villages, are very suggestive. Of course, it would be a great mistake to imagine that industry ought to return to its hand-work stage in order to be combined with agriculture. Whenever a saving of human labour can be obtained by means of a machine, the machine is welcome and will be resorted to, and there is hardly one single branch of industry into which machinery work could not be introduced with great advantage, at least at some of the stages of the fabrication. In the present chaotic state of industry, nails and cheap pen-knives can be made by hand, and plain cottons be woven in the hand-loom; but such an anomaly will not last. The machine will supersede hand-work in the manufacture of plain goods, while hand-

work probably will extend its domain in the artistic finishing of many things which are now made entirely in the factory, as well as in thousands of young and new trades.

But the question arises, Why should not the cottons, the woollen cloth, and the silks, now woven by hand in the villages, be woven by machinery in the same villages, without ceasing to remain connected with work in the fields? Why should not hundreds of domestic industries, now carried on entirely by hand, resort to labour-saving machines, as they already do in the knitting trade and many others? There is no reason why the small motor should not be of much more general use than it is now, wherever there is no need to have a factory; and there is no reason why the village should not have its small factory wherever factory work is preferable, as we already see it occasionally in certain villages in France. More than that. There is no reason why the factory, with its motive force and machinery, should not belong to the community, as is already the case for motive power in the above-mentioned workshops and small factories in the French portion of the Jura hills. It is evident that now, under the capitalist system, the factory is the curse of the village, as it comes to overwork children and to make paupers out of its male inhabitants; and it is quite natural that it should be opposed by all means by the workers, if they have succeeded in maintaining their olden trades' organisations (as at Sheffield, or Solingen), or if they have not yet been reduced to sheer misery (as in the Jura). But under a more rational social organisation the factory would find no such obstacles: it would be a boon to the village. And there is already unmistakable evidence to show that a move in this direction *is being made* in a few village communities.

The moral and physical advantages which man would derive from dividing his work between the field and the

workshop are self-evident. But the difficulty is, we are told, in the necessary centralisation of the modern industries. In industry, as well as in politics, centralisation has so many admirers! But in both spheres the ideal of the centralisers badly needs revision. In fact, if we analyse the modern industries, we soon discover that for some of them the co-operation of hundreds, or even thousands, of workers gathered at the same spot is really necessary. The great iron works and mining enterprises decidedly belong to that category; oceanic steamers cannot be built in village factories. But very many of our big factories are nothing else but agglomerations under a common management, of several distinct industries; while others are mere agglomerations of hundreds of copies of the very same machine; such are most of our gigantic spinning and weaving establishments. The manufacture being a strictly private enterprise, its owners find it advantageous to have all the branches of a given industry under their own management; they thus cumulate the profits of the successive transformations of the raw material. And when several thousand power-looms are combined in one factory, the owner finds his advantage in being able to hold the command of the market. But from a *technical* point of view the advantages of such an accumulation are trifling and often doubtful. Even so centralised an industry as that of the cottons does not suffer at all from the division of production of one given sort of goods at its different stages between several separate factories: we see it at Manchester and its neighbouring towns. As to the petty trades, no inconvenience is experienced from a still greater subdivision between the workshops in the watch trade and very many others.

We often hear that one horse-power costs so much in a small engine, and so much less in an engine ten times more powerful; that the pound of cotton yarn costs much less when the factory doubles the number of

its spindles. But, in the opinion of the best engineering authorities, such as Prof. W. Unwin, the hydraulic, and especially the electric, distribution of power from a central station sets aside the first part of the argument. As to its second part, calculations of this sort are only good for those industries which prepare the half-manufactured produce for further transformations. As to those countless descriptions of goods which derive their value chiefly from the intervention of skilled labour, they can be best fabricated in smaller factories which employ a few hundreds, or even a few scores of operatives. Even under the present conditions the leviathan factories offer great inconveniences, as they cannot rapidly reform their machinery according to the constantly varying demands of the consumers. How many failures of great concerns, too well known in this country to need be named, were due to this cause! As for the new branches of industry which I have mentioned at the beginning of the previous chapter, they always must make a start on a small scale; and they can prosper in small towns as well as in big cities, if the smaller agglomerations are provided with institutions stimulating artistic taste and the genius of invention. The progress achieved of late in toy making, as also the high perfection attained in the fabrication of mathematical and optical instruments, of furniture, of small luxury articles, of pottery and so on, are instances in point. Art and science are no longer the monopoly of the great cities, and further progress will be in scattering them over the country.

The geographical distribution of industries in a given country evidently depends to a great extent upon a complexus of natural conditions; it is obvious that there are spots which are best suited for the development of certain industries. The banks of the Clyde and the Tyne are certainly most appropriate for shipbuilding yards, and shipbuilding yards must be surrounded by a

variety of workshops and factories. The industries will always find some advantages in being grouped, to a limited extent, according to the natural features of separate regions. But we must recognise that now they are *not* grouped according to those features. Historical causes—chiefly religious wars and national rivalries—have had a good deal to do with their growth and their present distribution, and still more considerations as to the facilities for sale and export; that is, considerations which are already losing their importance with the increased facilities for transport, and will lose it still more when the producers produce for themselves, and not for customers far away. Why, in a rationally organised society, ought London to remain a great centre for the jam and preserving trade, and manufacture umbrellas for nearly the whole of the United Kingdom? Why should the countless Whitechapel petty trades remain where they are, instead of being spread all over the country? There is no reason whatever why the mantles which are worn by English ladies should be sewn at Berlin and in Whitechapel instead of in Devonshire or Derbyshire. Why should Paris refine sugar for almost the whole of France? Why should one-half of the boots and shoes used in the United States be manufactured in the 1500 workshops of Massachusetts? There is absolutely no reason why these and like anomalies should persist. The industries must scatter themselves all over the world, and the scattering of industries amidst all civilised nations will be necessarily followed by a further scattering of factories over the territories of each nation.

Agriculture is so much in need of aid from those who inhabit the cities, that every summer thousands of men leave their slums in the towns and go to the country for the season of crops. The London destitutes go in thousands to Kent and Sussex as haymakers and hop-pickers, it being estimated that Kent

alone requires 80,000 additional men and women for hop-picking; whole villages in France and their cottage industries are abandoned in the summer, and the peasants wander to the more fertile parts of the country; hundreds of thousands of human beings are transported every summer to the prairies of Manitoba and Dacota; and in Russia there is every year an exodus of several millions of men who journey from the north to the southern prairies for harvesting the crops; while many St. Petersburg manufacturers reduce their production in the summer, because the operatives return to their native villages for the culture of their allotments. Agriculture cannot be carried on without additional hands in the summer; but it still more needs temporary aids for *improving* the soil, for tenfolding its productive powers. Steam-digging, drainage, and manuring would render the heavy clays in the north-west of London a much richer soil than that of the American prairies. To become fertile, those clays want only plain, unskilled human labour, such as is necessary for digging the soil, laying in drainage tubes, pulverising phosphorites, and the like; and that labour would be gladly done by the factory workers if it were properly organised in a free community for the benefit of the whole society. The soil claims that aid, and it would have it under a proper organisation, even if it were necessary to stop many mills in the summer for that purpose. No doubt the present factory owners would consider it ruinous if they had to stop their mills for several months every year, because the capital engaged in a factory is expected to pump money every day and every hour, if possible. But that is the capitalist's view of the matter, not the community's view. As to the workers, who ought to be the real managers of industries, they will find it healthy *not* to perform the same monotonous work all the year round, and they will abandon it for the summer, if

indeed they do not find the means of keeping the factory running by relieving each other in groups.

The scattering of industries over the country—so as to bring the factory amidst the fields, to make agriculture derive all those profits which it always finds in being combined with industry (see the Eastern States of America) and to produce a combination of industrial with agricultural work—is surely the next step to be made, as soon as a reorganisation of our present conditions is possible. It is being made already, as we saw on the preceding pages. That step is imposed by the very necessity of producing for the producers themselves; it is imposed by the necessity for each healthy man and woman to spend a part of their lives in manual work in the free air; and it will be rendered the more necessary when the great social movements, which have now become unavoidable, come to disturb the present international trade, and compel each nation to revert to her own resources for her own maintenance. Humanity as a whole, as well as each separate individual, will be gainers by the change, and the change will take place.

However, such a change also implies a thorough modification of our present system of education. It implies a society composed of men and women, each of whom is able to work with his or her hands as well as with his or her brain, and to do so in more directions than one. This "integration of capacities" I am now going to analyse.

CHAPTER VIII.

BRAIN WORK AND MANUAL WORK.

Divorce between science and handicraft—Technical education—Complete education—The Moscow system: applied at Chicago, Boston, Aberdeen—Concrete teaching—Present waste of time—Science and technics—Advantages which science can derive from a combination of brain work with manual work.

IN olden times men of science, and especially those who have done most to forward the growth of natural philosophy, did not despise manual work and handicraft. Galileo made his telescopes with his own hands. Newton learned in his boyhood the art of managing tools; he exercised his young mind in contriving most ingenious machines, and when he began his researches in optics he was able himself to grind the lenses for his instruments, and himself to make the well-known telescope, which, for its time, was a fine piece of workmanship. Liebnitz was fond of inventing machines: windmills and carriages to be moved without horses preoccupied his mind as much as mathematical and philosophical speculations. Linnæus became a botanist while helping his father—a practical gardener—in his daily work. In short, with our great geniuses handicraft was no obstacle to abstract researches—it rather favoured them. On the other hand, if the workers of old found but few opportunities for mastering science, many of them had, at least, their intelligences stimulated by the very variety of work which was performed in the then unspecialised workshops; and some of them

had the benefit of familiar intercourse with men of science. Watt and Rennie were friends with Professor Robinson; Brindley, the road-maker, despite his fourteen-pence-a-day wages, enjoyed intercourse with educated men, and thus developed his remarkable engineering faculties; the son of a well-to-do family could "idle" at a wheelwright's shop, so as to become later on a Smeaton or a Stephenson.

We have changed all that. Under the pretext of division of labour, we have sharply separated the brain worker from the manual worker. The masses of the workmen do not receive more scientific education than their grandfathers did; but they have been deprived of the education of even the small workshop, while their boys and girls are driven into a mine or a factory from the age of thirteen, and there they soon forget the little they may have learned at school. As to the men of science, they despise manual labour. How few of them would be able to make a telescope, or even a plainer instrument? Most of them are not capable of even designing a scientific instrument, and when they have given a vague suggestion to the instrument-maker they leave it with him to invent the apparatus they need. Nay, they have raised the contempt of manual labour to the height of a theory. "The man of science," they say, "must discover the laws of nature, the civil engineer must apply them, and the worker must execute in steel or wood, in iron or stone, the patterns devised by the engineer. He must work with machines invented for him, not by him. No matter if he does not understand them and cannot improve them: the scientific man and the scientific engineer will take care of the progress of science and industry."

It may be objected that nevertheless there is a class of men who belong to none of the above three divisions. When young they have been manual workers, and some of them continue to be; but, owing

to some happy circumstances, they have succeeded in acquiring some scientific knowledge, and thus they have combined science with handicraft. Surely there are such men; happily enough there is a nucleus of men who have escaped the so-much-advocated specialisation of labour, and it is precisely to them that industry owes its chief recent inventions. But in old Europe at least, they are the exceptions; they are the irregulars —the Cossacks who have broken the ranks and pierced the screens so carefully erected between the classes. And they are so few, in comparison with the ever-growing requirements of industry—and of science as well, as I am about to prove—that all over the world we hear complaints about the scarcity of precisely such men.

What is the meaning, in fact, of the outcry for technical education which has been raised at one and the same time in England, in France, in Germany, in the States, and in Russia, if it does not express a general dissatisfaction with the present division into scientists, scientific engineers, and workers? Listen to those who know industry, and you will see that the substance of their complaints is this: "The worker whose task has been specialised by the permanent division of labour has lost the intellectual interest in his labour, and it is especially so in the great industries: he has lost his inventive powers. Formerly, he invented very much. Manual workers—not men of science nor trained engineers—have invented, or brought to perfection, the prime motors and all that mass of machinery which has revolutionised industry for the last hundred years. But since the great factory has been enthroned, the worker, depressed by the monotony of his work, invents no more. What can a weaver invent who merely supervises four looms, without knowing anything either about their complicated movements or how the machines grew to be what they are? What

can a man invent who is condemned for life to bind together the ends of two threads with the greatest celerity, and knows nothing beyond making a knot?

"At the outset of modern industry, three generations of workers *have* invented; now they cease to do so. As to the inventions of the engineers, specially trained for devising machines, they are either devoid of genius or not practical enough. Those 'nearly to nothings,' of which Sir Frederick Bramwell spoke once at Bath, are missing in their inventions—those nothings which can be learned in the workshop only, and which permitted a Murdoch and the Soho workers to make a practical engine of Watt's schemes. None but he who knows the machine—not in its drawings and models only, but in its breathing and throbbings—who unconsciously thinks of it while standing by it, can really improve it. Smeaton and Newcomen surely were excellent engineers; but in their engines a boy had to open the steam valve at each stroke of the piston; and it was one of those boys who once managed to connect the valve with the remainder of the machine, so as to make it open automatically, while he ran away to play with other boys. But in the modern machinery there is no room left for naïve improvements of that kind. Scientific education on a wide scale has become necessary for further inventions, and that education is refused to the workers. So that there is no issue out of the difficulty unless scientific education and handicraft are combined together—unless integration of knowledge takes the place of the present divisions." Such is the real substance of the present movement in favour of technical education. But, instead of bringing to public consciousness the, perhaps, unconscious motives of the present discontent, instead of widening the views of the discontented and discussing the problem to its full extent, the mouth-pieces of the movement do not mostly rise above the shopkeeper's view of the question. Some

of them indulge in jingo talk about crushing all foreign industries out of competition, while the others see in technical education nothing but a means of somewhat improving the flesh-machine of the factory and of transferring a few workers into the upper class of trained engineers.

Such an ideal may satisfy them, but it cannot satisfy those who keep in view the combined interests of science and industry, and consider both as a means for raising humanity to a higher level. We maintain that in the interests of both science and industry, as well as of society as a whole, every human being, without distinction of birth, ought to receive such an education as would enable him, or her, to combine a thorough knowledge of science with a thorough knowledge of handicraft. We fully recognise the necessity of specialisation of knowledge, but we maintain that specialisation must follow general education, and that general education must be given in science and handicraft alike. To the division of society into brain-workers and manual workers we oppose the combination of both kinds of activities; and instead of "technical education," which means the maintenance of the present division between brain work and manual work, we advocate the *éducation intégrale*, or complete education, which means the disappearance of that pernicious distinction. Plainly stated, the aims of the school under this system ought to be the following: To give such an education that, on leaving school at the age of eighteen or twenty, each boy and each girl should be endowed with a thorough knowledge of science—such a knowledge as might enable them to be useful workers in science—and, at the same time, to give them a general knowledge of what constitutes the bases of technical training, and such a skill in some special trade as would enable each of them to take his or her place in the grand world of the manual production of wealth. I know that many will find that

aim too large, or even impossible to attain, but I hope that if they have the patience to read the following pages, they will see that we require nothing beyond what can be easily attained. In fact, *it has been attained*, and what has been done on a small scale could be done on a wider scale, were it not for the economical and social causes which prevent any serious reform from being accomplished in our miserably organised society.

The experiment has been made at the Moscow Technical School for twenty consecutive years with many hundreds of boys; and, according to the testimonies of the most competent judges at the exhibitions of Brussels, Philadelphia, Vienna, and Paris, the experiment has been a success. The Moscow school admits boys not older than fifteen, and it requires from boys of that age nothing but a substantial knowledge of geometry and algebra, together with the usual knowledge of their mother tongue; younger pupils are received in the preparatory classes. The school is divided into two sections—the mechanical and the chemical; but as I personally know better the former, and as it is also the more important with reference to the question before us, so I shall limit my remarks to the education given in the mechanical section. After a five or six years' stay at the school, the students leave it with a thorough knowledge of higher mathematics, physics, mechanics, and connected sciences —so thorough, indeed, that it is not second to that acquired in the best mathematical faculties of the most eminent European universities. When myself a student of the mathematical faculty of the St. Petersburg University, I had the opportunity of comparing the knowledge of the students at the Moscow Technical School with our own. I saw the courses of higher geometry some of them had compiled for the use of their comrades; I admired the facility with which they applied the integral calculus to dynamical problems, and I came to the conclusion that while we, University students, had

more knowledge of a general character (for instance, in mathematical astronomy), they, the students of the Technical School, were much more advanced in higher geometry, and especially in the applications of higher mathematics to the most intricate problems of dynamics, the theories of heat and elasticity. But while we, the students of the University, hardly knew the use of our hands, the students of the Technical School fabricated *with their own hands*, and without the help of professional workmen, fine steam-engines, from the heavy boiler to the last finely turned screw, agricultural machinery, and scientific apparatus—all for the trade —and they received the highest awards for the work of their hands at the international exhibitions. They were scientifically educated skilled workers—workers with university education—highly appreciated even by the Russian manufacturers who so much distrust science.

Now, the methods by which these wonderful results were achieved were these: In science, learning from memory was not in honour, while independent research was favoured by all means. Science was taught hand in hand with its applications, and what was learned in the schoolroom was applied in the workshop. Great attention was paid to the highest abstractions of geometry as a means for developing imagination and research. As to the teaching of handicraft, the methods were quite different from those which proved a failure at the Cornell University, and differed, in fact, from those used in most technical schools. The student was not sent to a workshop to learn some special handicraft and to earn his existence as soon as possible, but the teaching of technical skill was prosecuted—according to a scheme elaborated by the founder of the school, M. Dellavos, and now applied also at Chicago and Boston —in the same systematical way as laboratory work is taught in the universities. It is evident that drawing

was considered as the first step in technical education. Then the student was brought, first, to the carpenter's workshop, or rather laboratory, and there he was thoroughly taught to execute all kinds of carpentry and joinery. No efforts were spared in order to bring the pupil to a certain perfection in that branch—the real basis of all trades. Later on, he was transferred to the turner's workshop, where he was taught to make in wood the patterns of those things which he would have to make in metal in the following workshops. The foundry followed, and there he was taught to cast those parts of machines which he had prepared in wood; and it was only after he had gone through the first three stages that he was admitted to the smith's and engineering workshops. Such was the system which English readers will find described in full in a work by Mr. Ch. H. Ham.* As for the perfection of the mechanical work of the students, I cannot do better than refer to the reports of the juries at the above-named exhibitions.

In America the same system has been introduced, in its technical part, first, in the Chicago Manual Training School, and later on in the Boston Technical School —the best, I am told, of the sort; and in this country, or rather in Scotland, I found the system applied with full success, for some years, under the direction of Dr. Ogilvie at Gordon's College in Aberdeen. It is the Moscow or Chicago system on a limited scale. While receiving substantial scientific education, the pupils are also trained in the workshops—but not for one special trade, as it unhappily too often is the case. They pass through the carpenter's workshop, the casting in metals, and the engineering workshop; and in each of these

* *Manual Training: the Solution of Social and Industrial Problems.* By Ch. H. Ham. London: Blackie & Son, 1886. I can add that like results have been achieved again at the Krasnoufimsk *Realschule*, in the province of Orenburg, especially with regard to agriculture and agricultural machinery. The achievements of the school, however, are so interesting that they deserve more than a short mention.

they learn the foundations of each of the three trades sufficiently well for supplying the school itself with a number of useful things. Besides, as far as I could ascertain from what I saw in the geographical and physical classes, as also in the chemical laboratory, the system of "through the hand to the brain," and *vice versâ*, is in full swing, and it is attended with the best success. The boys *work* with the physical instruments, and they study geography in the field, instruments in hands, as well as in the class-room. Some of their surveys filled my heart, as an old geographer, with joy. It is evident that the Gordon's College industrial department is not a mere copy of any foreign school; on the contrary, I cannot help thinking that if Aberdeen has made that excellent move towards combining science with handicraft, the move was a natural outcome of what has been practised long since, on a smaller scale, in the Aberdeen daily schools.

The Moscow Technical School surely is not an ideal school.* It totally neglects the humanitarian education of the young men. But we must recognise that the Moscow experiment—not to speak of hundreds of other partial experiments—has perfectly well proved the possibility of combining a scientific education of a very high standard with the education which is necessary for becoming an excellent skilled labourer. It has proved, moreover, that the best means for producing really good skilled labourers is to seize the bull by the horns, and to grasp the educational problem in its great features, instead of trying to give some special skill in some handicraft, together with a few scraps of knowledge in a certain branch of some science. And it has shown also what can be obtained, without over-pressure, if a

* What this school is now, I don't know. In the last years of Alexander II.'s reign it was wrecked, like so many other good institutions of the early part of his reign. But the system was not lost. It was carried over to America.

rational economy of the scholar's time is always kept in view, and theory goes hand in hand with practice. Viewed in this light, the Moscow results do not seem extraordinary at all, and still better results may be expected if the same principles are applied from the earliest years of education. Waste of time is the leading feature of our present education. Not only are we taught a mass of rubbish, but what is not rubbish is taught so as to make us waste over it as much time as possible. Our present methods of teaching originate from a time when the accomplishments required from an educated person were extremely limited; and they have been maintained, notwithstanding the immense increase of knowledge which must be conveyed to the scholar's mind since science has so much widened its former limits. Hence the over-pressure in schools, and hence, also, the urgent necessity of totally revising both the subjects and the methods of teaching, according to the new wants and to the examples already given here and there, by separate schools and separate teachers.

It is evident that the years of childhood ought not to be spent so uselessly as they are now. German teachers have shown how the very plays of children can be made instrumental in conveying to the childish mind some concrete knowledge in both geometry and mathematics. The children who have made the squares of the theorem of Pythagoras out of pieces of coloured cardboard, will not look at the theorem, when it comes in geometry, as on a mere instrument of torture devised by the teachers; and the less so if they apply it as the carpenters do. Complicated problems of arithmetic, which so much harassed us in our boyhood, are easily solved by children seven and eight years old if they are put in the shape of interesting puzzles. And if the *Kindergarten*—German teachers often make of it a kind of barrack in which each movement of the child

is regulated beforehand—has often become a small prison for the little ones, the idea which presided at its foundation is nevertheless true. In fact, it is almost impossible to imagine, without having tried it, how many sound notions of nature, habits of classification, and taste for natural sciences can be conveyed to the children's minds; and, if a series of concentric courses adapted to the various phases of development of the human being were generally accepted in education, the first series in all sciences, save sociology, could be taught before the age of ten or twelve, so as to give a general idea of the universe, the earth and its inhabitants, the chief physical, chemical, zoological, and botanical phenomena, leaving the discovery of the *laws* of those phenomena to the next series of deeper and more specialised studies. On the other side, we all know how children like to make toys themselves, how they gladly imitate the work of full-grown people if they see them at work in the workshop or the building-yard. But the parents either stupidly paralyse that passion, or do not know how to utilise it. Most of them despise manual work and prefer sending their children to the study of Roman history, or of Franklin's teachings about saving money, to seeing them at a work which is good for the "lower classes only". They thus do their best to render subsequent learning the more difficult.

And then come the school years, and time is wasted again to an incredible extent. Take, for instance, mathematics, which every one ought to know, because it is the basis of all subsequent education, and which so few really learn in our schools. In geometry, time is foolishly wasted by using a method which merely consists in committing geometry to memory. In most cases, the boy reads again and again the proof of a theorem till his memory has retained the succession of reasonings. Therefore, nine boys out of ten, if asked to prove an

elementary theorem two years after having left the school, will be unable to do it, unless mathematics is their speciality. They will forget which auxiliary lines to draw, and they never have been taught to *discover* the proofs by themselves. No wonder that later on they find such difficulties in applying geometry to physics, that their progress is despairingly sluggish, and that so few master higher mathematics. There is, however, the other method which permits progress, as a whole, at a much speedier rate, and under which he who once has learned geometry will know it all his life long. Under this system, each theorem is put as a problem; its solution is never given beforehand, and the pupil is induced to find it by himself. Thus, if some preliminary exercises with the rule and the compass have been made, there is not one boy or girl, out of twenty or more, who will not be able to find the means of drawing an angle which is equal to a given angle, and to prove their equality, after a few suggestions from the teacher; and if the subsequent problems are given in a systematic succession (there are excellent text-books for the purpose), and the teacher does not press his pupils to go faster than they can go at the beginning, they advance from one problem to the next with an astonishing facility, the only difficulty being to bring the pupil to solve the first problem, and thus to acquire confidence in his own reasoning.

Moreover, each abstract geometrical truth must be impressed on the mind in its concrete form as well. As soon as the pupils have solved a few problems on paper, they must solve them in the playing-ground with a few sticks and a string, and they must apply their knowledge in the workshop. Only then will the geometrical lines acquire a concrete meaning in the children's minds; only then will they see that the teacher is playing no tricks when he asks them to solve problems with the rule and the compass without resorting to the protractor;

only then will they *know* geometry. "Through the eyes *and* the hand to the brain"—that is the true principle of economy of time in teaching. I remember as if it were yesterday, how geometry suddenly acquired for me a new meaning, and how this new meaning facilitated all ulterior studies. It was as we were mastering a Montgolfier balloon, and I remarked that the angles at the summits of each of the twenty strips of paper out of which the balloon was going to be made must cover less than the fifth part of a right angle each. I remember, next, how the sinuses and the tangents ceased to be mere cabalistic signs when they permitted us to calculate the length of a stick in a working profile of a fortification; and how geometry in space became plain when we began to make on a small scale a bastion with embrasures and barbettes—an occupation which obviously was soon prohibited on account of the state into which we brought our clothes. "You look like navvies," was the reproach addressed to us by our intelligent educators, while we were proud precisely of being navvies, and of discovering the use of geometry.

By compelling our children to study real things from mere graphical representations, instead of *making* those things themselves, we compel them to waste the most precious time; we uselessly worry their minds; we accustom them to the worst methods of learning; we kill independent thought in the bud; and very seldom we succeed in conveying a real knowledge of what we are teaching. Superficiality, parrot-like repetition, slavishness and inertia of mind are the results of our method of education. We do not teach our children how to learn. The very beginnings of science are taught on the same pernicious system. In most schools even arithmetic is taught in the abstract way, and mere rules are stuffed into the poor little heads. The idea of a unit, which is arbitrary and can be changed at will in our measurement (the match, the box of matches, the

dozen of boxes, or the gross; the metre, the centimetre, the kilometre, and so on), is not impressed on the mind, and therefore, when the children come to the decimal fractions they are at a loss to understand them; whereas in France, where the decimal system of measures and money is a matter of daily life, even those workers who have received the plainest elementary education are quite familiar with decimals. To represent twenty-five centimes or twenty-five centimetres, they write "zero twenty-five," while most of my readers surely remember how this same zero at the head of a row of figures puzzled them in their boyhood. We do also what we can to render algebra unintelligible, and our children spend one year before they have learned what is not algebra at all, but a mere system of abbreviations, which can be learned by the way if it is taught together with arithmetic.

The waste of time in physics is simply revolting. While young people very easily understand the principles of chemistry and its formulæ, as soon as they themselves make the first experiments with a few glasses and tubes, they mostly find the greatest difficulties in grasping the mechanical introduction into physics, partly because they do not know geometry, and especially because they are merely shown costly machines instead of being induced to make themselves plain apparatus for illustrating the phenomena they study. Instead of learning the laws of force with plain instruments which a boy of fifteen can easily make, they learn them from mere drawings, in a purely abstract fashion. Instead of making themselves an Atwood's machine with a broomstick and the wheel of an old clock, or verifying the laws of falling bodies with a key gliding on an inclined string, they are shown a complicated apparatus, and in most cases the teacher himself does not know how to explain to them the principle of the apparatus, and indulges in irrelevant details. And so it goes on

from the beginning to the end, with but a few honourable exceptions.*

If waste of time is characteristic of our methods of teaching science, it is characteristic as well of the methods used for teaching handicraft. We know how years are wasted when a boy serves his apprenticeship in a workshop; but the same reproach can be addressed, to a great extent, to those technical schools which endeavour at once to teach some special handicraft, instead of resorting to the broader and surer methods of systematical teaching. Just as there are in science some notions and methods which are preparatory to the study of all sciences, so there are also some fundamental notions and methods preparatory to the special study of any handicraft. Reuleaux has shown in that delightful book, the *Theoretische Kinematik*, that there is, so to say, a philosophy of all possible machinery. Each machine, however complicated, can be reduced to a few elements—plates, cylinders, discs, cones, and so on—as well as to a few tools—chisels, saws, rollers, hammers,

* Take, for instance, the description of Atwood's machine in any course of elementary physics. You will find very great attention paid to the wheels on which the axle of the pulley is made to lie; hollow boxes, plates and rings, the clock, and other accessories will be mentioned before one word is said upon the leading idea of the machine, which is to slacken the motion of a falling body by making a falling body of small weight move a heavier body which is in the state of inertia, gravity acting on it in two opposite directions. That was the inventor's idea; and if it is made clear the pupils see at once that to suspend two bodies of equal weight over a pulley, and to make them move by adding a small weight to one of them, is one of the means (and a good one) for slackening the motion during the falling; they see that the friction of the pulley must be reduced to a minimum, either by using the two pairs of wheels, which so much puzzle the text-book makers, or by any other means; that the clock is a luxury, and the "plates and rings" are mere accessories: in short, that Atwood's idea can be realised with the wheel of a clock fastened, as a pulley, to a wall, or on the top of a broomstick secured in a vertical position. In this case the pupils will understand the *idea* of the machine and of its inventor, and they will accustom themselves to separate the leading idea from the accessories; while in the other case they merely look with curiosity at the tricks performed by the teacher with a complicated machine, and the few who finally understand it spend a quantity of time in the effort. In reality, all apparatus used to illustrate the fundamental laws of physics ought to be made by the children themselves.

etc.; and, however complicated its movements, they can be decomposed into a few modifications of motion, such as the transformation of circular motion into a rectilinear, and the like, with a number of intermediate links. So also each handicraft can be decomposed into a number of elements. In each trade one must know how to make a plate with parallel surfaces, a cylinder, a disc, a square, and a round hole; how to manage a limited number of tools, all tools being mere modifications of less than a dozen types; and how to transform one kind of motion into another. This is the foundation of all mechanical handicrafts; so that the knowledge of how to make in wood those primary elements, how to manage the chief tools in wood-work, and how to transform various kinds of motion, ought to be considered as the very basis for the subsequent teaching of all possible kinds of mechanical handicraft. The pupil who has acquired that skill already knows one good half of all possible trades. Besides, none can be a good worker in science unless he is in possession of good methods of scientific research; unless he has learned to observe, to describe with exactitude, to discover mutual relations between facts seemingly disconnected, to make hypotheses and to verify them, to reason upon cause and effect, and so on. And none can be a good manual worker unless he has been accustomed to the good methods of handicraft altogether. He must grow accustomed to conceive the subject of his thoughts in a concrete form, to draw it, or to model, to hate badly kept tools and bad methods of work, to give to everything a fine touch of finish, to derive artistic enjoyment from the contemplation of gracious forms and combinations of colours, and dissatisfaction from what is ugly. Be it handicraft, science, or art, the chief aim of the school is not to make a specialist from a beginner, but to teach him the elements of knowledge and the good methods of work, and, above all, to give him that general in-

spiration which will induce him, later on, to put in whatever he does a sincere longing for truth, to like what is beautiful both as to form and contents, to feel the necessity of being a useful unit amidst other human units, and thus to feel his heart at unison with the rest of humanity.

As for avoiding the monotony of work which would result from the pupil always making mere cylinders and discs, and never making full machines or other useful things, there are thousands of means for avoiding that want of interest, and one of them, in use at Moscow, is worthy of notice. It is not to give work for mere exercise, but to utilise everything which the pupil makes, from his very first steps. Do you remember how you were delighted, in your childhood, if your work was utilised, be it only as a part of something useful? So they do at Moscow. Each plank planed by the pupils is utilised as a part of some machine in some of the other workshops. When a pupil comes to the engineering workshop, and he is set to make a quadrangular block of iron with parallel and perpendicular surfaces, the block has an interest in his eyes, because, when he has finished it, verified its angles and surfaces, and corrected its defects, the block is not thrown under the bench—it is given to a more advanced pupil, who makes a handle to it, paints the whole, and sends it to the shop of the school as a paper-weight. The systematical teaching thus receives the necessary attractiveness.*

It is evident that celerity of work is a most important factor in production. So it might be asked if, under the above system, the necessary speed of work could be obtained. But there are two kinds of celerity. There is the celerity which I saw in a Nottingham lace-

* The sale of the pupils' work is not insignificant, especially when they reach the higher classes, and make steam-engines. Therefore the Moscow school, when I knew it, was one of the cheapest in the world. It gave boarding and education at a very low fee. But imagine such a school connected with a farm school, which grows food and exchanges it at its cost price. What will be the cost of education then?

factory; full-grown men, with shivering hands and heads, are feverishly binding together the ends of two threads from the remnants of cotton-yarn in the bobbins; you hardly can follow their movements. But the very fact of requiring such kind of rapid work is the condemnation of the factory system. What has remained of the human being in those shivering bodies? What will be their outcome? Why this waste of human force, when it could produce ten times the value of the odd rests of yarn? This kind of celerity is required exclusively because of the cheapness of the factory slaves; so let us hope that no school will ever aim at this kind of quickness in work. But there is also the time-saving celerity of the well-trained worker, and this is surely achieved best by the kind of education which we advocate. However plain his work, the educated worker makes it better and quicker than the uneducated. Observe, for instance, how a good worker proceeds in cutting anything—say a piece of cardboard—and compare his movements with those of an improperly trained worker. The latter seizes the cardboard, takes the tool as it is, traces a line in a haphazard way, and begins to cut; half-way he is tired, and when he has finished his work is worth nothing; whereas, the former will examine his tool and improve it if necessary; he will trace the line with exactitude, secure both cardboard and rule, keep the tool in the right way, cut quite easily, and give you a piece of good work. That is the true time-saving celerity, the most appropriate for economising human labour; and the best means for attaining it is an education of the most superior kind. The great masters painted with an astonishing rapidity; but their rapid work was the result of a great development of intelligence and imagination, of a keen sense of beauty, of a fine perception of colours. And that is the kind of rapid work of which humanity is in need.

Much more ought to be said as regards the duties

of the school, but I hasten to say a few words more as to the desirability of the kind of education briefly sketched in the preceding pages. Certainly, I do not cherish the illusion that a thorough reform in education, or in any of the issues indicated in the preceding chapters, will be made as long as the civilised nations remain under the present narrowly egotistic system of production and consumption. All we can expect, as long as the present conditions last, is to have some microscopical attempts at reforming here and there on a small scale—attempts which necessarily will prove to be far below the expected results, because of the impossibility of reforming on a small scale when so intimate a connection exists between the manifold functions of a civilised nation. But the energy of the constructive genius of society depends chiefly upon the depths of its conception as to what ought to be done, and how; and the necessity of recasting education is one of those necessities which are most comprehensible to all, and are most appropriate for inspiring society with those ideals, without which stagnation or even decay are unavoidable. So let us suppose that a community—a city, or a territory which has, at least, a few millions of inhabitants—gives the above-sketched education to all its children, without distinction of birth (and we *are* rich enough to permit us the luxury of such an education), without asking anything in return from the children but what they will give when they have become producers of wealth. Suppose such an education is given, and analyse its probable consequences.

I will not insist upon the increase of wealth which would result from having a young army of educated and well-trained producers; nor shall I insist upon the social benefits which would be derived from erasing the present distinction between the brain workers and the manual workers, and from thus reaching the concordance of interest and harmony so much wanted in our

times of social struggles. I shall not dwell upon the fulness of life which would result for each separate individual, if he were enabled to enjoy the use of both his mental and bodily powers; nor upon the advantages of raising manual labour to the place of honour it ought to occupy in society, instead of being a stamp of inferiority, as it is now. Nor shall I insist upon the disappearance of the present misery and degradation, with all their consequences—vice, crime, prisons, price of blood, denunciation, and the like—which necessarily would follow. In short, I will not touch now the great social question, upon which so much has been written and so much remains to be written yet. I merely intend to point out in these pages the benefits which science itself would derive from the change.

Some will say, of course, that to reduce men of science to the *rôle* of manual workers would mean the decay of science and genius. But those who will take into account the following considerations probably will agree that the result ought to be the reverse—namely, such a revival of science and art, and such a progress in industry, as we only can faintly foresee from what we know about the times of the Renaissance. It has become a commonplace to speak with emphasis about the progress of science during the nineteenth century; and it is evident that our century, if compared with centuries past, has much to be proud of. But, if we take into account that most of the problems which our century has solved already had been indicated, and their solutions foreseen, a hundred years ago, we must admit that the progress was not so rapid as might have been expected, and that something hampered it. The mechanical theory of heat was very well foreseen in the last century by Rumford and Humphrey Davy, and even in Russia it was advocated by Lomonosoff.* However, much more

* In an otherwise also remarkable memoir on the Arctic Regions.

than half a century elapsed before the theory reappeared in science. Lamarck, and even Linnæus, Geoffroy Saint-Hilaire, Erasmus Darwin, and several others were fully aware of the variability of species; they were opening the way for the construction of biology on the principles of variation; but here, again, half a century was wasted before the variability of species was brought again to the front; and we all remember how Darwin's ideas were carried on and forced on the attention of university people, chiefly by persons who were not professional scientists themselves; and yet in Darwin's hands the theory of evolution surely was narrowed, owing to the overwhelming importance given to only one factor of evolution. For many years past astronomy has been needing a careful revision of the Kant and Laplace's hypothesis; but no theory is yet forthcoming which would compel general acceptance. Geology surely has made wonderful progress in the reconstitution of the palæontological record, but dynamical geology progresses at a despairingly slow rate; while all future progress in the great question as to the laws of distribution of living organisms on the surface of the earth is hampered by the want of knowledge as to the extension of glaciation during the Quaternary epoch.* In short, in each branch

* The rate of progress in the recently so popular Glacial Period question was strikingly slow. Already Venetz in 1821 and Esmarck in 1823 had explained the erratic phenomena by the glaciation of Europe. Agassiz came forth with the glaciation of the Alps, the Jura mountains, and Scotland, about 1840; and five years later, Guyot had published his maps of the routes followed by Alpine boulders. But forty-two years elapsed after Venetz wrote before one geologist of mark (Lyell) dared timidly to accept his theory, even to a limited extent—the most interesting fact being that Guyot's maps, considered as irrelevant in 1845, were recognised as conclusive after 1863. Even now—half a century after Agassiz's first work—Agassiz's views are not yet either refuted or generally accepted. So also Forbes's views upon the plasticity of ice. Let me add, by the way, that the whole polemics as to the viscosity of ice is a striking instance of how facts, scientific terms, and experimental methods quite familiar to building engineers, were ignored by those who took part in the polemics. If these facts, terms and methods were taken into account, the polemics would not have raged for years with no result. Like instances, to show how science suffers from a want of acquaintance

of science a revision of the current theories as well as new wide generalisations are wanted. And if the revision requires some of that inspiration of genius which moved Galileo and Newton, and which depends in its appearance upon general causes of human development, it requires also an increase in the number of scientific workers. When facts contradictory to current theories become numerous, the theories must be revised (we saw it in Darwin's case), and thousands of simple intelligent workers in science are required to accumulate them.

Immense regions of the earth still remain unexplored; the study of the geographical distribution of animals and plants meets with stumbling-blocks at every step. Travellers cross continents, and do not know even how to determine the latitude nor how to manage a barometer. Physiology, both of plants and animals, psycho-physiology, and the psychological faculties of man and animals are so many branches of knowledge requiring more data of the simplest description. History remains a *fable convenue* chiefly because it wants fresh ideas, but also because it wants scientifically thinking workers to reconstitute the life of past centuries in the same way as Thorold Rogers or Augustin Thierry have done it for separate epochs. In short, there is not one single science which does not suffer in its development from a want of men and women endowed with a philosophical conception of the universe, ready to apply their forces of investigation in a given field, however limited, and having leisure for devoting themselves to scientific pursuits. In a community such as we suppose, thousands of workers would be ready to answer any appeal for exploration. Darwin spent almost thirty years in gathering and analysing facts for the elaboration of the theory of the origin of species. Had he lived in such a society

with facts, and methods of experimenting well known to engineers, florists, cattle-breeders, and so on, could be produced in numbers.

as we suppose, he simply would have made an appeal to volunteers for facts and partial exploration, and thousands of explorers would have answered his appeal. Scores of societies would have come to life to debate and to solve each of the partial problems involved in the theory, and in ten years the theory would have been verified; all those factors of evolution which only now begin to receive due attention would have appeared in their full light. The rate of scientific progress would have been tenfold; and if the individual would not have the same claims on posterity's gratitude as he has now, the unknown mass would have done the work with more speed and with more prospect for ulterior advance than the individual could do in his lifetime. Mr. Murray's dictionary is an illustration of that kind of work—the work of the future.

However, there is another feature of modern science which speaks more strongly yet in favour of the change we advocate. While industry, especially by the end of the last century and during the first part of the present, has been inventing on such a scale as to revolutionise the very face of the earth, science has been losing its inventive powers. Men of science invent no more, or very little. Is it not striking, indeed, that the steam-engine, even in its leading principles, the railway-engine, the steamboat, the telephone, the phonograph, the weaving-machine, the lace-machine, the lighthouse, the macadamised road, photography in black and in colours, and thousands of less important things, have *not* been invented by professional men of science, although none of them would have refused to associate his name with any of the above-named inventions? Men who hardly had received any education at school, who had merely picked up the crumbs of knowledge from the tables of the rich, and who made their experiments with the most primitive means—the attorney's clerk Smeaton, the instrument-maker Watt, the brakesman Stephenson, the

jeweller's apprentice Fulton, the millwright Rennie, the mason Telford, and hundreds of others whose very names remain unknown, were, as Mr. Smiles justly says, "the real makers of modern civilisation"; while the professional men of science, provided with all means for acquiring knowledge and experimenting, have invented little in the formidable array of implements, machines, and prime-motors, which has shown to humanity how to utilise and to manage the forces of nature.* The fact is striking, but its explanation is very simple: those men —the Watts and the Stephensons—knew something which the *savants* do not know—they knew the use of their hands; their surroundings stimulated their inventive powers; they knew machines, their leading principles, and their work; they had breathed the atmosphere of the workshop and the building-yard.

We know how men of science will meet the reproach. They will say: "We discover the laws of nature, let others apply them; it is a simple division of labour". But such a rejoinder would be utterly untrue. The march of progress is quite the reverse, because in a hundred cases against one the mechanical invention comes before the discovery of the scientific law. It was not the dynamical theory of heat which came before the steam-engine—it followed it. When thousands of engines already were transforming heat into motion under the eyes of hundreds of professors, and when they had done so for half a century, or more; when thousands of trains, stopped by powerful brakes, were disengaging heat and spreading sheaves of sparks on the rails at their approach to the stations; when all over the civilised world heavy hammers and perforators were rendering burning hot the masses of iron they were hammer-

* Chemistry is, to a great extent, an exception to the rule. Is it not because the chemist is to such an extent a manual worker? Besides, during the last ten years we see a decided revival in scientific inventiveness, especially in physics—that is, in a branch in which the engineer and the man of science meet so much together.

ing and perforating — then, and then only, a doctor, Mayer, ventured to bring out the mechanical theory of heat with all its consequences: and yet the men of science almost drove him to madness by obstinately clinging to their mysterious caloric fluid, and they described Joule's work on the mechanical equivalent of heat as "unscientific"

When every engine was illustrating the impossibility of utilising all the heat disengaged by a given amount of burnt fuel, then came the law of Clausius. When all over the world industry already was transforming motion into heat, sound, light, and electricity, and each one into each other, then only came Grove's theory of the "correlation of physical forces". It was not the theory of electricity which gave us the telegraph. When the telegraph was invented, all we knew about electricity was but a few facts more or less badly arranged in our books; the theory of electricity is not ready yet; it still waits for its Newton, notwithstanding the brilliant attempts of late years. Even the empirical knowledge of the laws of electrical currents was in its infancy when a few bold men laid a cable at the bottom of the Atlantic Ocean, despite the warnings of the authorised men of science.

The name of "applied science" is quite misleading, because, in the great majority of cases, invention, far from being an application of science, on the contrary creates a new branch of science. The American bridges were no application of the theory of elasticity; they came before the theory, and all we can say in favour of science is, that in this special branch, theory and practice developed in a parallel way, helping one another. It was not the theory of the explosives which led to the discovery of gunpowder; gunpowder was in use for centuries before the action of the gases in a gun was submitted to scientific analysis. And so on. The great processes of metallurgy; the alloys and the properties they acquire from the addition of very small amounts of

some metals or metalloids; the recent revival of electric lighting; nay, even the weather forecasts which truly deserved the reproach of being "unscientific" when they were started by an old Jack tar, Fitzroy—all these could be mentioned as instances in point. Of course, we have a number of cases in which the discovery, or the invention, was a mere application of a scientific law (cases like the discovery of the planet Neptune), but in the immense majority of cases the discovery, or the invention, is unscientific to begin with. It belongs much more to the domain of art—art taking the precedence over science, as Helmholtz has so well shown in one of his popular lectures—and only after the invention has been made, science comes to interpret it. It is obvious that each invention avails itself of the previously accumulated knowledge and modes of thought; but in most cases it makes a start in advance upon what is known; it makes a leap in the unknown, and thus opens a quite new series of facts for investigation. This character of invention, which is to make a start in advance of former knowledge, instead of merely applying a law, makes it identical, as to the processes of mind, with discovery; and, therefore, people who are slow in invention are also slow in discovery.

In most cases, the inventor, however inspired by the general state of science at a given moment, starts with a very few settled facts at his disposal. The scientific facts taken into account for inventing the steam-engine, or the telegraph, or the phonograph were strikingly elementary. So that we can affirm that what we presently know is already sufficient for resolving any of the great problems which stand in the order of the day —prime-motors without the use of steam, the storage of energy, the transmission of force, or the flying-machine. If these problems are not yet solved, it is merely because of the want of inventive genius, the scarcity of educated men endowed with it, and the

present divorce between science and industry. On the one side, we have men who are endowed with capacities for invention, but have neither the necessary scientific knowledge nor the means for experimenting during long years; and, on the other side, we have men endowed with knowledge and facilities for experimenting, but devoid of inventive genius, owing to their education and to the surroundings they live in—not to speak of the patent system, which divides and scatters the efforts of the inventors instead of combining them.

The flight of genius which has characterised the workers at the outset of modern industry has been missing in our professional men of science. And they will not recover it as long as they remain strangers to the world, amidst their dusty bookshelves; as long as they are not workers themselves, amidst other workers, at the blaze of the iron furnace, at the machine in the factory, at the turning-lathe in the engineering workshop; sailors amidst sailors on the sea, and fishers in the fishing boat, wood-cutters in the forest, tillers of the soil in the field. Our teachers in art have repeatedly told us of late that we must not expect a revival of art as long as handicraft remains what it is; they have shown how Greek and mediæval art were daughters of handicraft, how one was feeding the other. The same is true with regard to handicraft and science; their separation is the decay of both. As to the grand inspirations which unhappily have been so much neglected in most of the recent discussions about art—and which are missing in science as well—these can be expected only when humanity, breaking its present bonds, shall make a new start in the higher principles of solidarity, doing away with the present duality of moral sense and philosophy.

It is evident, however, that all men and women cannot equally enjoy the pursuit of scientific work. The variety of inclinations is such that some will find more pleasure

in science, some others in art, and others again in some of the numberless branches of the production of wealth. But, whatever the occupations preferred by every one, every one will be the more useful in his own branch if he is in possession of a serious scientific knowledge. And, whosoever he might be—scientist or artist, physicist or surgeon, chemist or sociologist, historian or poet —he would be the gainer if he spent a part of his life in the workshop or the farm (the workshop *and* the farm), if he were in contact with humanity in its daily work, and had the satisfaction of knowing that he himself discharges his duties as an unprivileged producer of wealth. How much better the historian and the sociologist would understand humanity if they knew it, not in books only, not in a few of its representatives, but as a whole, in its daily life, daily work, and daily affairs! How much more medicine would trust to hygiene, and how much less to prescriptions, if the young doctors were the nurses of the sick and the nurses received the education of the doctors of our time! And how much the poet would gain in his feeling of the beauties of nature, how much better would he know the human heart, if he met the rising sun amidst the tillers of the soil, himself a tiller; if he fought against the storm with the sailors on board ship; if he knew the poetry of labour and rest, sorrow and joy, struggle and conquest! *Greift nur hinein in's volle Menschenleben!* Goethe said; *Ein jeder lebt's—nicht vielen ist's bekannt.* But how few poets follow his advice!

The so-called division of labour has grown under a system which condemned the masses to toil all the day long, and all the life long, at the same wearisome kind of labour. But if we take into account how few are the real producers of wealth in our present society, and how squandered is their labour, we must recognise that Franklin was right in saying that to work five hours a day would generally do for supplying each member

of a civilised nation with the comfort now accessible for the few only, provided everybody took his due share in production. But we have made some progress since Franklin's times, and some of that progress in the hitherto most backward branch of production has been indicated in the preceding pages. Even in that branch the productivity of labour can be immensely increased, and work itself rendered easy and pleasant. More than one half of the working day would thus remain to every one for the pursuit of art, science, or any hobby he might prefer; and his work in those fields would be the more profitable if he spent the other half of the day in productive work—if art and science were followed from mere inclination, not for mercantile purposes. Moreover, a community organised on the principles of all being workers would be rich enough to conclude that every man and woman, after having reached a certain age—say of forty or more—ought to be relieved from the moral obligation of taking a direct part in the performance of the necessary manual work, so as to be able entirely to devote himself or herself to whatever he or she chooses in the domain of art, or science, or any kind of work. Free pursuit in new branches of art and knowledge, free creation, and free development thus might be fully guaranteed. And such a community would not know misery amidst wealth. It would not know the duality of conscience which permeates our life and stifles every noble effort. It would freely take its flight towards the highest regions of progress compatible with human nature.

CHAPTER IX.

CONCLUSION.

READERS who have had the patience to follow the facts accumulated in this book; especially those who have given them a thoughtful attention, will probably feel convinced of the immense powers over the productive forces of Nature that man has acquired within the last half a century. Comparing the achievements indicated in this book with the present state of production, some will, I hope, also ask themselves the question which will be ere long the main object of a scientific political economy: Whether the means now in use for satisfying human needs, under the present system of permanent division of functions and production for profits, are really *economical;* whether they really lead to economy in the expenditure of human forces; or whether they are not mere wasteful survivals from a past that was plunged into darkness, ignorance and oppression, and never took into consideration the economical and social value of the human being?

In the domain of agriculture it may be taken as proved that if a small part only of the time that is now given in each nation or region to field culture was given to well thought out and socially carried out permanent improvements of the soil, the duration of work which would be required afterwards to grow the yearly bread-food for an average family of five would be less than a fortnight every year; and that the work required for that purpose would not be the hard toil of the ancient

slave, but work which would be agreeable to the physical forces of every healthy man and woman in the country.

It has been proved that by following the methods of intensive market-gardening—partly under glass—vegetables and fruit can be grown in such quantities that men could be provided with a rich vegetable food and a profusion of fruit, if they simply devoted to the task of growing them the hours which every one willingly devotes to work in the open air, after having spent most of his day in the factory, the mine, or the study. Provided, of course, that the production of food-stuffs should not be the work of the isolated individual, but the planned out and combined action of human groups.

It has also been proved—and those who care to verify it by themselves may easily do so by calculating the real expenditure for labour which was lately made in the building of workmen's houses by both private persons and municipalities *—that under a proper combination of labour, twenty to twenty-four months of one man's work would be sufficient to secure for ever, for a family of five, an apartment or a house provided with all the comforts which modern hygiene and taste could require.

And it has been demonstrated by actual experiment that, by adopting methods of education, advocated long since and partially applied here and there, it is most easy to convey to children of an average intelligence, before they have reached the age of fourteen or fifteen, a broad general comprehension of Nature, as well as of human societies; to familiarise their minds with sound methods of both scientific research and technical work; and inspire their hearts with a deep feeling of human solidarity and justice. And that it is extremely easy

* These figures may be computed, for instance, from the data contained in "The Ninth Annual Report of the Commissioner of Labour of the United States, for the year 1893: Building and Loan Associations".

to convey during the next four or five years a reasoned, scientific knowledge of Nature's laws, as well as a knowledge, at once reasoned and practical, of the technical methods of satisfying man's material needs. Far from being inferior to the "specialised" young persons manufactured by our universities, the *complete* human being, trained to use his brain and his hands, excels them, on the contrary, in all respects, especially as an initiator and an inventor in both science and technics.

All this has been proved. It is an acquisition of the times we live in—an acquisition which has been won despite the innumerable obstacles always thrown in the way of every initiative mind. It has been won by the obscure tillers of the soil, from whose hands greedy States, landlords and middlemen snatch the fruit of their labour even before it is ripe; by obscure teachers who only too often fall crushed under the weight of Church, State, commercial competition, inertia of mind and prejudice.

And now, in the presence of all these conquests—what is the reality of things?

Nine-tenths of the whole population of grain-exporting countries like Russia, one-half of it in countries like France which live on home-grown food, work upon the land—most of them in the same way as the slaves of antiquity did, only to obtain a meagre crop from a soil, and with a machinery which they cannot improve, because taxation, rent and usury keep them always as near as possible at the margin of starvation. At the beginning of this century, whole populations plough with the same plough as their mediæval ancestors, live in the same incertitude of the morrow, and are as carefully denied education; and they have, in claiming their portion of bread, to march with their children and wives against their own sons' bayonets, as their grandfathers did a hundred and three hundred years ago.

In industrially developed countries, a couple of months'

work, or even much less than that, would be sufficient to produce for a family a rich and varied vegetable and animal food. But the researches of Engel (at Berlin) and his many followers tell us that the workman's family has to spend one full half of its yearly earnings —that is, to give six months of labour, and often more, to provide its food. And what food! Is not bread and dripping the staple food of more than one-half of English children?

One month of work every year would be quite sufficient to provide the worker with a healthy dwelling. But it is from 25 to 40 per cent. of his yearly earnings —that is, from three to five months of his working time every year—that he has to spend in order to get a dwelling, in most cases unhealthy and far too small; and this dwelling will never be his own, even though at the age of forty-five or fifty he is sure to be sent away from the factory, because the work that he used to do will by that time be accomplished by a machine and a child.

We all know that the child ought, at least, to be familiarised with the forces of Nature which some day he will have to utilise; that he ought to be prepared to keep pace in his life with the steady progress of science and technics; that he ought to study science and learn a trade. Every one will grant thus much; but what do we do? From the age of ten or even nine we send the child to push a coal-cart in a mine, or to bind, with a little monkey's agility, the two ends of threads broken in a spinning gin. From the age of thirteen we compel the girl—a child yet—to work as a "woman" at the weaving-loom, or to stew in the poisoned, over-heated air of a cotton-dressing factory, or, perhaps, to be poisoned in the death chambers of a Staffordshire pottery. As to those who have the relatively rare luck of receiving some more education, we crush their minds by useless overtime, we consciously deprive them of all possibility of themselves

becoming producers; and under an educational system of which the motive is "profits," and the means "specialisation," we simply work to death the women teachers who take their educational duties in earnest. What floods of useless sufferings deluge every so-called civilised land in the world!

When we look back on ages past, and see there the same sufferings, we may say that perhaps then they were unavoidable on account of the ignorance which prevailed. But human genius, stimulated by our modern Renaissance, has already indicated new paths to follow.

For thousands of years in succession to grow one's food was the burden, almost the curse, of mankind. But it need be so no more. If you make yourselves the soil, and partly the temperature and the moisture which each crop requires, you will see that to grow the yearly food of a family, under rational conditions of culture, requires so little labour that it might almost be done as a mere change from other pursuits. If you return to the soil, and co-operate with your neighbours instead of erecting high walls to conceal yourself from their looks; if you utilise what experiment has already taught us, and call to your aid science and technical invention which never fail to answer to the call—look only at what they have done for warfare—you will be astonished at the facility with which you can bring a rich and varied food out of the soil. You will admire the amount of sound knowledge which your children will acquire by your side, the rapid growth of their intelligence, and the facility with which they will grasp the laws of Nature, animate and inanimate.

Have the factory and the workshop at the gates of your fields and gardens, and work in them. Not those large establishments, of course, in which huge masses of metals have to be dealt with and which are better placed at certain spots indicated by Nature, but the countless variety of workshops and factories which are

required to satisfy the infinite diversity of tastes among civilised men. Not those factories in which children lose all the appearance of children in the atmosphere of an industrial hell, but those airy and hygienic, and consequently economical, factories in which human life is of more account than machinery and the making of extra profits, of which we already find a few samples here and there; factories and workshops into which men, women and children will not be driven by hunger, but will be attracted by the desire of finding an activity suited to their tastes, and where, aided by the motor and the machine, they will choose the branch of activity which best suits their inclinations.

Let those factories and workshops be erected, not for making profits by selling shoddy or useless and noxious things to enslaved Africans, but to satisfy the unsatisfied needs of millions of Europeans. And again, you will be struck to see with what facility and in how short a time your needs of dress and of thousands of articles of luxury can be satisfied, when production is carried on for satisfying real needs rather than for satisfying shareholders by high profits or for pouring gold into the pockets of promoters and bogus directors. Very soon you will yourselves feel interested in that work, and you will have occasion to admire in your children their eager desire to become acquainted with Nature and its forces, their inquisitive inquiries as to the powers of machinery, and their rapidly developing inventive genius.

Such is the future — already possible, already realisable; such is the present—already condemned and about to disappear. And what prevents us from turning our backs to this present and from marching towards that future, or, at least, making the first steps towards it, is not the "failure of science," but first of all our crass cupidity—the cupidity of the man who killed the hen that was laying golden eggs—and then our laziness

of mind—that mental cowardice so carefully nurtured in the past.

For centuries science and so-called practical wisdom have said to man: "It is good to be rich, to be able to satisfy, at least, your material needs; but the only means to be rich is to so train your mind and capacities as to be able to compel other men—slaves, serfs or wage-earners—to make these riches for you. You have no choice. Either you must stand in the ranks of the peasants and the artisans who, whatsoever economists and moralists may promise them in the future, are now periodically doomed to starve after each bad crop or during their strikes, and to be shot down by their own sons the moment they lose patience. Or you must train your faculties so as to be a military commander of the masses, or to be accepted as one of the wheels of the governing machinery of the State, or to become a manager of men in commerce or industry." For many centuries there was no other choice, and men followed that advice, without finding in it happiness, either for themselves and their own children, or for those whom they pretended to preserve from worse misfortunes.

But modern knowledge has another issue to offer to thinking men. It tells them that in order to be rich they need not take the bread from the mouths of others; but that the more rational outcome would be a society in which men, with the work of their own hands and intelligence, and by the aid of the machinery already invented and to be invented, should themselves create all imaginable riches. Technics and science will not be lagging behind if production takes such a direction. Guided by observation, analysis and experiment they will answer all possible demands. They will reduce the time which is necessary for producing wealth to any desired amount, so as to leave to every one as much leisure as he or she may ask for. They surely cannot guarantee happiness, because happiness depends as

much, or even more, upon the individual himself as upon his surroundings. But they guarantee, at least, the happiness that can be found in the full and varied exercise of the different capacities of the human being, in work that need not be overwork, and in the consciousness that one is not endeavouring to base his own happiness upon the misery of others.

These are the horizons which the above inquiry opens to the unprejudiced mind.

APPENDIX.

A.—French Imports.

About one-tenth part of the cereals consumed in France is still imported; but, as will be seen in a subsequent chapter, the progress in agriculture has lately been so rapid that even without Algeria France will soon have a surplus of cereals. Wine is imported, but nearly as much is exported. So that coffee and oil seeds remain the only food articles of durable importance for import. For coal and coke France is still tributary to Belgium and this country; but it is chiefly the inferiority of organisation of coal extraction which stands in the way of the home supply. The other important items of imports are: raw cotton (about £8,000,000 of net imports), raw wool to the same amount, and raw silk (about £5,000,000), as well as hides and furs. The exports of manufactured goods were £80,000,000 in 1890 and about £74,000,000 in subsequent years. Exports of textiles, exclusive of yarn and linen, £29,800,000 in 1890, and £25,500,000 in 1891-4. Imports of all textiles, £6,900,000 in 1890, and £4,800,000 in 1891-4.

B.—Growth of Industry in Russia.

The growth of industry in Russia will be best seen from the following:—

	1880-1. Cwts.	1893-4. Cwts.
Cast iron	8,810,000	25,450,000
Iron	5,770,000	9,700,000
Steel	6,030,000	9,610,000
Railway rails	3,960,000	4,400,000
Coal	64,770,000	160,000,000
Naphtha	6,900,000	108,700,000
Sugar	5,030,000	11,470,000
Raw cotton, home grown	293,000	1,225,000

		1889.
Cottons, spinning	£7,410,000	£18,760,000
,, weaving	9,970,000	22,230,000
,, printing and dyeing	6,110,000	7,280,000

C.—Iron Industry in Germany.

The following tables will give some idea of the growth of mining and metallurgy in Germany.

The extraction of minerals in the German Empire, in metric tons, which are very little smaller than the English ton (0.984), was:—

	1883. Tons.	1893. Tons.
Coal	55,943,000	76,773,000
Lignite	14,481,000	22,103,000
Iron ore	8,616,000	12,404,000
Zinc ore	678,000	729,000
Mineral salts (chiefly potash)	1,526,000	2,379,000

	1874.	1894.
Pig iron	1,906,260	5,382,170
Half finished and finished iron and steel	489,000	5,825,000
Imports of iron and steel	757,700	349,160
Exports of same	546,900	2,008,760
Total home consumption of pig iron, iron and steel	2,117,080	3,772,570
	Eng. lb.	Eng. lb.
Do. per head of population	115	161
Production of same per head of population	103	232

For the Grand Duchy of Luxemburg the proportion is still more striking:—

	1868. Tons.	1893. Tons.
Iron ore raised	722,000	3,352,000
Pig iron produced (1871)	93,400	558,300
Steel, begun to be produced in 1886 only	20,554	129,120
Workmen employed	3,508	7,087

(From the *Journal of the Iron and Steel Institute*, vol. xlviii., 1895, p. 6.)

D.—Machinery in Germany.

The growth of the productive powers in Germany is best illustrated by the development of machinery. In the year 1879 Prussia had 29,985 standing engines (887,780 horse-power), 5442 moving engines (47,100 horse-power), and 623 engines on ships (50,310 horse-power). Total, 35,960 engines (985,190 horse-power). Fifteen years later the respective figures were:—57,224 standing (2,172,250 horse-power), 14,425 moving (147,130 horse-power), and 1726 on ships (219,770 horse-power). Total, 73,375 engines (2,539,150 horse-power).

Same increase in Bavaria. In 1879, 2411 standing engines (70,680 horse-power), 892 moving (5520 horse-power), and 98 on ships (2860 horse-power). Total, 3401 engines (79,060 horse-power). In 1889 there were 3819 standing engines (124,680 horse-power), 2021 moving (13,730 horse-power), and 38 on ships (4370 horse-power). Total, 5868 engines (142,750 horse-power).

For the German Empire Prof. Lexis estimated the total of all engines in 1879 at 65,170 engines, 4,510,640 horse-power. In 1892 the aggregate horse-power was 7,206,000, namely, 2,500,000 horse-power in standing engines, 4,200,000 in moving, and 500,000 on ships (Schmoller's *Jahrbuch*, xix., i., p. 275).

The rapid progress in the fabrication of machinery in Germany is still better seen from the growth of the German exports as shown by the following table:—

	1890.	1895.
Machines and parts thereof .	£2,450,000	£3,215,000
Sewing-machines and parts thereof .	315,000	430,000
Locomotives and locomobiles .	280,000	420,000

Every one knows that part of the German sewing-machines and a considerable amount of tools find their way even into this country, and that German tools are plainly recommended in English books.

E.—Cotton Industry in Germany.

Dr. G. Schulze-Gaewernitz, in his excellent work, *The Cotton Trade in England and on the Continent* (English translation by Oscar S. Hall, London, 1895), calls attention to the fact that Germany has certainly not yet attained, in her cotton industry, the high technical level of development attained by England; but he shows also the progress lately realised. The cost of each yard of plain cotton, notwithstanding low wages and long hours, is still greater in Germany than in England, as seen from the following tables. Taking a certain quality of plain cotton in both countries, he gives (p. 151, German edition) the following comparative figures:—

	England.	Germany.
Hours of labour	9 hours	12 hours
Average weekly earnings of the operatives	16s. 3d.	11s. 8d.
Yards woven per week per operative	706 yards	466 yards
Cost per yard of cotton	0.275d.	0.303d.

But he remarks also that in all sorts of printed cottons, in which fancy, colours and invention play a predominant part, *the advantages are entirely on the side of the smaller German factories.*

In the spinning mills the advantages, on the contrary, continue to remain entirely on the side of England, the number of operatives per 1000 spindles being in various countries as follows (p. 91, English edition):—

	Per 1000 spindles.
Bombay	25 operatives.
Italy	13 ,,
Alsace	9½ ,,
Mulhouse	7½ ,,
Germany, 1861	20 ,,
,, 1882	8 to 9 ,,
England, 1837	7 ,,
,, 1887	3 ,,

For the last ten years considerable improvements have taken place. "India shows us, since 1884, extraordinary developments," Schulze-Gaewernitz remarks, and "there is no doubt that Germany also has reduced the number of

operatives per 1000 spindles since the last Inquest". "From a great quantity of materials lying before me, I cull," he writes, "the following, which, however, refer solely to leading and technically distinguished spinning mills:—

	Per 1000 spindles.
Switzerland	6.2 operatives.
Mulhouse	5.8 ,,
Baden and Würtemberg	6.2 ,,
Bavaria	6.8 ,,
Saxony (new and splendid mills)	7.2 ,,
Vosges, France (old spinning mills)	8.9 ,,
Russia	16.6 ,,

The average counts of yarn for all these are between twenties and thirties.

The progress realised in Augsburg between 1875 and 1891 appears as follows:—

	1875.	1891.
Per spindle, lb. yarn	32.6	35.9
Counts	34	34
Per spindle, lb. cotton	39.3	42.4
Operatives, per 1000 spindles	9.7	7.8
Hours of labour, per week	72	66

Wages have been raised everywhere."

F.—Mining and Textiles in Austria.

To give an idea of the development of industries in Austria-Hungary, it is sufficient to mention the growth of her mining industries and the present state of her textile industries.

The value of the yearly extraction of coal and iron ore appears as follows:—

	1880.	1893.
Coal (Austria)	£1,611,000	£2,796,000
Brown coal (Austria)	1,281,300	2,837,400
Raw iron (Austria-Hungary)	1,749,000	3,015,800

At the present time the exports of coal entirely balance the imports.

As to the textile industries, Austria alone, already in 1890, had 1970 steam-engines, of 113,280 horse-power, employed in

the fabrication of textiles. For cotton spinning she had 153 establishments, with 2,392,360 spindles, employing 33,815 work-people, while for cotton weaving she had 194 establishments, with 47,902 power-looms.

The imports of raw cotton attained, in 1894, the respectable sum of £4,333,000 (cotton yarn, £1,375,000); of wool, £3,000,000 (woollen yarn, £1,775,000); of silk, £1,560,000; while her exports of woollen goods quite balanced the imports of the same.

G.—Mr. Giffen's and Mr. Flux's Figures Concerning the Position of the United Kingdom in International Trade.

A few remarks concerning these figures may be of some avail.

When a sudden fall in the British and Irish exports took place in the years 1882-6, and the alarmists took advantage of the bad times to raise the never-forgotten war-cry of protection, especially insisting on the damages made to British trade by "German competition," Mr. Giffen analysed the figures of international trade in his "Finance Essays" and in a report read in 1888 before the Board of Trade Commission. Subsequently, Mr. A. W. Flux analysed again the same figures, extending them to a later period. He confirmed Mr. Giffen's conclusions and endeavoured to prove that the famous "German competition" is a fallacy.

Mr. Giffen's conclusions, quoted by Mr. A. W. Flux ("The Commercial Supremacy of Great Britain," in *Economical Journal*, 1894, iv., p. 457), were as follows:—

"On the whole, the figures are not such as to indicate any great and overwhelming advance in German exports in comparison with those of the United Kingdom. There is greater progress in certain directions, but, taken altogether, no great disproportionate advance, and in many important markets for the United Kingdom Germany hardly appears at all."

In this subdued form, *with regard to German competition alone*—and due allowance being made for figures in which

no consideration is given to what sort of goods make a given value of exports, and in what quantities—Mr. Giffen's statement may be accepted. But that is all.

If we take, however, Mr. Giffen's figures as they are reproduced in extended tables (on pp. 461-467 of the just quoted paper), tabulated with great pains in order to show that Germany's part in the imports to several European countries, such as Russia, Italy, Servia, etc., has declined, as well as the part of the United Kingdom, all we can conclude from these figures is, that there are other countries besides Germany, namely, the United States and Belgium, which compete very effectively with England, France, and Germany for supplying what manufactured goods are still taken by Russia, Italy, Servia, etc., from abroad.

At the same time such figures give no idea of the fact that where manufactured metal goods were formerly supplied, coal and raw metals are imported now, for the home manufacture of those same goods; or, where dyed and printed cottons were imported, only yarn is now required. The whole subject is infinitely more complicated than it appears in Mr. Giffen's calculations; and, valuable as his figures may have been for appeasing exaggerated fears, they contain no answer whatever to the many economic questions involved in the matters treated by Mr. Giffen.

H.—Cotton Manufacture in India.

The views taken in the text about the industrial development of India have been confirmed by a mass of evidence. One of them, coming from authorised quarters, deserves special attention. In an article on the progress of the Indian cotton manufacture, the *Textile Recorder* (15th October, 1888) wrote:—

"No person connected with the cotton industry can be ignorant of the rapid progress of the cotton manufacture in India. Statistics of all kinds have recently been brought before the public, showing the increase of production in the country; still it does not seem to be clearly understood that this increasing output of cotton goods must seriously lower

the demand upon Lancashire mills, and that it is not by any means improbable that India may at no very distant period be no better customer than the United States is now.

"In former times, Manchester goods were to be found in the most remote villages on the banks of the Ganges and the Brahmaputra, and even in the far distant bazaars of Assam, Sylhet and Cachar. But now," the *Recorder* wrote, "a change is taking place. Indian cotton piece goods are coming to the front, and displacing those of Manchester.

"Unbiassed persons having a thorough knowledge of the resources of the country, and having watched the growth of the cotton industry during the last ten years, do not hesitate to say that in a limited period of time the output of all the plainer classes of goods will be sufficient to meet the Indian demand without the supply of goods from Lancashire."

One hardly need add at what price the Indian manufacturers obtain cheap cottons. The report of the Bombay Factory Commission which was laid before Parliament in August, 1888, contained facts of such horrible cruelty and cupidity as would hardly be imagined by those who have forgotten the disclosures of the inquiry made in this country in 1840-42. The factory engines are at work, as a rule, from 5 A.M. till 7, 8, or 9 P.M., and the workers remain at work for twelve, thirteen, fourteen hours, only releasing one another for meals. In busy times it happens that the same set of workers remain at the gins and presses night and day with half an hour's rest in the evening. In some factories the workers have their meals at the gins, and are so worn out after eight and ten days' uninterrupted work that they supply the gins mechanically "three parts asleep".

"It is a sad tale of great want on one side, and cruel cupidity on the other" the official report concludes. However, it would be absolutely erroneous to conclude that Indian manufactures can compete with the British ones as long as they continue the terrible exploitation of human labour which we see now. Forty years ago the British manufactures offered absolutely the same terrible picture of cruel cupidity. But times will come when Indian workers will restrain the cupidity of the capitalists, and the manufactures

of Bombay will be none the worse for that in the competition with the British manufactures.

I.—Irrigated Meadows in Italy.

In the *Journal de l'Agriculture* (2nd Feb., 1889) we find the following about the *marcites* of Milan:—

"On part of these meadows water runs constantly, on others it is only left running for ten hours every week. The former give six crops every year; since February—80 to 100 tons of grass, equivalent to twenty to twenty-five tons of dry hay, being obtained from the hectare (eight to ten tons per acre). Lower down, thirteen tons of dry hay per acre is the regular crop. Taking eighty acres placed in average conditions, they will yield fifty-six tons of green grass per hectare, that is, fourteen tons of dry hay, or the food of three milch cows to the hectare (two and a half acres). The rent of such meadows is from £8 to £9 12s. per acre."

For Indian corn, the advantages of irrigation are equally apparent. On irrigated lands, crops of from seventy-eight to eighty-nine bushels per acre are obtained, as against from fifty-six to sixty-seven bushels on unirrigated lands, also in Italy, and twenty-eight to thirty-three bushels in France (Garola, *Les Céréales*).

As to the ways in which agriculture is ruined in Italy we can best see them from the work of Mr. Beauclerck (*Rural Italy*, London, 1888). Speaking of the Milan province, he remarks that we find there "one of the densest agricultural populations in the world, congregated in a country, of which half is occupied by arid mountains" (416 inhabitants to the square mile). "Flanders alone equals Milan in density of population. The soil is not naturally fertile, and an immense expenditure of capital and labour has alone produced the richness of the land." But "the taxation is fabulously high," as it attains 2620 francs per square kilometre of the cultivated area. Altogether, Mr. Beauclerck considers that rural Italy pays 300,000,000 francs of direct taxes, out of returns not exceeding 1,000,000,000 francs, not to mention the salt tax, the tax on personal property and the indirect taxation.

J.—The Channel Islands.

The excellent state of agriculture in Jersey and Guernsey has often been referred to in the agricultural and general literature of this country, so I need only refer to the works of Mr. W. E. Bear (*Journal of the Agricultural Society*, 1888; *Quarterly Review*, 1888; *British Farmer*, etc.) and to the exhaustive work of D. H. Ansted and R. G. Latham, *The Channel Islands*, third edition, revised by E. Toulmin Nicolle (London, Allen, 1893).

Many English writers, certainly not those just named, are inclined to explain the successes obtained in Jersey by the wonderful climate of the islands and the fertility of the soil. As to climate, it is certainly true that the yearly record of sunshine in Jersey is greater than in any English station. It reaches from 1842 hours a year (1890) to 2300 (1893), and thus exceeds the highest aggregate sunshine recorded in any English station by from 168 to 336 hours (exclusively high maximum in 1894) a year; May and August seeming to be the best favoured months.* But, to quote from the just mentioned work of Ansted and Latham:—

"There is, doubtless, in all the islands, and especially in Guernsey, *an absence of sunheat* and of the direct action of the sun's rays *in summer*, which must have its effect, and *a remarkable prevalence of cold, dry, east wind in late spring, retarding vegetation*" (p. 407). Every one who has spent, be it only two or three weeks in late spring in Jersey, must know by experience how true this remark is. Moreover, there are the well-known Guernsey fogs, and "owing also to rain and damp the trees suffer from mildew and blight, as well as from various aphides". The same authors remark that the nectarine does not succeed in Jersey in the open air "owing to the absence of autumn heat"; that "the wet autumns and cold summers do not agree with the apricot," and so on.

If Jersey potatoes are, on the average, three weeks in advance of those grown in Cornwall, the fact is fully explained by the continual improvements made in Jersey in view of

* *Ten Years of Sunshine in the British Isles*, 1881-1890.

obtaining, be it ever so small, quantities of potatoes a few days in advance, either by special care taken to plant them out as soon as possible, protecting them from the cold winds, or by choosing tiny pieces of land naturally protected or better exposed. The difference in price between the earliest and the later potatoes being immense, the greatest efforts are made to obtain an early crop, and it would seem that the potatoes begin to be grown earlier and earlier, so that three or perhaps even four weeks have been won within the last ten years.

The following table shows when the exporting season began and what prices were realised per cabot (= $\frac{1}{560}$ of a ton) on the very first day of export:—

	s.	d.		s.	d.
1883, May 22	12	0	to	14	0
1884, ,, 6	6	6	,,	8	0
1885, ,, 19				6	0
1886, June 2	6	0	,,	7	0
1887, May 24	8	0	,,	10	0
1888, ,, 29	8	0	,,	10	0
1889, ,, 14	8	0	,,	10	0
1890, ,, 6	9	0	,,	10	0
1891, ,, 1	12	0	,,	15	0
1892, ,, 17	12	0	,,	14	0
1893, April 24	8	3	,,	8	6
1894, ,, 26				11	6

The decline of prices per ton is best seen from the following:—

	1887.	1888.	1889.	1894.
Week ending:—				
May 5	...	...	...	£18 2 6
,, 12	...	...	...	11 9 2
,, 19	...	...	...	9 3 4
,, 26-28	£22 10 7	£20 12 6	£17 6 8	6 9 2
June 2	...	...	...	7 18 4
,, 9-11	10 14 7	10 14 7	6 14 4	6 13 4
,, 16	...	...	...	6 15 5
,, 23	...	...	...	8 6 8
,, 30	...	...	...	...
July 2	9 15 6	4 7 6	5 17 0	6 17 6
,, 7	...	...	...	9 3 4
,, 14-16	5 12 7	2 10 0	2 18 6	6 17 6
,, 30	6 11 9	2 8 11	2 12 0	...
Aug. 20	6 7 6	2 10 0	2 12 0	...

As to the fertility of the soil, it is still worse advocacy, because there is no area in the United Kingdom of equal size which would be manured to such an extent as the area of Jersey and Guernsey is by means of artificial manure. In the seventeenth century, as may be seen from the first edition of Falle's *Jersey*, published in 1694, the island "did not produce that quantity as is necessary for the use of the inhabitants, who must be supplied from England in time of peace, or from Dantzic in Poland". In *The Groans of the Inhabitants of Jersey*, published in London in 1709, we find the same complaint. And Quayle, who wrote in 1812 and quoted the two works just mentioned, in his turn complained in these terms: "The quantity at this day raised is quite inadequate to their sustenance, apart from the garrison" (*General View of the Agriculture and the Present State of the Islands on the Coast of Normandy*, London, 1815, p. 77). And he added: "After making all allowance, the truth must be told; the grain crops are here foul, in some instances execrably so". And when we consult the modern writers, Ansted, Latham and Nicolle, we learn that the soil is by no means rich. It is decomposed granite, and easily cultivable, but "it contains no organic matter besides what man has put into it".

This is certainly the opinion any one will come to if he only visits thoroughly the island and looks attentively to its soil—to say nothing of the Quenvais where, in Quayle's time, there was "an Arabian desert" of sands and hillocks covering about seventy acres (p. 24), with a little better but still very poor soil in the north and west of it. The fertility of the soil has entirely been made, first, by the *vraic* (sea-weeds), upon which the inhabitants have maintained communal rights; later on, by considerable shipments of manure, in addition to the manure of the very considerable living stock which is kept in the island; and finally, by an admirably good cultivation of the soil.

Much more than sunshine and good soil, it was the conditions of land-tenure, and the low taxation which contributed to the remarkable development of agriculture in Jersey. First of all, the people of the Isles know but little of the

tax-collector. While the English pay, in taxes, an average of 50s. per head of population; while the French peasant is over-burdened with taxes of all imaginable descriptions, and the Milanese peasant has to give to the Treasury full 30 per cent. of his income—all taxes paid in the Channel Islands amount to but 10s. per head in the town parishes and to much less than that in the country parishes. Besides, of indirect taxes, none are known but the 2s. 6d. paid for each gallon of imported spirits and 9d. per gallon of imported wine.

As to the conditions of land-tenure, the inhabitants have happily escaped the action of Roman Law, and they continue to live under the *coutumier de Normandie* (the old Norman common law). Accordingly, more than one-half of the territory is owned by those who themselves till the soil; there is no landlord to watch the crops and to raise the rent before the farmer has ripened the fruit of his improvements; there is nobody to charge so much for each cart-load of sea-weeds or sand taken to the fields; every one takes the amount he likes, provided he cuts the weeds at a certain season of the year, and digs out the sand at a distance of sixty yards from the high-water mark. Those who buy land for cultivation can do so without becoming enslaved to the money-lender. One-fourth part only of the permanent rent which the purchaser undertakes to pay is capitalised and has to be paid down on purchase (often less than that), the remainder being a perpetual rent in wheat which is valued in Jersey at 50 to 54 *sous de France* per cabot. To seize property for debt is accompanied with such difficulties that it is seldom resorted to (Quayle's *General View*, pp. 41-46). Conveyances of land are simply acknowledged by both parties on oath, and cost nearly nothing. And the laws of inheritance are such as to preserve the homestead notwithstanding the debts that the father may have run into (*ibid.*, pp. 35-41).

After having shown how small are the farms in the islands (from twenty to five acres, and very many less than that)—there being "less than 100 farms in either island that exceed twenty-five acres; and of these only about half a dozen in

Jersey exceed fifty acres"—Messrs. Ansted, Latham and Nicolle remark:—

"In no place do we find so happy and so contented a country as in the Channel Islands. . . ." "The system of land-tenure has also contributed in no small degree to their prosperity. . . ." "The purchaser becomes the absolute owner of the property and his position cannot be touched so long as the interest of these [wheat] rents be paid. He cannot be compelled, as in the case of mortgage, to refund the principal. *The advantages of such a system are too patent to need any further allusion.*" (*The Channel Islands*, third edition, revised by E. Toulmin Nicolle, p. 401; see also p. 443.)

The following will better show how the cultivable area is utilised in Jersey:—

		1893. Acres.	1894. Acres.
Corn crops	Wheat	1526	1709
	Barley and bere	109	113
	Oats and rye	286	499
	Beans and peas	12	16
Green crops	Potatoes	7599	7007
	Turnips and swedes	126	111
	Mangolds	219	232
	Other green crops	382	447
Clover, sainfoin and grasses under rotation	For hay	2604	2842
	Not for hay	2563	2208
Permanent pasture or grass	For hay	989	1117
	Not for hay	3120	3057
		21,428	21,252

In 1889 there were under:—

	Acres.
Small fruit	2487
Orchards	156
Market gardens	83
Nursery gardens	30

Living Stock.

	1893.	1894.
Horses used solely for agriculture	2300	2252
Unbroken horses	103	83
Mares solely for breeding	14	16
Horses	2417	2351

	1893.	1894.
Cows and heifers in milk or in calf	7004	6709
Other cattle :—		
Two years or more	760	864
One year to two years	2397	2252
Less than one year	2489	2549
Total cattle	12,650	12,374
Sheep, all ages	335	332
Pigs, including sows for breeding	5587	6021

Exports.

	1887.	1888.	1889.
Bulls	102	100	92
Cows and heifers	1395	1639	1629

Potatoes exported :—

	Tons.	£
1887	50,670	434,907
1888	60,527	242,110
1889	52,700	264,153
1890	54,110	293,681
1891	66,840	487,642
1892	66,332	376,535
1893	57,762	327,366
1894	60,605	462,895

The areas under potatoes having been for the last two years respectively 7599 and 7007 acres, the export value *per acre* attained £27 6s. in 1893, and £66 1s. in 1894.

As regards greenhouse culture, a friend of mine, who has worked as a gardener in Jersey, has collected for me various information relative to the productivity of culture under glass. Out of it the following may be taken as a perfectly reliable illustration, in addition to those given in the text :—

Mr. B.'s greenhouse has a length of 300 feet and a width of 18 feet, which makes 5400 square feet, out of which 900 square feet are under the passage in the middle. The cultivable area is thus 4500 square feet. There are no brick walls, but brick pillars and boards are used for front walls. Hot water heating is provided, but is only used occasionally, to keep off the frosts in winter—the crops being early potatoes (which require no heating), followed by tomatoes. The latter are Mr. B.'s speciality. Catch crops of radishes, etc., are taken. The cost of the greenhouse, without the

heating apparatus, is 10s. per running foot of greenhouse, which makes £150 for one-eighth of an acre under glass, or a little less than 7d. per glass-roofed square foot.

The crops are: potatoes, four cabots per perch, *i.e.*, three-quarters of a ton of early potatoes from the greenhouse; and tomatoes, in the culture of which Mr. B. attains extraordinary results. He puts in only 1000 plants, thus giving to his plants more room than is usually given; and he cultivates a corrugated variety which gives very heavy crops but does not fetch the same prices as the smooth varieties. In 1896 his crop was four tons of tomatoes, and so it would have been in 1897—each plant giving an average of twenty pounds of fruit, while the usual crop is from eight to twelve pounds per plant.

The total crop was thus four and three-quarter tons of vegetables, to which the catch crops must be added—thus corresponding to 85,000 lb. per acre (over 90,000 lb. with the catch crops). I again omit the money returns, and only mention that the expenditure for fuel and manure was about £10 a year, and that the Jersey average is three men, each working fifty-five hours a week (ten hours a day), for each acre under glass.

K.—Planted Wheat.

The Rothamsted Challenge.

Sir A. Cotton delivered, in 1893, before the Balloon Society, a lecture on agriculture, in which lecture he warmly advocated deep cultivation and planting the seeds of wheat wide apart. He published it later on as a pamphlet (*Lecture on Agriculture*, 2nd edition, with Appendix. Dorking, 1893). He obtained, for the best of his sort of wheat, an average of "fifty-five ears per plant, with three oz. of grain of fair quality—perhaps sixty-three lbs. per bushel" (p. 10). This corresponded to ninety bushels per acre—that is, his result was very similar to those obtained at the Tomblaine and Capelle agricultural stations by Grandeau and F. Desprèz, whose work seems not to be known to Sir A. Cotton. True,

Sir A. Cotton's experiments were not conducted, or rather were not reported, in a thoroughly scientific way. But the more desirable it would have been, either to contradict or to confirm his statements by experiments carefully conducted at some experimental agricultural station. This is, in fact, what was expected from the veteran head of the Rothamsted experimental farm, Sir John Lawes, even though the author of the pamphlet may have been hard upon the general lines followed in the Rothamsted experiments. Sir John Lawes took, however, another course, and inserted in the *Echo* a letter (reproduced in an Appendix to Sir A. Cotton's lecture), in which we read the following:—

"There are, obviously, two important questions to consider, first—whether so much as from 100 to 120 bushels of wheat can be grown per acre on ordinary arable land? And secondly, whether, if a crop of this magnitude can be grown, it can be done at a cost which will give profit to the farmer? If Sir A. Cotton, or any one else, will grow 1000 *bushels on ten acres* of fairly average wheat land, spending as much as he likes on the cultivation, I will give him £250. Further, in order to ascertain whether our country can grow sufficient wheat to feed our population, and even, perhaps, for export besides, upon from 2,000,000 to 3,000,000 acres, I will give £1000 to Sir A. Cotton, or any one else, who will grow 100 bushels of wheat per acre, *on ten separate acres of wheat land, one in each of the ten English counties* growing the largest acreage of wheat at the present time; the cost of production being less than the value of the crop, so as to prove that such crops could be grown profitably by our farmers."

I reprint this letter almost in full (italics are mine) because I have already had letters from correspondents, and seen public affirmations to the effect that Sir John Lawes had offered £1000 to the person who would grow 100 bushels to the acre, but that no one had answered his challenge. Every one may see now that actually no such challenge has ever been made.

The fact is this. All Rothamsted experiments were carried on on plots of two-thirds and one-third of an acre. And, from experiments on such a scale, the far-reaching

conclusion in agriculture as to the limits of profitable manuring was arrived at at Rothamsted. The highest *average* crop ever attained at Rothamsted on such plots, by any amount of manuring, was thirty-six and a quarter bushels, and the *maximum* crop obtained in the best season was fifty-six bushels. Now Sir A. Cotton claims that as much as from 80 to 100 bushels to the acre can be obtained by means of deep cultivation and planting wide apart in addition to proper manuring, that is, nearly three times as much as the Rothamsted average was for the best-manured plots. The only fair challenge which could be made with reference to such an assertion would be, in my opinion, to propose to grow an average of 80 or 100 bushels (instead of the Rothamsted thirty-six and a quarter) for several years in succession (bad and good seasons) *on plots of the same size as the Rothamsted plots, i.e.*, one-third and two-thirds of an acre; under the condition, of course, that full account be kept, as it was at Rothamsted, of the manure used and the labour required. But such a challenge was *not* made, and it was proposed, instead, to grow 1000 *bushels on ten acres*, in ten different counties, in the second part of the challenge. To make a challenge under such conditions—Sir John Lawes must well know it himself—amounts to *no challenge at all.* Let us hope, however, that some day the experiments of Hallett, Cotton, Grandeau and Dessprèz will be repeated at Rothamsted as well, and that Sir John Lawes will give them as brilliant a confirmation as he gave some time ago to Hellriegel's work on nitrification.

L.—Replanted Wheat.

A few words on this method which now claims the attention of the experimental stations may perhaps not be useless.

In Japan, rice is always treated in this way. It is treated as our gardeners treat lettuce and cabbage; that is, it is let first to germinate; then it is sown in special warm corners, well inundated with water and protected from the birds by strings drawn over the ground. Thirty-five to fifty-five days

later, the young plants, now fully developed and possessed of a thick network of rootlets, are *replanted* in the open ground. In this way the Japanese obtain from twenty to thirty-two bushels of *dressed* rice to the acre in the poor provinces, forty bushels in the better ones, and from sixty to sixty-seven bushels in the best lands. The average, in six rice growing states of North America, is at the same time only nine and a half bushels.*

In China, replanting is also in general use, and consequently the idea has been circulated in France by M. Eugène Simon and the late M. Toubeau, that replanted wheat could be made a powerful means of increasing the crops in Western Europe.† So far as I know, the idea has not yet been submitted to a practical test; but when one thinks of the remarkable results obtained by Hallett's method of planting; of what the market gardeners obtain by replanting once and even twice; and of how rapidly the work of planting is done by market gardeners in Jersey, one must agree that in replanted wheat we have a new opening worthy of the most careful consideration. Experiments have not yet been made in this direction; but Prof. Grandeau, whose opinion I have asked on this subject, wrote to me that he believes the method must have a great future. Practical market gardeners (Paris *maraîcher*) whose opinion I have asked, see, of course, nothing extravagant in that idea.

With plants yielding 1000 grains each—and in the Capelle experiment they yielded an average of 600 grains—the yearly wheat-food of one individual man (5.65 bushels or 265 lbs.), which is represented by from 5,000,000 to 5,500,000 grains, could be grown on a space of 250 square yards; while for an experienced hand replanting would represent no more than ten to twelve hours' work. With a proper machine-tool, the

* Dr. M. Fesca, *Beiträge zur Kenntniss der Japanesischen Landwirthschaft*, Part ii., p. 33 (Berlin, 1893). The economy in seeds is also considerable. While in Italy 250 kilogrammes to the hectare are sown, and 160 kilogrammes in South Carolina, the Japanese use only sixty kilogrammes for the same area. (Semler, *Tropische Agrikultur*, Bd. iii., pp. 20-28.)

† Eugène Simon, *La cité chinoise* (translated into English); Toubeau, *La répartition métrique des impôts*, 2 vols., Paris (Guillaumin), 1880.

work could probably be very much reduced. In Japan, two men and two women plant with rice three-quarters of an acre in one day (Ronna, *Les Irrigations*, vol. iii., 1890, p. 67 *seq.*). That means (Fesca, *Japanesische Landwirthschaft*, p. 33) from 33,000 to 66,000 plants, or, let us say, a minimum of 8250 plants a day for one person. The Jersey gardeners plant from 600 (inexperienced) to 1000 plants per hour (experienced).

M.—Imports of Vegetables to the United Kingdom.

That the land in this country is not sufficiently utilised for market gardening, and that the largest portion of the vegetables which are imported from abroad could be grown in this country, has been said over and over again within the last few years.

It is certain that considerable improvements have taken place lately—the area under market gardens, and especially the area under glass for the growth of fruit and vegetables, having largely been increased of late. Thus, instead of 38,957 acres, which were given to market-gardening in Great Britain in 1875, there were, in 1894, 88,210 acres, exclusive of vegetable crops on farms, given to that purpose (*The Gardener's Chronicle*, 20th April, 1895, p. 483). But that increase remains a trifle in comparison with similar increases in France, Belgium, and the United States. In France, the area given to market gardening was estimated in 1892 by M. Baltet (*L'horticulture dans les cinq parties du monde*, Paris, Hachette, 1895) at 1,075,000 acres—four times more, in proportion to the cultivable area, than in this country, and the most remarkable of it is that considerable tracts of land formerly treated as uncultivable have been reclaimed for the purposes of market gardening as also of fruit growing.

As things stand now in this country, we see that very large quantities of the commonest vegetables, each of which could be grown in this country, are imported.

Lettuces are imported—not only from the Azores or from the south of France, but they continue until June to be imported from France, where they are mostly grown—not in

the open air, but in frames. Early cucumbers, also grown in frames, are largely imported from Holland, and are sold so cheaply that many English gardeners have ceased to grow them.* Even beetroot and pickling cabbage are imported from Holland; and while onions were formerly largely grown in this country, we see that in 1894, 5,288,512 bushels of onions, £765,049 worth, were imported from Belgium (chief importer), Germany, Holland, France, and so on.

Again, that early potatoes should be imported from the Azores and the south of France is quite natural. It is not so natural, however, that more than 50,000 tons of potatoes (58,060 tons, £521,141 worth, on the average during the years 1891-4) should be imported from the Channel Islands, because there are hundreds if not thousands of acres in South Devon, and most probably in other parts of the south coast too, where early potatoes could be grown equally well. But besides the 88,200 tons of early potatoes (£710,586 worth) which are imported to this country, no less than 54,100 tons of late potatoes, for which £441,300 are paid every year, are imported from Holland, Germany and Belgium. And, moreover, this country imported, during the same three years, all sorts of green vegetables, for the sum of £1,027,411 (as against £467,290 in 1885) from different countries,† while thousands of acres lie idle, and the country population is driven to the cities in search of work, without finding it.

Every one knows how well potatoes succeed in this country, and what admirable sorts of potatoes have been bred by the British growers. But the rent and the middleman absorb the best profits of the grower. I could produce striking facts to prove this last assertion concerning the middleman; but similar facts having already been produced in heaps, it would be useless to swell by more figures an evidence already overwhelming.‡

* *The Gardener's Chronicle*, 20th April, 1895, p. 483.
† *Ibid.*
‡ *Cf.* W. Bear's *British Farmer and His Competitors*, p. 151.

N.—Market Gardening in Belgium.

In 1885 the superficies given to market gardening in Belgium was 99,600 acres. Now, a Belgian professor of agriculture, who has kindly supplied me with notes on this subject, writes:—

"The area has considerably increased, and I believe it can be taken at 112,000 acres (45,000 hectares), if not more." And further on: "Rents in the neighbourhood of the big towns, Antwerp, Liège, Ghent and Brussels, attain as much as £5 16s. and £8 per acre; the cost of instalment is from £13 to £25 per acre; the yearly cost of manure, which is the chief expense, attains from £8 to £16 per acre the first year, and then from £5 to £8 every year". The gardens are of the average size of two and a half acres, and in each garden from 200 to 400 frames are used. About the Belgian market-gardeners the same remark must be made as has been made concerning the French *maraîchers*. They work awfully hard, having to pay extravagant rents, and to lay money aside, with the hope of some day being able to buy a piece of land, and to get rid of the blood-sucker who absorbs so much of their money returns; having moreover every year to buy more and more frames in order to obtain their produce earlier and earlier, so as to fetch higher prices for it, they work like slaves. But it must be remembered that in order to obtain the same amount of produce under glass, in greenhouses, the work of *three men only*, working fifty-five hours a week, is required in Jersey for cultivating one acre of land under glass.

O.—Petty Trades in the Lyons Region.

The neighbourhoods of St. Etienne are a great centre for all sorts of industries, and among them the petty trades occupy an important place. Iron works and coal mines with their high smoking chimneys; noisy manufactories; roads blackened by coal, and a poor vegetation, give the country the well-known aspects of the "Black Country". In certain

towns, such as St. Chamond, one finds numbers of big factories in which thousands of women are employed in the fabrication of *passementerie*. But side by side with the great industry the petty trades also maintain a high development. Thus we have first the fabrication of silk ribbons, in which no less than 50,000 men and women were employed in the year 1885. Only 3000 or 4000 looms were located then in the factories; while the remainder—that is, from 1200 to 1400 looms—belonged to the workers themselves, both at St. Etienne and in the surrounding country.* As a rule the women and the girls spin the silk or make the winding off, while the father with his sons weave the ribbons. I saw these small workshops in the suburbs of St. Etienne, where complicated ribbons (with interwoven addresses of the manufacture), as well as ribbons of high artistic finish, were woven in three to four looms, while in the next room the wife prepared the dinner and attended to household work.

There was a time when the wages were high in the ribbon trade (reaching over ten francs a day), and M. Euvert wrote me that half of the suburban houses of St. Etienne had been built by the *passementiers* themselves. But the affairs took a very gloomy aspect when a crisis broke out in 1884. No orders were forthcoming, and the ribbon weavers had to live on casual earnings. All their economies were soon spent. "How many," M. Euvert wrote, "have been compelled to sell for a few hundred francs the loom for which they had paid as many thousand francs." What an effect this crisis has had on the trade I could not say, as I have no recent information about this region. Very probably a great number of the ribbon weavers have emigrated to St. Etienne, where artistic weaving is continued, while the cheapest sorts of ribbon must be made in factories.

The manufacture of arms occupies from 5000 to 6000 workers, half of whom are in St. Etienne, and the remainder

* I am indebted for these figures and the following information to M. V. Euvert, President of the Chamber of Commerce of St. Etienne, who sent me, while I was in the Clairvaux prison, in April, 1885, a most valuable sketch of the various industries of the region, in reply to a letter of mine. I avail myself of the opportunity for expressing to M. Euvert my best thanks for his courtesy.

in the neighbouring county. All work is done in small workshops, save in the great arm factory of the State, which sometimes will employ from 10,000 to 15,000 persons, and sometimes only a couple of thousand men.

Another important trade in the same region is the manufacture of hardware, which is all made in small workshops, in the neighbourhoods of St. Etienne, Le Chambon, Firminy, Rive de Giers, and St. Bonnet le Château. The work is pretty regular, but the earnings are low as a rule. And yet the peasants continue to keep to those trades, as they cannot go on without some industrial occupation during part of the year.

The yearly production of silk stuffs in France attained no less than 7,558,000 kilogrammes in 1881;* and most of the 5,000,000 to 6,000,000 kilogrammes of raw silk which were manufactured in the Lyons region were manufactured by hand.† Twenty years before, *i.e.*, about 1865, there were only from 6000 to 8000 power-looms, and when we take into account both the prosperous period of the Lyons silk industry about 1876, and the crisis which it underwent in 1880-6, we cannot but wonder about the slowness of the transformation of the industry. Such is also the opinion of the President of the Lyons Chamber of Commerce, who wrote me that the domain of the power-loom is increased every year, "by including new kinds of stuffs, which formerly were reputed as unfeasible in the power-looms; but," he added, "the transformation of small workshops into factories still goes on so slowly that the total number of power-looms reaches only from 20,000 to 25,000 out of an aggregate of from 100,000 to 110,000".

The leading features of the Lyons silk industry are the following:—

The preparatory work—winding off, warping and so on—

* 7,558,000 kilogrammes in 1881, as against 5,134,000 kilogrammes in 1872. *Journal de la Société de Statistique de Paris*, September, 1883.

† I take these figures from a detailed letter which the President of the Lyons Chamber of Commerce kindly directed to me in April, 1885, to Clairvaux, in answer to my inquiries about the subject. I avail myself of this opportunity for addressing to him my best thanks for his most interesting communication.

is mostly made in small workshops, chiefly at Lyons, with only a few workshops of the kind in the villages. Dyeing and finishing are also made, of course, in great factories, and it is especially in dyeing, which occupies 4000 to 5000 hands, that the Lyons manufacturers have attained their highest repute. Not only silks are dyed there, but also cottons and wools, and not only for France, but also to some extent for London, Manchester, Vienna, and even Moscow. It is also in this branch that the best machines have to be mentioned.*

As to the weaving, it is made, as we just saw, on from 20,000 to 25,000 power-looms and from 75,000 to 90,000 hand-looms, which partly are at Lyons (from 15,000 to 18,000 hand-looms in 1885) and chiefly in the villages. The workshops, where one might formerly find several *compagnons* employed by one master, have a tendency to disappear, the workshops mostly having now but from two to three hand-looms, on which the father, the mother and the children are working together. In each house, in each storey of the Croix Rousse, you find until now such small workshops. The *fabricant* gives the general indications as to the kind of stuff he desires to be woven, and his draughtsmen design the pattern, but it is the workman himself who must find the way to weave in threads of all colours the patterns sketched on paper. He thus continually creates something new; and many improvements and discoveries have been made by workers whose very names remain unknown.†

The Lyons weavers have retained until now the character of being the elite of their trade in higher artistic work in silk stuffs. The finest, really artistic brocades, satins and velvets, are woven in the smallest workshops, where one or two looms only are kept. Unhappily the unsettled character of the demand for such a high style of work is often a cause of misery amongst them. In former times, when the orders for

* *La fabrique lyonnaise de soieries. Son passé, son présent.* Imprimé par ordre de la Chambre de Commerce de Lyon, 1873. (Published in connection with the Vienna Exhibition.)

† Marius Morand, *L'organisation ouvrière de la fabrique lyonnaise;* paper read before the Association Française pour l'avançement des Sciences, in 1873.

higher sorts of silks became scarce, the Lyons weavers resorted to the manufacture of stuffs of lower qualities: *foulards*, *crêpes*, *tulles*, of which Lyons had the monopoly in Europe. But now the commoner kinds of goods are manufactured by the million, on the one side by the factories of Lyons, Saxony, Russia and Great Britain, and on the other side by peasants in the neighbouring departments of France, as well as in the Swiss villages of the cantons of Basel and Zurich, and in the villages of the Rhine provinces, Italy and Russia.

The emigration of the French silk industry from the towns to the villages began long ago, *i.e.*, about 1817, but it was especially in the sixties that this movement took a great development. About the year 1872 nearly 90,000 hand-looms were scattered, not only in the Rhône department, but also in those of Ain, Isère, Loire, Saône-et-Loire, and even those of Drôme, Ardèche and Savoie. Sometimes the looms were supplied by the merchants, but most of them were bought by the weavers themselves, and it was especially women and girls who worked on them at the hours free from agriculture. But already since 1835 the emigration of the silk industry from the city to the villages began in the shape of great factories erected in the villages, and such factories continue to spread in the country, making terrible havoc amidst the rural populations.

When a new factory is built in a village it attracts at once the girls, and partly also the boys of the neighbouring peasantry. The girls and boys are always happy to find an independent livelihood which emancipates them from the control of the family. Consequently, the wages of the factory girls are extremely low. At the same time the distance from the village to the factory being mostly great, the girls cannot return home every day, the less so as the hours of labour are usually long. So they stay all the week at the factory, in barracks, and they only return home on Saturday evening; while at sunrise on Monday a waggon makes the tour of the villages, and brings them back to the factory. Barrack life—not to mention its moral consequences—soon renders the girls quite unable to work in the fields. And,

when they are grown up, they discover that they cannot maintain themselves at the low wages offered by the factory; but they can no more return to peasant life. It is easy to see what havoc the factory is thus doing in the villages, and how unsettled is its very existence, based upon the very low wages offered to country girls. It destroys the peasant home, it renders the life of the town worker still more precarious on account of the competition it makes to him; and the trade itself is in a perpetual state of unsettledness.

P.—Small Industries at Paris.

It would be impossible to enumerate here all the varieties of small industries which are carried on at Paris; nor would such an enumeration be complete, because every year new industries are brought into life. I therefore will mention only a few of the most important industries.

A great number of them are connected, of course, with ladies' dress. The *confections*, that is, the making of various parts of ladies' dress, occupy no less than 22,000 operatives at Paris, and their production attains £3,000,000 every year, while gowns give occupation to 15,000 women, whose annual production is valued at £2,400,000. Linen, shoes, gloves, and so on, are as many important branches of the petty trades and the Paris domestic industries, while one-fourth part of the stays which are sewn in France (£500,000 out of £2,000,000) are made at Paris.

Engraving, book-binding, and all kinds of fancy stationery, as well as the manufacture of musical and mathematical instruments, are again as many branches in which the Paris workmen excel. Basket-making is another very important item, the finest sorts only being made in Paris, while the plainest sorts are made in the above-mentioned centres (Haute Marne, Aisne, etc.). Brushes are also made in small workshops, the trade being valued at £800,000 both at Paris and in the neighbouring department of Oise.

For furniture, there are at Paris as many as 4340 workshops, in which three or four operatives per workshop are

employed on the average. In the watch trade we find 2000 workshops with only 6000 operatives, and their production, about £1,000,000, reaches nevertheless nearly one-third part of the total watch production in France. The *maroquinerie* gives the very high figure of £500,000, although it employs only 1000 persons, scattered in 280 workshops, this high figure itself testifying to the high artistic value of the Paris leather fancy goods. The jewelry, both for articles of luxury, and for all descriptions of cheap goods, is again one of the specialities of the Paris petty trades; and another well-known speciality is the fabrication of artificial flowers. Finally, we must mention the carriage and saddlery trades, which are carried on in the small towns round Paris; the making of fine straw hats; glass cutting, and painting on glass and china; and numerous workshops for fancy buttons, attire in mother-of-pearl, and small goods in horn and bone.

Q.—Petty Trades in Germany.

The literature of the small industries in Germany being very bulky, the chief works upon this subject may be found, either in full or reviewed, in Schmoller's *Jahrbücher*, and in Conrad's *Sammlung national-ökonomischer und statistischer Abhandlungen*. For a general review of the subject and rich bibliographical indications, Schönberg's *Volkwirthschaftslehre*, vol. ii., which contains excellent remarks about the proper domain of small industries (p. 401 *seq.*), as well as the above-mentioned publication of K. Bücher (*Untersuchungen über die Lage des Handwerks in Deutschland*), will be found most valuable. The work of O. Schwarz, *Die Betriebsformen der modernen Grossindustrie* (in *Zeitschrift für Staatswissenschaft*, vol. xxv., p. 535), is interesting by its analysis of the respective advantages of both the great and the small industries, which brings the author to formulate the following three factors in favour of the former: (1) economy in the cost of motive power; (2) division of labour and its harmonic organisation; and (3) the advantages offered for the sale of the produce. Of these three factors, the first is more and more eliminated

every year by the progress achieved in the transmission of power; the second exists in small industries as well, and to the same extent, as in the great ones (watchmakers, toymakers, and so on); so that only the third remains in full force; but this factor as already mentioned in the text of this book, is a *social* factor which entirely depends upon the degree of development of the spirit of association amongst the producers. As to Schwarz's figures relative to the higher productivity of great spinning mills as compared with smaller ones, it remains to be known whether the large mills which he mentions are not more modern than the small ones, and are not provided, therefore, with better machinery. One conclusion of Schwarz is, however, absolutely correct: small industries, unless they are engaged in the production of *artistic* goods, as is the case at Paris, Lyons, Warsaw, Vienna, and so on, can thrive only in connection with agriculture.

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