# Building an Innovative Organization

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Assessing the Organization's Capacity for Innovation

There are two key criteria to consider when assessing the organization's capacity for innovation: effectiveness and efficiency. Effectiveness is a measure of the alignment of the organization's innovation capability with the opportunity in the marketplace as translated through the strategy. Efficiency is a measure of the consistency of focus among all the elements of the organization. Organizations can, depending on their state of development and their degree of focus on the market, exist with various mixtures of effectiveness and efficiency (Figure 1).
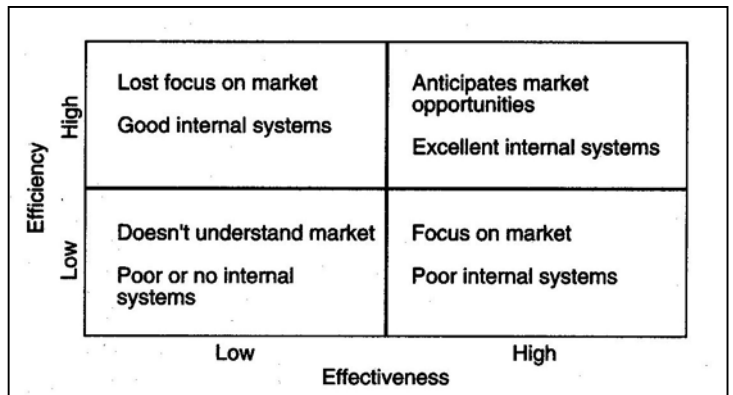
● Figure 1 Effectiveness and Efficiency

Effectiveness is being on target most of the time. No person, or organization, can hit the bull's-eye every time. For an archer, effectiveness is having the pattern of shots clustered around the center of the target. The pattern of those shots can be broad or narrow. If the pattern is broad, the archer is not efficient. If the pattern is clustered all together in the bull's-eye, the archer is efficient and effective. If the archer is effective, his or her aim for the target is good, even if the target is moving. If the archer's process of drawing the bow back, aiming, and releasing is consistent, the archer is efficient.

Organizations at their inception are searching for the right combination of effectiveness and efficiency. If an organization works too long to maximize its effectiveness before addressing efficiency, it will not be successful; if it stresses efficiency too soon, it will also not be successful. Therefore, striking the right balance between effectiveness and efficiency is one of the key problems of a start-up organization, maintaining a balance of effectiveness and efficiency is one of the key tasks of a mature organization, and redefining effectiveness and reestablishing efficiency is one of the key problems for a declining organization.

A powerful way to evaluate an organization's effectiveness and efficiency is by examining the type of innovation the organization has a natural proclivity to generate. This characteristic of an organization is similar to its genetic code. An innovation map of the organization's capabilities describes its natural tendency to innovate.

Genetics eliminates some people from playing professional basketball; they simply are not tall enough. For those who can play, genetics is important in determining the position that can be played. Centers are different from forwards who are different from guards. Similarly, there are some organizations that just cannot play in some markets, and those that can play are limited to specific roles. But .unlike our genetic makeup, which we can do little about, organizations can, and do, change their natural innovation tendencies - giving them access to new markets, or expanded roles in current markets. The first step to changing an organization's capability to innovate is an assessment of that current capability.

Organizational Elements

Organizations are composed of three major elements:

- **Projects:** The projects of an organization are the identified and organized ways that the resources of the organization are applied in order for the organization to reach its goals, and exploit the market opportunities and avoid or minimize the threats. Projects are the way in which the strategy is implemented. Projects can be focused on products, processes, or procedures. They can have the purpose of improving technologies, methods, or materials.

- **Resources:** Resources are the "means" of an organization; the resources of an organization are capital, people, facilities/land and tools/equipment, strategic relationships, knowledge and natural resources. The resources of an organization are applied through projects to produce the results required by its strategy and goals.

- **Culture:** The culture of an organization determines its character; it encourages the development of specific types of resources and the implementation of certain projects. Like social cultures, organizational cultures are known by their artifacts, the things they produce, and the behavior of individuals within the culture. The output of an organizational culture, its products or services, reflects the culture itself.

Figure 2 shows a typical anthropological model of a culture. At the core of a culture is its philosophy, how it relates what it believes, values, and acts upon to life. The philosophy gives existence in the culture purpose and meaning. Built upon the philosophy, a culture has a small number of beliefs, things it holds self-evident, beyond questioning. Values are built upon the beliefs, and, therefore, there can be many more values than beliefs. Values determine the priorities for action, and they become the key factors in decisions. Decisions are made based on what the organization values, and the behavior of people within the culture is based upon their values. There are two different kinds of behavior sometimes shown in cultural models. In psychological parlance the term behavioral norms describes behaviors that clearly express, as they are directly linked to, the organization's values. Other behavior patterns follow the norms. The output of the organization is its products and services, which have consequences to the organization and its stakeholders, customers and competitors, and society in general.
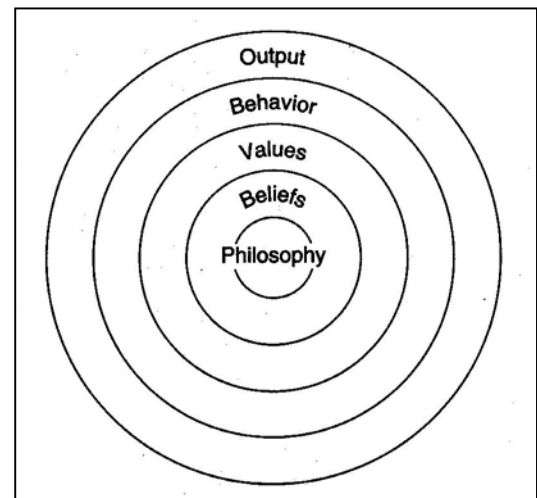
• Figure 2 Organizational Culture

Dysfunctional Organizations

Organizations become dysfunctional when one or more of the innovation capabilities of the elements of the organization (projects, resources, or culture) are not aligned with the innovation opportunity in the market. The organization then is inefficient at what it does. If the organization is ineffective, its products or services will not meet the needs of customers; it will lose market share, and begin to decline. However, an inefficient organization has no such dramatic symptoms. It just struggles with everything it does. It may hang in there, or even decline, depending on the severity of the inefficiencies.

There are six general symptoms of an inefficient organization. No one of these is sufficient in itself to warrant the undertaking of an organizational development program. However, if your organization suffers from several of these symptoms, it may be wise to assess formally the organization's capacity to innovate, and to check the alignment of that capacity with the needs of the market. The following are symptoms of an inefficient organization:

- **Stress and frustrations.** Organizations that have misalignments of the innovation capacity of their resources or culture with their projects have a high degree of stress and frustration. If the people in the organization are better

in tune with the needs of the market than the culture allows or the projects dictate, the people will feel stressed and frustrated. If the people are trying to implement the projects but the culture prohibits them from doing so, or it requires a fight each time something is attempted, stress will be obvious.

- **Inappropriate behavior.** Behavior which is inappropriate to the marketplace or the goals of the organization is one indication that the culture may be misaligned with the market.

- **Recurring problems.** The organization may have recurring problems, and the organization may find that quick fixes don't work. This is often caused by a misdiagnosis of the problem; a symptom is observed and a standard solution prescribed. When the solution fails, frustration results. A classic example of this is an organization thinking that its sales force is not responsive enough to customer needs, and prescribing sensitivity training, when in reality the real problem is that the organization's products only partially meet customer needs. Quick fixes often fail because the organization has misdiagnosed the problem. And they fail because the quick fix does not have enough flexibility in it to cover the real problem.

- **Requirements only partially met.** For each product or service, there is a set of requirements that must be fulfilled. If the organization's projects, resources, and culture are not aligned, their innovation capacities will also differ. The result of the product commercialization process in this type of situation will fill only a subset of the total requirements, even though all requirements were understood at the beginning. Attempts to fill the remaining requirements after the product is in the market will be extremely painful; an organization with this symptom seems to need continuous proof that additional requirements must be met. Sometimes the requirements of the market involve a trade-off between quality, price, and date of availability. Organizations with misaligned projects, resources, and culture have a hard time balancing these in a way appropriate to the market. For example, one large software company we worked with had a new product that the market needed now. But the company held it up until the product could meet its own internal defect standards, even though customers told the company that they would tolerate some higher level of defects to get the function right away.

- **Commercialization cycle too long.** When the project, resources, and culture of the organization are misaligned, it takes the organization too long to do anything, much less to commercialize a product. With the three elements pulling in different directions, the process slows down as each step becomes a painful excursion.

- **Excessive utilization of external capabilities.** Appropriate use of external capabilities is essential to an organization's success, but if the organization finds itself having to turn to external capabilities on core issues or competencies, then something's gone wrong. The organization may find itself having to partner with other companies too frequently, or having to buy its way out of intellectual property problems. The current national trend toward temporary workers to solve many problems is one example. In one large company, almost all the software developers who possess a critical new skill that is required. to meet current market needs come from a temporary agency. This is a clear symptom that the resources are not aligned with the market opportunity.

Types of Innovation

There are six different classifications of innovation that when combined in a matrix produce nine different types of innovation.

The nature of innovation:

- **Product.** The product or service provided to customers (external or internal). Examples include improvements in machinery, consumer goods, software, automobiles, etc. These innovations typically involve new and attractive features. A product innovation involves the way things interact with other things.

- **Process.** The way a product is produced or a service is provided. Examples include improvements in internal distribution systems, software programming systems, etc. These innovations reduce lifetime cost of the product/service and improve their quality. A process innovation involves the way people interact with things.

- **Procedure.** The way in which products/processes are integrated into the operations of the organization. Examples include improvements in advertising programs, repair and maintenance service, and reaction times. These innovations contribute to the customer's comfort in that the product/service is well-supported before and after purchase. A procedure innovation involves the way people interact with other people.

The class of innovation:

- **Incremental.** An innovation which provides modest improvements in performance and/or profitability. Allows goods or services to be produced faster, cheaper, better, more reliably, etc.

- **Distinctive.** An innovation which significantly improves performance and/or profitability, but is not based on an approach fundamentally different from those presently being used. Typically serves as a foundation for a number of incremental innovations.

- **Breakthrough.** An innovation based on a fundamentally different approach than those presently being used. Allows one to perform task that could not be performed at present, or to perform a present task in a markedly improved manner. Typically serves as a foundation for a number of distinctive innovations.

When combined into a matrix, they describe nine types of innovation (Figure 3)

• Figure 3 Innovation Map

It is important to note that the definitions of the type and class of innovation is relative. It depends upon the perspective. In this article we will be taking the perspective of the customer. However, it can also be used internal to the organization to look at how groups support each other.

Assessing the Organization's Capacity to Innovate

Assessing the organization's capacity to innovate requires an analysis of its projects, resources, and culture. This process begins with "customizing" of the definitions of two categories of innovation. These are used as guidelines to assess the innovation focus of the projects. Each major project of the organization must be analyzed for its innovation content. This is usually done by a team of people cognizant of the projects, either in a group meeting or by survey. The projects may be weighted as to their significance to the organization and the innovation content.

The resources are assessed for their capacity to support innovation along a number of different criteria. Each of these must be addressed and their impact on the innovation capacity determined.

Innovation Capacity of the Resources

There are seven areas to consider to evaluate the innovation capacity of the organization's resources:

- Capital (The amount of money available, the patience of the money source, and the return expected all control the type of innovation possible.}

- People (skills, personality type, information, creativity)

- Facilities/Land

- Equipment/Tools

- Knowledge (patents, copyrights, trade secrets, know-how, reports, standards, specifications)

- Strategic relationships (vendors, suppliers, consultants, contracts, joint ventures, cooperative programs, strategic alliances)

- Natural resources

The seven elements are combined to create a perspective on the innovation potential of the organization's resources.

Quality concept	Innovation nature		
	Product	Process	Procedure
Jones	■		▨
Deming		■	
Juran	■		
Ishikawa	■	▨	▨
Crosby	■		
Shuster			■
Taguchi	■		

• Figure 4 Correlation of innovation nature with quality approach (1. Key: Black = strong, Hatched = moderate and White = some.)

Innovation Capacity of the Culture

The culture can be assessed by examining the consequences of its output, the behavior of its people, and the values of the organization. The most effective way to assess the culture is to determine what its values are by making direct inquiries and then check these values against behavior, output, and consequences.

For each of the two parameters of innovation, nature and class, there are different values. The class of innovation is related to the degree of change that the innovation represents. For a culture to produce breakthrough innovation, it must value the type of behavior that is likely to produce breakthroughs, and similar correlations must exist for distinctive and incremental innovation. Because the class of innovation represents the size of change that the organization can support, the values related to innovation class can be thought of as being related to the organization's vitality. For organizations to be vital, they must be alive, growing and changing. The degree of change that the organization can support connotes different types of vitality. No one type, or equivalent set of values, is any better inherently than any other set. It depends on the opportunity and threat in the market, and the organization's strategy.

Organizations that are vital may generate all three classes of innovation.

The nature of innovation is related to the quality management system used. The different quality management systems that have been developed over time have a mix of emphases on product, process, and procedure, but each one has a central focus on only one or two of the three. Again, there are no inherently better quality management approaches; which one is most useful depends on the market opportunity and organizational strategy. What is of absolute importance, however, is that the organization pick the correct quality management system for its situation. Mixes of several approaches are also acceptable if the market-driven blueprint is there to follow-otherwise, a mixture is likely to produce mediocre results and confuse the culture. Figure 4 shows the approximate correlation between the different quality approaches and innovation nature.

There are ten values related to each of the two attributes of the culture that must be assessed in order to understand the innovation propensity of the culture:

Vitality Values

- **Self-Development:** Acceptance of the responsibility for one's own future. The members of the organization feel that it is their responsibility to begin a creative course of action or to act on their conscience for self-development without external prompting.

- **Communication:** Effective and efficient transmission and flow of ideas and factual data within and between persons, departments, divisions and other organizations. Selection of appropriate media for the message is implied.

- **Awareness:** Perception and understanding of what is transpiring in the world and how it directly or indirectly affects the organization's vision, mission, goals, strategies, plans and actions. The environment is made up of current and future perspectives of customers, competition, and technology within the context of social, political, economic, scientific, and demographic driving forces for change.

- **Multiple Skills:** A well-rounded, broad perspective with expert capabilities in several key skill areas. These areas must include life skills as well as organizational skills.

- **Teamwork:** Working effectively with and through others. Working cooperatively with one another such that the skills and qualities of one individual supplement, support and enhance the skills and qualities of others in the group.

- **Vision:** To perceive the purposes of an organization and communicate that purpose to its members in such a lucid manner that its members are able to transcend their own limited personal perspectives and abilities.

- **Leadership:** The capability to translate intention into reality. The personal organizational or conceptual influence to motivate others to accept responsibility for the process of change.

- **Creativity:** The capacity for original thought and expression that brings new ideas and images into an existing reality or brings forth a new reality.

- **Innovativeness:** Ability to apply creativity. Innovativeness requires an understanding of the organization, its interaction patterns, and most importantly, how ideas flow within the organization to become accepted.

- **Knowledge:** The accumulation, development and management of products of the mind. Examples include -- patents, copyrights, trade marks, trade secrets, know-how, books, reports and standards.

Quality Values

- **Achievement:** Accomplishment of a desirable result as defined by the organization.

- **Effectiveness:** The production of relevant results as defined by the market.

- **Appropriate Technology:** Selecting the best technology to fulfill an application while minimizing the adverse effects on the surrounding systems.

- **Service:** The motivation to make a contribution to society (customers, community, and world) through one's work.

- **Productivity:** Adding value by generating and completing tasks and activities that achieve externally established goals and expectations.

- **Efficiency:** Thinking about and designing acts and purposes in the best possible and least wasteful manner before implementing them.

■ **Control:** Providing restraint and direction according to prescribed rules in order to achieve methodological arrangements of persons or things.

■ **Pioneering Progress**: Originating and introducing creative ideas for positive change in social organizations and systems, and providing the framework for actualizing them.

■ **Community:** Sufficient depth of commitment to a group, its members and its purpose that both independent creativity and interdependent cooperation are maximized simultaneously.

■ **Self Actualization:** The inner drive toward experiencing and expressing the totality of one's being through spiritual, psychological, physical, and mental activities that enhances the development of one's maximum potential.

The values of the organization can be assessed by a team of people knowledgeable about the organization, or by a survey of a sample of the people in the organization with an instrument designed to test these values.

Once the values are determined, they must be related to the innovation class and nature. This is done qualitatively as indicated in the tables below.

Vitality Value	Incremental	Distinctive	Breakthrough
Self development	(white)	(light gray)	(dark gray)
Communications	(light gray)	(dark gray)	(dark gray)
Awareness	(white)	(light gray)	(dark gray)
Multiple skills	(white)	(light gray)	(dark gray)
Teamwork	(dark gray)	(light gray)	(white)
Vision	(white)	(white)	(dark gray)
Leadership	(white)	(dark gray)	(light gray)
Creativeness	(dark gray)	(light gray)	(white)
Innovativeness	(light gray)	(dark gray)	(white)
Knowledge	(white)	(dark gray)	(light gray)

● Table 1. Innovation Vitality Values

Quality Value	Product	Process	Procedure
Achievement	(dark gray)	(white)	(white)
Effectiveness	(dark gray)	(white)	(white)
Appropriate technology	(dark gray)	(light gray)	(white)
Service	(white)	(white)	(dark gray)
Productivity	(dark gray)	(white)	(light gray)
Efficiency	(dark gray)	(light gray)	(light gray)
Control	(dark gray)	(white)	(dark gray)
Pioneering progress	(white)	(dark gray)	(light gray)
Community	(white)	(white)	(dark gray)
Self actualization	(white)	(white)	(dark gray)

● Table 2. Innovation Quality Values

Note: Key - Dark gray = strong, Light gray = moderate correlation, White = some correlation.

Summary

The three innovation maps (for projects, resources, and culture) provide a summary of the innovation potential of the organization. The first thing to look for is consistency. If the three elements of the organization have the same innovation focus, then it is likely that the organization will be efficient. The more dissimilar the focus of innovation is for projects, resources, and culture, the more likely the organization is to be inefficient and hence working in the organization stressful.

The second thing to look for is centrality of focus. Does each innovation map have a clearly defined pattern? Or is it, on the one hand, devoid of any focus? or on the other hand, multi-focused? If there is no focal point for the organization, then there is no preferred outcome. Every series of actions in such an organization is just as likely to result in one innovation outcome as another. If there are two areas of focus within the same row or column, then the organization can become schizophrenic unless the areas are adjacent to one another on the innovation map. This can cause stress and conflict within the organization.

The third thing to look at is how similar the three innovation maps are to the innovation map of the strategy. If the innovation capacities of the projects, resources, and culture are focused on the strategy, the organization will be effective, assuming that the strategy is focused on the opportunity. Compare the strategy to the projects, resources, and culture. This is now the basis for an organizational development plan.

Developing an Organization Which Can Effectively and Efficiently Implement the Strategy

Organizational development is at once simple and complex. Volumes have been written about, degrees are granted in, and professional societies are focused on it. This article has the difficult task of converting some of this wealth of information into practical guidelines on developing your organization.

The simple side of organizational development can be summarized in a few sentences: If the key values of the marketplace are known, and these are developed within the organization, the organization will be effective. If the values inside the organization are consistently administered in every decision and program, the organization will be efficient. If the people in the organization naturally support those key values or have a belief structure which will allow them to adopt the values, morale will be high and the people will be motivated to achieve.

The complex side of organizational development is the actual implementation of the simple side. The implementation may take years and is very much a puzzle within a puzzle. Every action or non-action of management conveys values. Each decision, communication, and action must be weighed against its values content. Values become the ruler against which all organizational strategies, plans, and activities must be measured. And these values do not supplant existing good business practices and measurements. They do, in most cases, help simplify them, but they must overlay them. Values management becomes another dimension of management which every member of the management team must learn and practice. Values management is the real battleground of business. It is where the victories will be won over competition and where the challenges of delighting customers will be met. Values management is the key to successful business development.

Values Management

Values management is an important management tool. The organization must be able to assess the current and future opportunity in the market by determining and forecasting how the needs of customers, responses of competition, and capability of technologies interact with each other and the social, political, economic, technical, and demographic driving forces for change which affect the market. It is necessary not only to translate these into requirements which drive the strategy of the organization but also to transmit values to and through the strategy. The values transmitted by the strategy must then be made inherent in the organization's projects, resources, and culture (Figure 5).
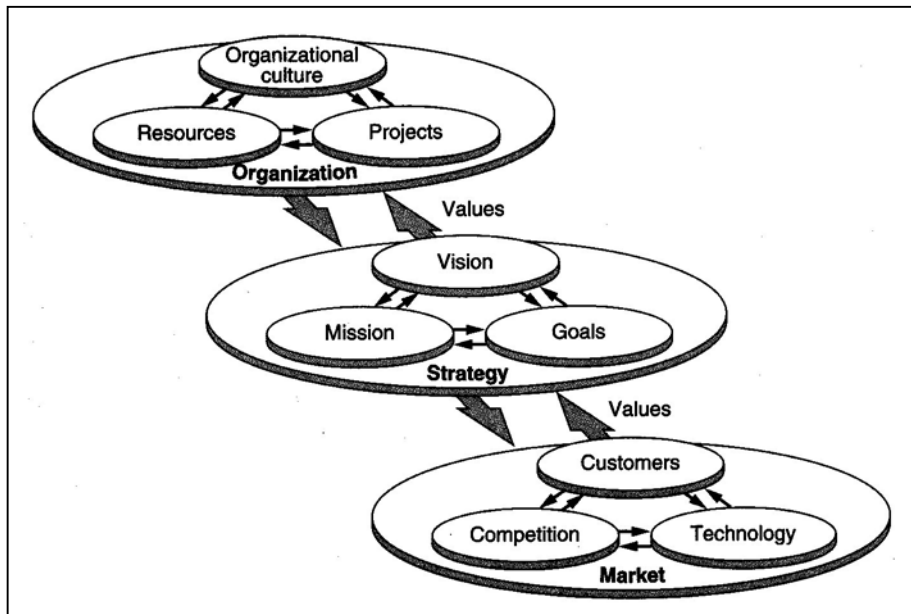
• Figure 5. Linking organizational culture to the market.
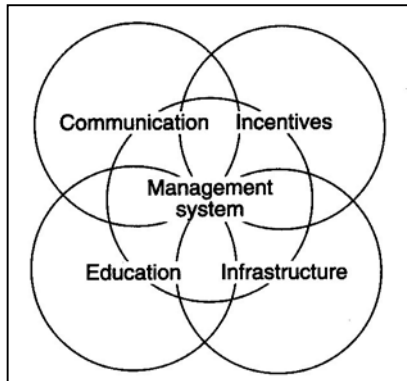
Creating an Innovative Organization

No matter what the focus of the innovation improvement program is, it must have certain characteristics to be successful:

■ It must support the vision, mission, goals, strategies, and plans of the organization.

■ It has to emphasize the correct type of innovation.

■ It must have a balanced and interdependent use of projects, resources, and culture.

■ It has to build on current programs.

■ It must be affordable.

■ It must employ the appropriate management style.

■ It must be capable of being implemented incrementally.

■ It must demonstrate early results but be strategically focused.

■ It must have built-in sharing of organizational experiences.

■ There must be long-term commitment to the program.

These characteristics must be matched up against the characteristics of the program developed. If there is not a match, the program must be changed to have all these characteristics.

Developing an Innovation Improvement Plan

Within the organization there are five fundamental areas to influence and encourage innovation. These are shown in Figure 6 as the areas for an action plan. The task you are faced with to implement changes in an organization is to use management systems, incentives, communication systems, infrastructure, and education programs to influence and develop projects, resources, and culture. The easiest to influence is projects; the most difficult is culture

While it is impossible to generalize, typically project changes can be effected in large organizations in one to two years, resource changes can take from two to five years, and cultural changes take over five years. This means that your strategic perspective must have at least a five-year horizon to effectively utilize the organizational culture you have developed. If you must change a large organization in less than five years, it is probably wise to consider other ways of developing an organization such as starting a new company, acquisition, or joint venture.

● Figure 6. Implementation elements.

The five areas, or elements, are interdependent and overlapping as shown in Figure 6. As you can see, it is the management system that holds it all together. The five areas were defined in earlier and will be discussed again below.

Incentives are programs, formal and informal, which recognize, reward, and encourage members of the organization to be innovative. Communication systems are both informal and formal ways to facilitate the free flow of information within the organization. They also exist to facilitate the interchange of information with the world outside the organization. Education programs are put in place to train and educate members of the organization. They exist to develop skills, ability; and knowledge in four areas, technical, personal, management, and integrative, as shown in Figure 18.

Integrative skills are generally overlooked by organizations. Quite often thought to be "soft," they are bypassed for the "harder" skills like learning how to design an integrated circuit. However, in today's environment, and especially when trying to encourage innovation, they are essential. They actually should be emphasized by the organization over technical skills, which individuals can be expected to develop on their own. Integrative skills fall into categories such as innovation, creativity, forecasting, professionalism, and leadership.
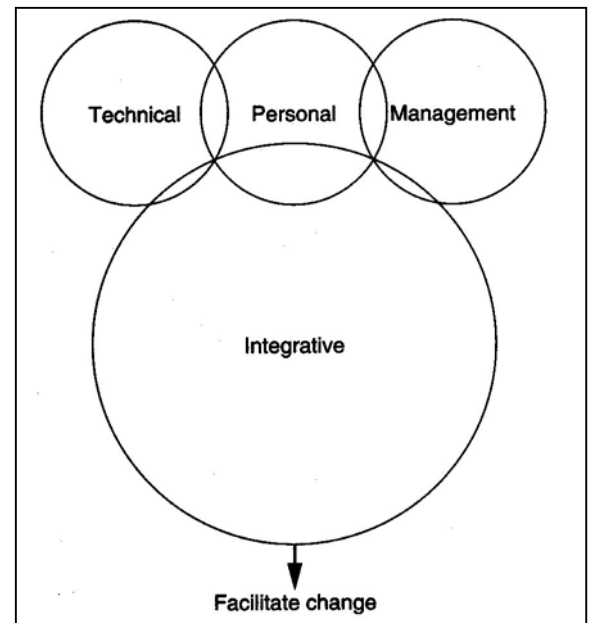
● Figure 7. Education programs.

Infrastructure refers to the formal structures that facilitate the operation of the organization. This covers business structures that organize activities and provide a hierarchy of control and responsibility. Some examples of business structures are listed in Table 3.

Management systems refers to the formal and informal programs that management uses to manage and monitor performance of the organization.

Business Structure	Purpose
Technical center	Advances state of the art in company/ industry
	Focus on materials and methods/tools of fabrications
	Upgrading /replacement materials/ practices
	Lower-cost manufacturing
	Improve performance
Research center	Basic & Applied research
New-products center	Enriches product line of existing business within a company
	Innovative features to existing products
	Utilize existing technologies
	Conform to existing product functions
	Exploit existing marketing channels
Captive R&D	Addresses needs of a single business entity in a company
	Single or few missions
	Can include: Basic research, Applied research, Improved product design and New business ventures (skunk works)
External teams	Service oriented
	Contract R&D
	Universities/consultants/companies
	Government-supported centers
Internal ventures center	Strategic business unit (SBU)Independent business unit (IBU)
	Incubator
	Skunk works
External ventures center	Product or business oriented
	Acquisition
	Establishment of minority position
	Joint venture
Licensing arrangements	Fill gap
	Shorten time to market
	Maintain technical dynamism of an industry

• Table 3. Examples of business structures relevant to innovation.

Working with these five elements of the organization, the innovation action plan is devised. It has three steps:

■ Make changes in projects. (Enhance those needed. De-emphasize those not needed. Create incentives, education, communications, infrastructure, and management systems which reinforce the project changes.)

■ Support project mix change with changes to resources by creating incentives, education, communications, infrastructure, and management systems which encourage appropriate resource development.

■ Ensure effectiveness of project mix change and resource change through changes in organizational culture. Again, this is implemented by incentives, education, communications, infrastructure, and management systems which encourage the development of the appropriate culture.

Action area	Projects	Resources	Organization culture
Incentives			
Communication			
Education			
Infrastructure			
Management system			

• Table 4. Organizational improvement plan.

Project Improvement Plan

The project improvement plan is developed in four steps:

1) Review the innovation gap for projects, i.e., the difference between the capability and strategy.

2) Identify the projects that are contributing to the gap.

3) Change the project mix to support the innovation strategy by building on the current mix.

4) Make necessary changes to the implementation elements to enable the altered project mix (Management systems, Communication Incentives, Infrastructure and Education).

Resource Improvement Plan

The resource improvement plan is developed in three steps:

- Review the innovation gap for resources needs.

- For types of innovation where change is needed, determine the reason for needed change and alter those elements of the resources which contribute to the needed change.

- Make the necessary changes to the implementation elements to enable the altered resources. (Management systems, Communication, Incentives, Infrastructure and Education)
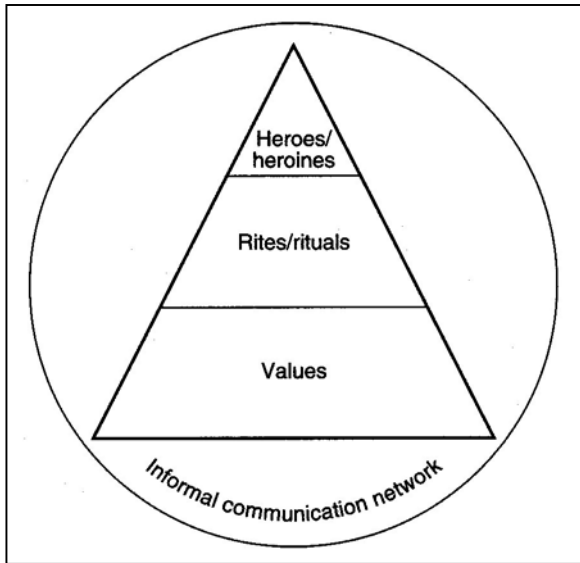
An example of a resource improvement plan is shown in Table 5. In this example, the resource categories which needed help were the people, facilities, and equipment. Improvement was needed in one type of innovation breakthrough process. In looking at the assessment of innovation capability of the organization, it was determined that the reasons for the innovation capability not matching the strategy had to do with education level, thinking style, and pilot lines. In this case the five areas were reviewed for potential programs that might help build the specific type of innovation required and fix the identified problems. The column labeled "Action" is the result of this process. Several programs are suggested which would help this organization improve its ability to produce breakthrough process innovations.

Innovation resource	Innovation gap	Reason	Action	Area
People	Breakthrough process	Education level	Patent process	Infrastructure
		Thinking style	Encourage participation in process-oriented professional societies	Communications
			Reward for process implementation	Incentives
			Increase education level	Education
			Teach integrative skills	Education
			Develop process measurements systems	Management
Facilities/equipment	Breakthrough process	Pilot lines	Set up internal venture	Infrastructure
			Establish computer conference	Communication
			Develop education program to support new pilot line	Education

- Table 5. Example of a resource improvement plan.

Organizational Culture Improvement Plan

As we have noted before, there are four basic elements of an organizational culture: values, heroes and heroines, rites and rituals, and an informal communication network." These are shown schematically in Figure 8.

The values of an organization are its bedrock; they are fundamental. They determine the characteristics of the culture and the people in it. They determine what will work and what won't. Values determine the priority of attention and action within the organization.

Rites and rituals are the way the values become institutionalized. They are embodied in the informal and formal methods by which work is accomplished. They span the range from the informal manner of greeting visitors to the formal planning process.

Heroes and heroines personify the values. Values are difficult to comprehend. People who make the values real by their actions become the heroes and heroines of the organization.

• Figure 8. Elements of organizational culture.

The informal communications network holds it all together with stories about the heroes and heroines.
It is the role of management to determine the value set that the organization must have for success. Then it is the manager's role to ensure that no inconsistent messages are sent into the organization through the identification of heroes and heroines, implementation of rites and rituals, and selection of stories that are passed around.

It is important to have a strong, simple, and consistent culture. It has been shown that organizations with strong cultures are much more likely to succeed than those with weak or unfocused cultures.

Organizational culture is also important to people in the organization for the following reasons:

■   People know how to behave.

■   People feel better about what they do.

■   Better decisions are made.

■   The culture directs innovative activities.

■   The culture can support needed project and resource changes.

The important characteristics of culture are:

■   There is no "absolute right" corporate culture.

■   Companies with a strong corporate culture are more likely to be successful.

■   There is a best organizational culture for the situation.

■   The organizational culture controls the amount and type of innovation in an organization.

- A balanced, strong organizational culture with mechanisms for culture change is essential in today's environment.

What are some of the elements of a culture which promotes innovation?

- It is not category conscious.

- It encourages the continuous creating of teams with new and different configurations.

- The culture encourages problem identification by its members.

- It has looseness of boundaries so that people can envision new and intriguing projects.

- It has virtually unrestricted communication for its projects and for the discussion of alternatives to anything it does.

- The people have a sense of unity and identification with the whole, with mutual respect, participatory teams, multiple ties across the organization, and off-job socializing.

- This type of culture is guided by the future.

- It has investment centered rewards rather than payoff-oriented rewards.

- Individuals and teams are not contradictory concepts.

- Job assignments are broad, ambiguous, nonroutine, change-directed, and overlapping.

- It generally has complex organizational relationships.

- Members of the organization have pride.

- There is a great deal of mobility for its people.

- Excitement is everywhere. The people are excited about what they are doing.

To develop a culture which promotes innovation it is necessary to:

- Encourage a culture of pride by highlighting achievements through visible rewards and by applying innovation from one area to another

- Enlarge access to power tools for innovative problem solving

- Improve lateral communication by bringing departments together, exchanging people, creating cross-functional links/overlaps and by team formation for tasks

- Reduce unnecessary layers of hierarchy by removing barriers to resource access and by lowering decision authority

- Increase information about company plans

- Take advantage of the capacity of people

The culture improvement plan is focused on values. There are six steps:

- Determine values needed to fill innovation gap.

- Determine current values.

- For each value that needs changing or for new values needed, develop a cultural change plan.

- Consider heroes/ heroines, rites/rituals, and cultural network.

- Establish culture that best meets type of innovation required.

- Develop through implementation elements. (Management system, Communications, Incentives, Infrastructure and Education)

Cultural elements			
Implementation elements	Heroes/ heroines	Rites/ rituals	Informal communication network
Management system			
Communication			
Incentives			
Infrastructure			
Education			

- Table 6. Cultural values development plan-defining the task.

Your task in developing a cultural change program is described in Table 6. You must identify for each value that needs improvement a series of actions in each of the three cultural elements in some or all of the implementation elements.

An example of a value development plan is shown in Table 7. As in the previous example involving resources, the values needed are those that will promote development of breakthrough processes. The figure indicates the type of action that could be taken in some of the areas to develop this type of value in the organization.

Innovation type	Organizational culture element	Actions to develop needed values	Implementation element
Breakthrough process	Heroes/heroines	Use person who has demonstrated breakthrough process capability as an internal consultant.	Infrastructure
		Establish internal professional society on process with leader who has demonstrated capability	Communications
		Set up special project for person who demonstrates capability and give freedom to pursue interests	Incentive
Breakthrough process	Rites/rituals	Junior members process of staff serve an apprenticeship with hero or heroine.	Infrastructure
		Set up weekly seminar.	Education
		Establish special award ceremony.	Incentive
		Establish periodic review meeting.	Communications
Breakthrough process	Informal communication network	As successes occur, build on and pass stories into organization.	Communications

- Table 7. Example of a cultural values development plan.

You have now completed the market-driven innovation process. You started by determining the innovation opportunity in the marketplace. Then you developed vision, mission, and goals which not only met the needs of the marketplace but also met the needs of business and the people in the organization. This helped you to develop an innovation strategy to take advantage of the opportunity. Then you assessed the innovation capability of the organization, compared it with the strategy, and created an innovation improvement plan to help your organization effectively implement your innovation strategy.
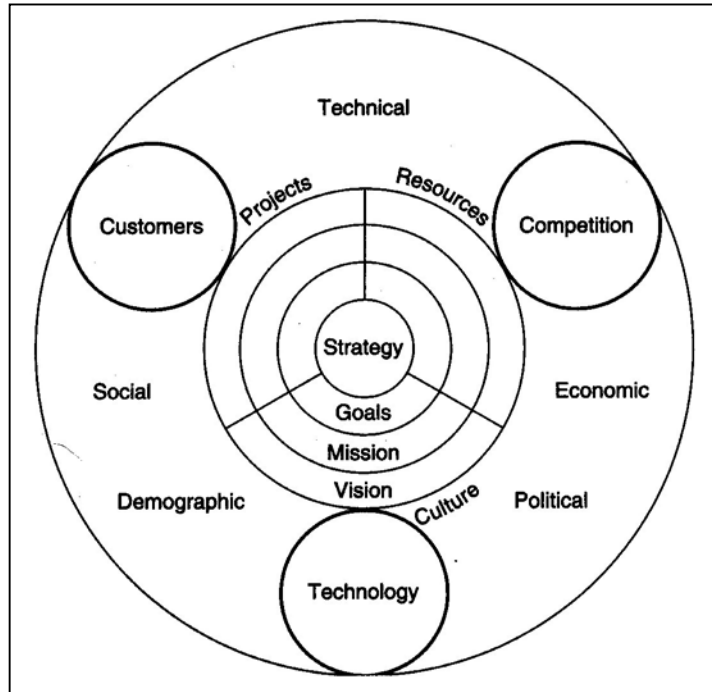
This has been described as a linear process for simplicity, but only rarely does it stay a linear process. In the real world there are loops, feedback, and diversions. It is important, however, to keep the structure in mind and to keep returning to it. This process will serve you well at solving complex problems you face if you use it to organize your thinking and actions. A different, more integrated, view of the concepts is shown in Figure 9.

- Figure 9. Market-driven innovation-an integrative view.

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Appendix

Quality Concepts

To understand the fundamentals of quality it is instructive to look at the roots of the word quality. Like many of the words in the English language, it has its origins in the Indo-European language. It began as kuo which was the interrogative. This became quo in Latin, also the interrogative: Why? Where? What? When? How? These are all questions of the quality interrogative. Why do it? What are the consequences? What is the output? Where, when, and how are the processes performed? Who are the people?

Quality, then, is the essence of something. Quality is what distinguishes that thing from something else. It is what yields competitive advantage. Therefore, any good quality program must answer all these questions and include elements of each of the four major quality categories. But these elements must be put together in a manner that produces a strong culture sharply focused on the market.

The organization must somehow present itself to the market like the artisan or craftsperson mentioned earlier. It must reflect back to the markets it serves the values of the current and future customers within those markets, and have the right products and the right resources to produce things they want. This is the key to a good TQM process.

Quality is an important ingredient in today's global marketplace. Customers expect it, competitors provide it, and technology enables it. Yet so-called "total-quality" programs have had varying degrees of success; they have ranged from being outstanding drivers of total organizational change to being total failures. Reasons for the failures abound but generally can be traced to the use of the wrong quality philosophy for the market, attempts to mix and match from other companies and industries, attempts to do too much too fast, or poor implementation. Of particular concern is the continuing problem of attempting to force what has been learned about quality to date, primarily in manufacturing, into other areas of the organization.

The definition of quality is elusive. It varies between customers in different cultures and between individuals within a culture. What is quality in one application is not quality in another. What constitutes quality in personal transportation is vastly different for an Amish farmer in Pennsylvania, a successful businesswoman in Los Angeles, and a teenage girl in Austin. The customer's definition of quality is contextual, i.e., it depends on the circumstances of the person and the application of the product or service being considered. What a customer considers quality depends upon what he or she values.

If you, as an individual, seek out an artisan or craftsperson to produce something for you, given an accessible, open market, you will seek out someone who has the same values as yours with respect to what is being produced, and has the skills and resources to produce it. In this way, what will be produced will have a higher probability of matching your definition of quality.

We have long since left the age in which artisans or craftspeople produce any significant portion of the goods and services consumed. Organizations have proven to be much more efficient at producing the goods and services needed by mass markets. Where organizations are failing is in effectiveness, i.e., ability to match the values of the customers they would like to serve.

Quality inside organizations has a different "feel" to it. Organizations tend to want to make quality absolute and dictate inside the organization how quality should be created and managed. This creates a conflict between the changing, ethereal nature of quality in the market and the rigid dogmatism of organizations.

Even inside organizations, the concept of quality has changed over time. While it is difficult to pin down specific dates and people influential in the dynamic development of the concept of quality, it is possible, and instructive, to examine some of the key milestones. Table A-1 indicates some of the key milestones in development of quality concepts in organizations. It is important to note that the definition of quality attributed to each individual is only the

essence of this person's concept. Each proposes multiple elements of a plan for success, as shown for three of these theorists, Deming, Juran and Crosby in Tables A-2, A-3, and A-4, respectively.

Year	Author	Concept
1924	Jones	Quality control-statistical inspection of outgoing goods
1950	Deming	A process which results in satisfied customers
1951	Juran	Fitness for use
1976	Ishikawa	Reduced variance in characteristics
1979	Crosby	Conformance to requirements
1986	Taguchi	Minimal loss to society
1989	Shuster	Relentless individual pursuit of continuous quality improvement

- Table A-1. Evolution of quality concepts.

1. Create constancy of purpose toward improvement of product and service.
2. Adopt a new philosophy. We can no longer live with commonly accepted levels of delays, mistakes, defective materials, and defective workmanship.
3. Cease dependence on mass inspection. Require, instead, statistical evidence that quality is built in.
4. End the practice of awarding business on the basis of a price tag.
5. Find problems. It is management's job to continually work on the system.
6. Institute modern methods of training on the job.
7. Institute modern methods of supervision of production workers. The responsibility of foremen must be changed from numbers to quality.
8. Drive out fear, so that everyone may work for the company.
9. Break down barriers between departments.
10. Eliminate numerical goals, posters, and slogans asking for new levels of productivity without providing methods.
11. Eliminate work standards that prescribed numerical quotas.
12. Remove barriers that stand between the hourly worker and the right of pride of workmanship.
13. Institute a vigorous program of education and retraining.
14. Create a structure in top management that will push every day on the above 13 points.

- Table A-2. Deming.

1. Build awareness of the need and opportunity for improvement.
2. Set goals for improvement.
3. Organize to reach the goals (establish a quality council, identify problems, select projects, appoint teams, designate facilitators).
4. Provide training.
5. Carry out projects to solve problems.
6. Report progress.
7. Give recognition.
8. Communicate results.
9. Keep score.
10. Maintain momentum by making annual improvement part of the regular systems and processes of the company.

- Table A-3. Juran.

In the United States, the concept of quality was originated in 1924 at Western Electric, then the manufacturing arm of AT&T. The key was to produce quality telephone handsets. They accomplished this through quality control, the statistical inspection of outgoing goods. Since production volumes were so large, they couldn't inspect each telephone, so they relied on sampling procedures. This sufficed until 1950 when Deming, summarized by Dixon and Swiler (1990) went a step back into the business and defined quality as a process that will result in a satisfied customer. This is a tremendously powerful concept because it could significantly improve the efficiency of the operation, reduce loss of finished goods, and be proactive rather than reactive.

In 1951, Juran pointed out that it didn't matter how defect-free a product was -that if it wasn't fit for use, it wasn't quality. This is discussed in his book Juran on Planning for Quality (1988). A quality buggy whip is no replacement for high-octane gasoline.

Ishikawa (1985)6 introduced in 1976 some additional concepts of the dispersion of the quality characteristics, pointing out that higher quality would be perceived by the customer if there were less variance in the characteristics. Crosby (1979) introduced the concept of quality as being conformance to requirements. All of us have customers, internal to our organizations and external. If each person in the chain required to fulfill an external customer's need conforms to their customer's requirements, a quality product or service will result. These concepts, combined with the previous work of Jones and Deming, resulted in concepts such as the Six Sigma Program described by Rifkin (1991).

1. Make it clear that management is committed to quality.
2. Form quality improvement teams with representatives from each department.
3. Determine where current and potential quality problems lie.
4. Evaluate the cost of quality and explain its use as a management tool.
5. Raise the quality awareness and personal concern of all employees.
6. Take actions to correct problems identified through previous steps.
7. Establish an ad hoc committee for the zero-defects program.
8. Train supervisors to actively carry out their part of the quality improvement program.
9. Hold a "Zero Defects Day" to let all employees realize there has been a change.
10. Encourage individuals to establish improvement goals for themselves and their groups.
11. Encourage employees to communicate to management the obstacles they face in attaining their improvement goals.
12. Recognize and appreciate those who participate.
13. Establish a quality council to communicate on a regular basis.
14. Do it all over again to emphasize that the quality improvement program never ends.

- Table A-4. Crosby.

With the advent of environmental concerns and other issues that roused social consciousness, Taguchi (1986) introduced the concept of loss to society. For every customer need that is filled, there may be some unintended detrimental impact to the rest of society as a result of the method used to satisfy that need. By Taguchi's definition, a high quality product or service is one that minimizes negative impacts on the rest of society.

In recent years, total-quality management (TQM) programs have evolved. The theory behind these includes the concept, as described by Shuster (1990) of quality as the relentless individual pursuit of continuous performance improvements.
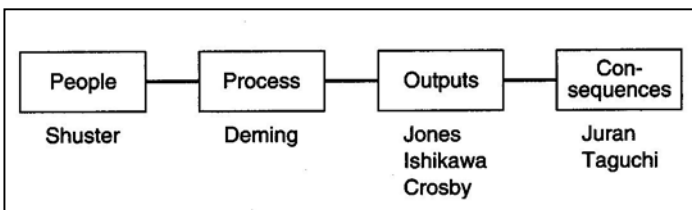

Figure A-1. Reordered approach to quality.

The various concepts of quality we have been discussing can be organized under four categories as shown in Figure A-1:

- People

- Processes

- Outputs

- Consequences

There is a relationship between the four categories: People working together using processes produce outputs which result in consequences to the end user, the producing organization, and society.
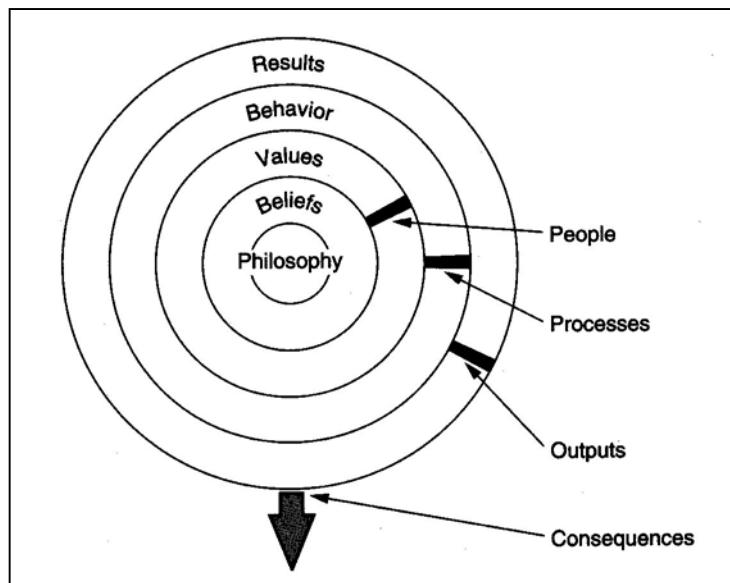
Culture

From an anthropological point of view, organizations are cultures. And it is this culture that dictates how effectively organizations produce results. A strong, highly focused culture will result in a very efficient organization. If the focal point of the culture is the market, the organization will be effective. If not, it will produce quality buggy whips instead of high-octane gas.

Cultures are composed of five elements:

- Philosophy

- Beliefs

- Values

- Behavior

- Results

The five are related to each other as shown in Figure A-2.

• Figure A-2. Organizational culture.

At the core of any culture is its philosophy. The philosophy is a statement of its rules for success, the formula that has been worked out through years of experience in determining "what works." Beliefs are statements of what the organization believes to be true. Values are based on the beliefs and determine what receives attention; values determine priorities and establish the basis for the behavior of individuals within the organization. Behavior patterns in organizations determine results.

The five elements of culture can be related to the quality concepts as shown in Figure A-2. The people hold the philosophy, beliefs, and values. Processes are the way people behave with respect to each other and the things they produce. The results of the culture are the outputs, which produce consequences. Thus it

is no accident that the pioneers of quality have been, in a piecemeal fashion, mapping out the territory of organizational culture. The choice of which quality concepts to follow has in part been dictated by the time frame in which the organization has operated but also in part by fad. Different philosophies of quality have swept through industry in waves. Some good, even outstanding, results have been obtained when the application of the philosophical approach happily matches the environment in which the organization operates. Lately, it has been fashionable to construct TQM programs in pursuit of a standard or award of some kind or other. In TQM programs, elements in all or many of the quality philosophies have been fitted together. In some cases, companies use benchmarking techniques to determine "best practices" and then cobble all these best practices together.

Suppose you wanted to bake the best possible cake in the world, and you set out to do this by visiting all the famous bakery chefs of the world to determine their most important ingredient. You then proceeded to bake a cake made up of all the critical ingredients of all the master bakery chefs. What would you get? You would get what many quality programs fashioned in this way get, mediocre results that have few if any significant consequences. This blandness pervades the products and services of many organizations. The application of a mix and match strategy for quality results in a diffuse culture that can only produce incremental innovations and is confused about the future needs of the market.

Caution. To appropriately develop a TQM program, the focus of the culture must be sharp and on the market.

Applying Quality Concepts to R&D

It is thought that research and development (R&D) could benefit from a total-quality approach, but R&D organizations have had only limited success with it. What worked in manufacturing doesn't seem to work in R&D, and R&D professionals resist its implementation. The application of total-quality concepts to R&D is an example of how the concepts can be applied to organizational development.

The practical application of quality concepts to productive endeavors started in manufacturing and has been refined there. Since manufacturing accounts for 30 to 60 percent of the total cost of the product and delivers the product to the customer through a distribution system, this was appropriate. It is also proper that the focus of the quality programs was on efficiency; there is tremendous leverage in reducing costs and defects in the manufacturing process. It is not appropriate to apply these same quality concepts to R&D, where the financial leverage is different. R&D costs are 5 to 10 percent of the total product costs. Reducing these costs through efficiency, while it may drop through to the bottom line immediately, has little if any positive long term impact, and has the potential for disastrous negative future impacts. The focus of quality in R&D should be on effectiveness. The leverage here is 10s to 100s of times the R&D costs. A product that matches the requirements and mirrors the values of the customers can produce revenues that dwarf the gains of quality programs in manufacturing. Companies that learn how to apply quality concepts properly in R&D will thus sustain significant competitive advantage.

Implications for R&D Organizations

Quality in R&D should therefore be defined in terms of how well the R&D team has anticipated customer requirements and delivered innovation which delights customers. The research scientist or development engineer must consider more than technology to produce innovation. He or she must be able to see technology as one of three elements of the market their organization operates within, the other two being customers and competition. In addition, this view must go beyond customers, competition, and technology to the environment in which the market operates, the social, political, economic, technical, and demographic driving forces for change that affect how the market is going to evolve over time. To increase effectiveness, the R&D professional must be able to understand these market dynamics and forecast customer needs, technological capabilities, and competitive response. It is only then, because of the length of time that it takes to do technology development and product commercialization, that the professional can produce products that the customer needs. Timing is everything.

As we have stated earlier, R&D must become more effective before focusing on efficiency. Once it does focus on efficiency, the biggest leverage it has will come from the concept of technology management. By focusing its energies on a few key strategic technologies, it can become efficient. However, it also must have strategic alliances to be able to meet all needs. Strategic planning of technology and alliances thus becomes a very powerful tool to improve the organization's efficiency.

Utilizing outside sources of technology can be a problem as well. The organization must have effective means of technology transfer. Technology transfer has two major components. The first is communication of the technology, and the second is acceptance of the technology. The first is mechanical, and the second is cultural. To ensure effective and efficient transfer of technology, it is advisable to match the values in the R&D organization to those of the strategic partners.

Technology road maps or some equivalent form of technology management are essential in R&D. It is important to consider three different types of technology: direct, supportive, and enabling. Each of these must be forecasted, and the forecast must not be done in a vacuum but within the context of the market-customers, competitors, and the environmental forces for change. Embedded within this forecasting process is a part of a competitive analysis. The organization must then assess its technological capability against the completed forecast. As noted above, selection of key technologies and the management of strategic alliances to provide other capabilities are essential.

Time and cost of innovation commercialization are only two of the factors important to success. The focus of the innovation effort is also vital. And, the focus of the innovation effort is also different from that in a manufacturing operation.

A focus on not making mistakes is not appropriate in R&D. We know from human nature that we learn by making mistakes. The key to an effective R&D organization is not to reduce mistakes but to minimize the time required to learn from the mistakes and correct the course of action. This can only occur if R&D is linked to the market and the rest of the organization. This can best be accomplished if all are part of a team effort to help make the customer's customer more effective. In many cases, it will be wise also to involve competitors in this "team" through various mechanisms. Collaborative competition involves choosing to collaborate on some elements while reserving others as the basis of competition. Benchmarking is one form this can take. Consortia are another. Technology assessment is another way of determining if you are on track by forecasting technical advance and assessing your organization's position relative to the forecasted advancement.

To focus its innovation efforts, an R&D organization needs a vision, mission, and goals. The vision, mission, and goals are established to take advantage of the future opportunity in the market (customers, competition, and technology), meet the needs of the organization's stakeholders, and fulfill the desires of the members of the organization. A good vision links these three pieces together effectively. The current capabilities-the projects, resources, and culture of the organization-must then be assessed. The difference between the current capabilities and the future desired state must be closed through innovation. R&D must innovate in products, processes, and procedures, and with the degree of innovation (breakthrough, distinctive, or incremental) required to close the gap. This gap defines what the R&D program must be. The R&D strategy maps the route that the organization intends to take from the current state to the future desired state.
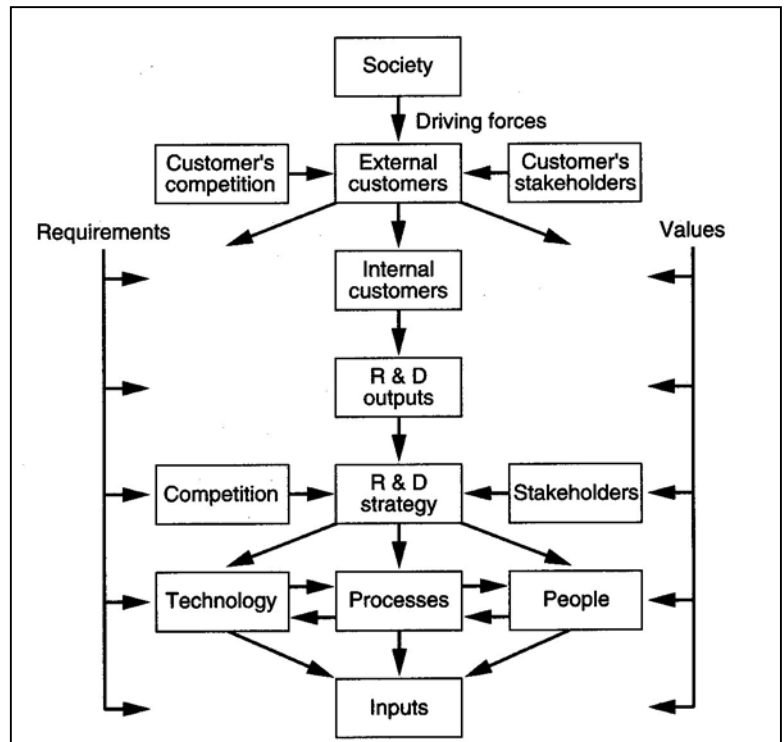

Figure A-3. Market-driven requirements and values processes.

Establishing a Market-Driven Quality Measurement System

To establish a market-driven quality system in R&D with the appropriate measurements, the consequences must drive the entire process and establish requirements for the outputs, which in turn establish the needs for the R&D lab's processes and people. This in turn places requirements on the input to the entire process (Figure A-3).

This has significant implications for the lab and the way it views itself. The entire process from input to consequences takes time, and therefore the lab must develop the ability to forecast the future needed consequences for society, external customers, and internal customers. This implies that the R&D lab must be able to understand the driving forces for change in society and how these forces affect the organization's customers. Social, political, economic, demographic, and technical driving forces for change can be identified and provide a multiyear perspective on the evolution of the market the organization serves.

Attempts to shorten the time between input and consequences can be valuable because they reduce the need for long-term forecasting which can be difficult. Reduction of the cycle time can also reduce costs. However, an excess emphasis on reducing the cycle time guarantees that only incremental innovations will result. Depending on the market, this may be acceptable. However, in today's environment there are many markets -where distinctive, and even breakthrough, innovations are required to delight customers, internal and external, and sustain competitive advantage.

The measurements that an R&D organization chooses to use to evaluate itself must be driven by the market. Figure A-4 indicates that two sets of conditions must be applied to all measurements. The future requirements of the organization's customers must be forecasted by the organization far enough into the future to allow the R&D organization to produce the innovations in the form of outputs to its internal customers so that it can satisfy customer needs. In order to develop the organization's culture, however, the values embedded in the requirements must also be transmitted, in addition to the traditional requirements of function, form, and cost, throughout the entire process. Each measurement must then be carefully analyzed to determine whether it is encouraging the development of the right requirements and the right values.
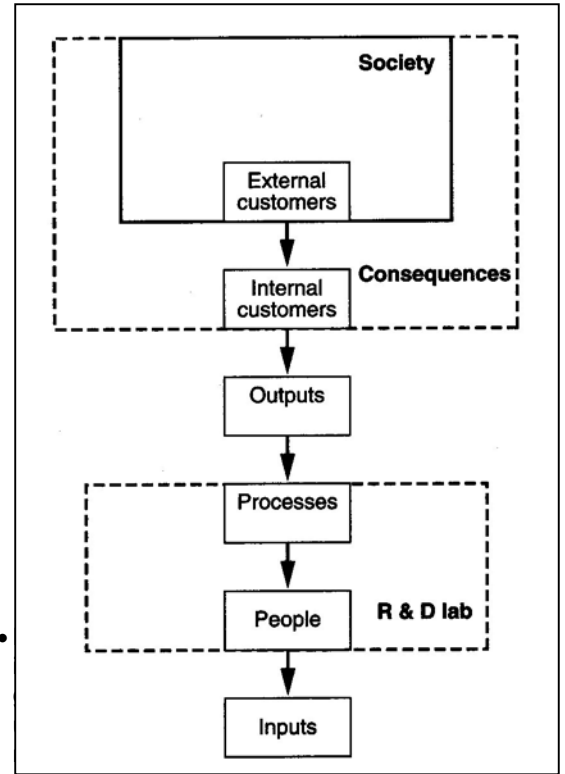
A-4. Market-driven measurement system

Developing a Technically Vital Organization

An organization is vital when it focuses on a few key values which are highly developed; has values which are appropriate to the market and surrounding environment; has consistency of values throughout its projects, resources, and culture; and has values which encourage change and growth. To be vital means to be alive, growing and adapting to the environment.

The term technical vitality connotes a special application of this concept of vitality to the technical professionals in an organization. The first application of the concepts took place at IBM's Austin, Texas, site. It was an eight-year (1982 - 1990) program to change the organizational culture of the site to enable the site to cope with and later lead the company in the application of new technology. The site began as a second-source manufacturer of typewriters and is now the lead laboratory for RISC (reduced instruction set computer) workstations and personal computer (PC) operating systems. Following is an account of this development.

Objectives

The requirements for the technical vitality plan and its objectives came from the following 1980 studies:

- A review of several years of opinion survey data and all write-in comments

- A review of several years of "Speak-ups"

- Interviews with key technical professionals and managers

- Review of corporate technical professional development (TPD) programs and discussions with TPD corporate staff (including site visits with the director of TPD programs)

- Division executive program review

- Senior site management advice and review

- Support function discussions

- A literature review

- Personal experience as a technical professional and as a manager of technical professionals

Analysis and synthesis of these data resulted .in the statement of a set of objectives which remained the same throughout the program:

- Improve image

- Improve communication

- Improve innovation

- Optimize personnel development and education

- Ensure recognition

Image. First, the technical professional's self-image had to be improved. The technical professional population had, for years, lacked an identity and a strong self-image. This was the result of the organizational culture as it had

evolved from its roots, management restrictions on technical professional growth and development, numerous changes to the products and missions, and the lack of an identifiable site wide shared vision of purpose.

Second, the site's image, as a technical leader in the company, had to be improved. In order to have a broad technology base to fuel technical vitality, the site, in competing for mission, needed to be recognized as having the technical capability to carry out a complex mission. Third, the site, and therefore the company, had almost no presence as a technical leader in the technical world outside the company in the field in which the site specialized. The site published very little in the technical press.

Communication. First, technical communication systems had to be built and technical communications improved within the site. Then technical communication with the rest of the company had to be improved. The site also had to engage in the free flow of nonproprietary technical and business information in the world outside the company. The site had to build on the development work of others within the site, within the company, and outside the company to reduce costs, avoid false starts, reduce failures, shorten development time, and become a technology leader.

Personnel Development and Education. Personnel development and education had to be optimized because the site was in a period of rapid, revolutionary change. This fueled an increasing need for education to meet the needs of change and to cause change. Projections
showed that the site would not be able to offer all the education that would be required, and methods were developed to improve the effectiveness and productivity of internal education. The largest single factor in potential gains in this area was the technical professional, who had to learn to take responsibility for his or her own development. Teaching technical professionals how to be professional and how to learn was the single most effective thing that could be done. Then, the teaching of process, rather than hard skill, was key to the future of the company.

Recognition. The site had to ensure recognition so that technical professionals who did what was needed became heroes and heroines. Others would then emulate them and those who made contributions would continue to do so.

Innovation. It was clear that creativity was key to the future of the site. Innovation is the commercialization of creativity, and in times of rapid change it is strategically and tactically important. History has shown that companies that establish an innovation-based competitive advantage stay ahead longer. During periods of rapid, revolutionary change, a constant commitment to change is essential. More than a year's worth of study of the barriers to innovation at the Austin site showed the following.

First, pervasive throughout all the studies, there was a very strong desire among the technical professionals to be innovative. They wanted to make change and that was contrary to normal ways of thinking at IBM. Most management, at least most old-line management, believed that people like stability, but that was not what they were saying: they wanted change and they wanted to participate in the change. (People don't want to be changed; they want some involvement in the change; there is a significant difference.)

Second, senior management throughout the corporation said repeatedly that they were interested in innovation. That interest was not being transferred down into the organization clearly. The organization didn't have guidelines on innovation, and the people were not really convinced that the company was serious about innovation.

In those cases where management became involved in innovation, that innovation process moved quite a bit faster. What was needed was to convince people that management really was supportive of innovation. What people needed in order to make changes was a sense of security, a sense that it was okay to make change. The only way they could get that was from their management, who needed to reassure them that they really were interested in the change.

Third, the management system that was in place was viewed as a constraint, rather than a support, to innovation. That probably does not come as a surprise to anyone. It is a very difficult, political process to gain acceptance of an idea, and that is not meant negatively. What is meant is that an innovator searches continuously for some coalition of support that will enable him or her to carry the innovation forward.

In general, middle-level management was viewed as unsupportive of innovation programs. Almost universally, the suggestion that came forward was: "Take management out of the innovation process. Provide some sort of bypass to get them out of the way, out of the decision-making process." That was inappropriate; rather, people needed to be

convinced that management ought to be in the process and that management ought to support innovation, not find ways to get around it.

Fourth, the formal channels of communication did not significantly impact innovation. There was very weak interorganizational communication-on site, from this site to other company sites, and from the company to outside the company. What everyone says who studies innovation is that free and open communication is the only way that innovations can move ahead more rapidly. It is necessary to get a broad base of information, to get the synergism going that will result in successful innovation. Most people get information from their friends. This is okay, but limits the scope of knowledge that one can have. There are many significant disadvantages to working in a large corporation, but one of the significant advantages is technological sharing; one can build a lot of work on the technological base that exists in the corporation. However, the only way to get at that information is through some of the formal communication mechanisms. People at the site said that two things were inhibiting communication. One was parochialism: people would try to guard information because information is power in an organization as complex as this one. The other was security: people felt that the company's emphasis on security was a detriment to the free flow of technical information.

Fifth, traditional management methods were not necessarily ideal for managing innovation. The company had a very strong emphasis on short-term cost savings. That is not a good way to measure innovation in its early stages. Many times, you cannot determine a return on investment for an innovative idea at its very early stages. You just don't know enough about it. Other tools are needed to help make a decision. This implies that the personality of the innovator becomes more important than the idea because the business cases are not solid. A person who is convincing, who has a strong and dominant personality-or one who has a proven track record-has a greater probability of having his or her ideas accepted and implemented than somebody who has none of those things. Of course, the people who usually have none of these things are the newer people in the organization. So the site was losing ideas from a lot of their young people because they were not allowing them access to the power tools of change. In these studies, we found an example of someone trying to start an innovation who did not have the credentials. He recognized the problem, found somebody who had that kind of experience, brought them into the innovation team, and used that person to help them make the change. The organization needed to employ ways of evaluating ideas other than financially.

Number six was inadequate infrastructure, and we heard many loud complaints about the lack of this support function. There really was none in place to help innovators at the site, and so a lot of suggestions were offered in this particular area. Again, people did not know how to get started. When they did get started, there was nobody there to help, to guide, and to provide the assistance necessary whenever a new idea is started. A new idea is like an infant: it is very susceptible to damage. In its formative stages, you need to have the kind of support system that can help it, enable it to grow a little bit, and then let it stand on its own.

An overarching conclusion was that the environment for innovation in the organization needed to be strengthened. The site needed to create, an organizational structure which was innovative. In order to do that a clear vision was required, one that people as well as management shared, one that set direction. The word vision implies the power of imagination coupled with unusual foresight. That is the kind of vision that was needed to motivate people and to provide the background and the culture necessary for innovation.

The five program objectives could be met and the process of cultural change facilitated by a focus on four key values:

- Focused creativity

- Purposeful innovation

- Effective peer communication

- Development of intellectual property

Technical Vitality Development Plan

The plan was established in two sections: (1) promotion of corporate programs and (2) development of specific site programs necessary because of the site's unique problems.

The strategy for the development of an Austin Technical Vitality Cultural Change Program was:

- Plan an early, highly visible project.

- Assure an early success.

- Stage the program with quality evident in each new endeavor.

- Develop a phased approach to hierarchy: senior management, technical professional, middle management.

- Treat it as a cultural transformation (five to seven years), have long-

- term personal commitment, and be persistent and patient.

- Publicize throughout the corporation.

- Solicit voluntary participation from technical professionals.

- Don't add any bureaucracy.

- Keep program ownership in the hands of line management.

- Involve support groups.

- Utilize consultants.

The phased approach to the management hierarchy was considered because of indications as to where the maximum resistance lay. Senior management was clearly supportive of the program, and technical professionals wanted to be involved. The middle management caught between the demands of the business, the often conflicting desires of senior management, and the constant pressure from the technical professional-was the most reluctant to make changes.

It was clear that this program had to be treated as a cultural transformation. This required patience, with a long-term commitment to change. The elements of a corporate culture-rites and rituals, heroes and heroines, cultural network, and values-were considered in each of the elements of the program.

It was important to publicize such activity throughout the corporation in order to gain support for change. Even if there was no direct line of management control, peer pressure through acceptance and success at other sites was vital to this type of change.

Utilization of support groups and consultants was necessary because of the magnitude of the task and the low level of resources available to the project. This provided an effective lever.

The program to support the corporate plan had three aims:

- Increase awareness of programs.

- Educate in how to use them.

- Establish simple, non-bureaucratic methods for their use.

The corporate programs promoted for utilization at the site were chosen because they supported the four key values. They included:

- Continuing education, such as graduate work study, resident study, special study

- Establishment of corporate technical publications

- Sabbaticals

- Technical documentation, for example, technical memos, technical reports, external publications/ presentations

- Interdivisional technical liaison (ITL) group: membership, leadership, host meetings (internal professional societies focused on corporate technical needs)

- Corporate technical information center: Current Information Systems (CIS), on-line (computer-based library and publication access)

- Patents and awards

- Technical professional societies: membership, meetings

- Advanced technical positions (high-level technical positions to allow technical professionals to be promoted to non-management roles)

Utilizing the growing knowledge of the site's specific requirements, a series of special programs which emphasized the four key values were initiated to fill the gaps left by the corporate program:

1. Management emphasis booklet. This was a report issued by the lab director enumerating the principles of management he wished line managers to follow. It had a heavy technical vitality emphasis.

2. Austin Technical Symposium. The first program was the Austin Technical Symposium, held in the fall of 1981 with a low budget and mainly volunteer workers. This vehicle was chosen because it had a high probability of success, a high profile, a high level of employee involvement, and a high leverage. The theme was "Creativity-Key to the Future." After the success of the first program, this was institutionalized for every two years. The second symposium had the theme "Creativity-A Key to Productivity." The Austin Technical Symposium was, at its heart, an internal technical professional society meeting. At its core was delivery of 100 to 120 technical presentations on a variety of topics important to the site. The presentations were made by Austin technical professionals and by technical professionals from throughout the global IBM technical community. Executive presentations and consultant talks acted as the focus for the general sessions. Special education programs were provided before and after the symposium. Attendance at the symposium was limited to about 400 people, 300 from Austin, because of facilities. Displays of products, technology, and technical vitality programs were open to the entire site. Held on site, it was a high-profile cultural extravaganza that embodied all the values the technical professional culture required.

3. Monthly seminar series. This was a series of consultant and academic speakers that covered a wide variety of topics. The purpose was to bring people into contact with ideas that they might not come in contact with during their normal work. These sessions typically lasted three hours and were attended by an average of 100 people.

4. Technical magazine. The technical magazine, Creativity, was developed to establish a communications link to and between technical professional employees. It matured over the years and was widely accepted for its usefulness, content, and readability. It was the precursor of other site newsletters. It was used to affect values, communicate programs, recognize contributions, and educate. It was received by over 50,000 people in other sites and divisions by the end of the program.

5. Technical library enhancements. The technical library was completely revamped, both staff and facilities. The goal was to change it into the type of library necessary during periods of rapid change and to increase its effectiveness.

6. Special events. Two special events were developed: the inventor's dinner and the technical author luncheon. The inventor's dinner, a guest event, was held off site each year to recognize those employees who had contributed to the development of the company's intellectual property. It rapidly became the premier technical recognition event of the site. It helped, among other things, to make the site the per capita leader in inventors among the product sites. The event grew to over 400 invitees and 800 attendees. The author recognition luncheon, also held each year, recognized all the employees who contributed to the technical documentation program of the company.

7. Special education programs. A series of education programs to develop integrative skills for technical professionals was started. Integrative skills were important to the future of the site. The segmentalist approach, necessary for the past environment, is ineffective and will become even more ineffective in the future. The trend had to be reversed and more integrative approaches utilized. Integrative approaches could lead to major cost savings and significant innovations. In addition, the productivity of the technical professional would be markedly improved if his or her perspective were broadened.

Integrative skill development encourages the technical professional in self-development and mastering change. Creativity, innovation, forecasting, professionalism, and leadership are categories of integrative skills. Integrative skills blend technical skills, personal skills, and management skills to facilitate and lead change.

Curriculum Development. Sixty-six courses and seminars were developed to promote integrative skills. Examples are:

Innovation

- Innovation by Design

- Entrepreneurship Workshop

- Selling Your Innovative Concepts

- Proposing Innovative Concepts

- Gaining Acceptance in Pursuit of Rejection

- Innovation: The Sleeper Awakes

- Creativity

- Creative Productivity Workshop

- Creativity Workshop

- Breaking Out of Your Mental Bondage

- Relax Your Way to Improved Creativity

- Creativity Workshop for Managers

Forecasting

- Technology Forecasting Workshop

- The Age of Innovation

- The Strategic Context for Decisions

Leadership

- Managing Change

- Mastering Change

- Change: Opportunity or Challenge?

- Forefronts of Technology

Professionalism

- Managing Technical Vitality

- Staying Alive: Technical Professional Programs for Growth

- Management of Professionals

- Revitalizing Technical Professionals

- Creating a Professional Development Environment

General

- Technical Seminar Series

Program Results

The results of the eight-year-long cultural change program were tracked through a series of surrogate measurements, comparison of performance among sites in the corporation, and subjective evaluations of the site's capability.

Technical reports, i.e., internal formally documented and distributed articles on technical advances, increased over four times. External presentations at professional society meetings and external publications in professional journals increased significantly over the time period. Starting from zero, although cyclical with product commercialization cycles, the number trended upward. Inventions, on a downward trend at the start, took some time to be impacted by the cultural change, which is not surprising if one considers the invention cycle. The number of inventions eventually increased by over 30 percent. The number of site Ph.D. candidates in a corporate-sponsored program also increased dramatically, clearly indicative of changes in attitude both on the part of staff, who applied for the program in larger numbers, and on the part of management, who had to approve the applications. Senior technical staff increased more than six fold during the program. These were corporate appointments, clearly indicative of the change in stature of the site and its technical people. (See Figures A-5 through A-10.)

The technical vitality program at the site was clearly a leader in raising the level of effort on technical vitality throughout the company. Many of the programs were adopted or adapted throughout the corporation, and site personnel acted as leaders in many corporate technical and technical vitality programs.

Changes in the state of the site are difficult to quantify. It has clearly been transformed from a low-technology site with no clear future to a multi-high-technology site with a vital role in the future of the company. It is recognized and promoted as the company's most inventive development and manufacturing site. The RISC technology for advanced workstations is of great strategic importance to the corporation. The development of the programming center, the 1989 commitment to build a software laboratory facility, and the missioning of OS2 to the site is indicative of the company's dependence on the site. Of course, this is not all due to the technical vitality program, but the program did create a transformed environment that fed and supported the growth.

The eight-year-long cultural change program at the site to improve its technical vitality was successful. Indicators of vitality have shown marked increases. As noted above, programs have been utilized and duplicated throughout the company. From a handful of people scattered throughout the company who were interested in technical vitality, the company developed a dedicated team of over 50 leaders of cultural change at many sites. And, as also noted above, the site now has a high-technology mission of strategic importance to the corporation.
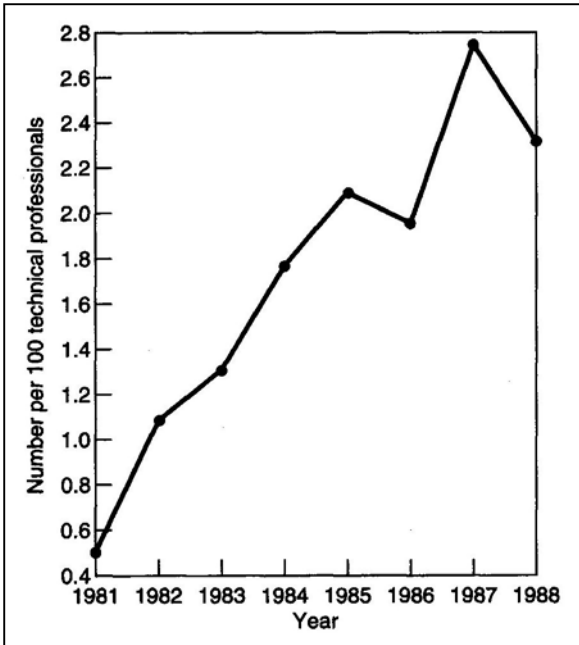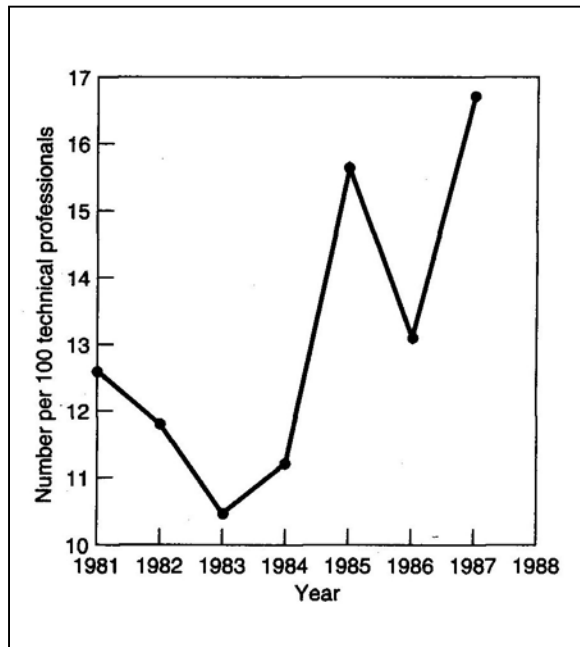
• Figure A-5 Technical Reports
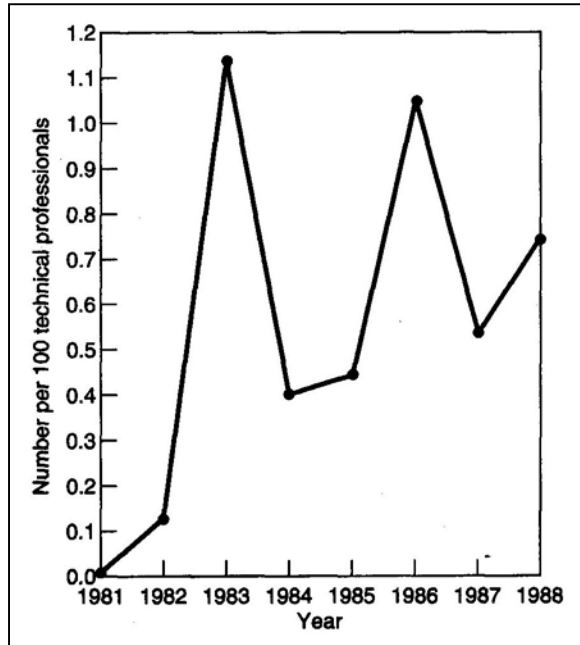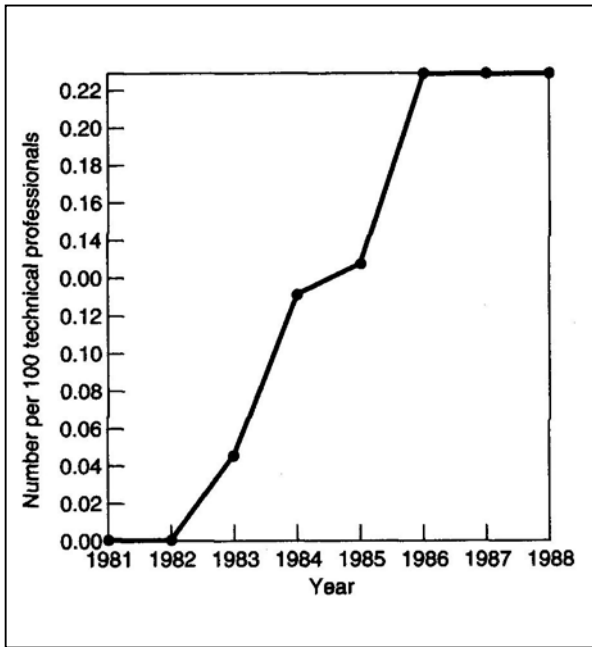

• Figure A-6 External Presentations
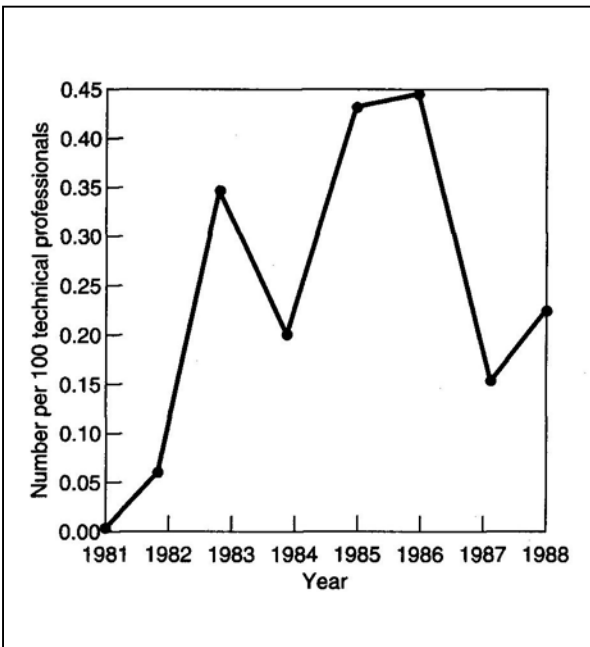
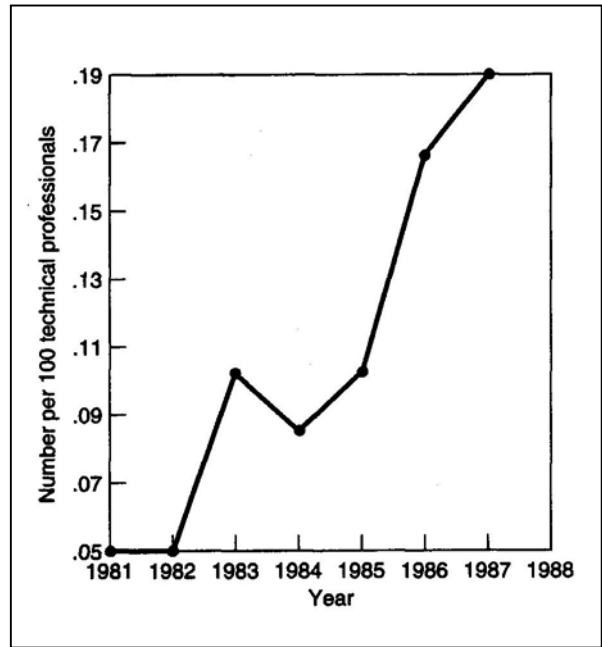• Figure A-7 External Publications

• Figure A-8 Inventions

• Figure A-9 Ph.D Program Participants

• Figure A-10 Senior Technical Staff