

Deming's  
Redefinition of  
Management

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Recent publications in The Harvard Business Review and the popular press have indicated American management practices as the principal reason behind America's decline in international competitiveness. The problem seems to lie in the self-image of managers. Everyone, of course, has an image of what his or her job requires. People need self-images; they help them decide how to behave in different circumstances. It seems that many managers do not have images that correspond to their true responsibilities.

I was inspired to this line of inquiry by a conversation with Dr. W. Edwards Deming, well known for his contributions to Japanese productivity and quality of manufacture. I asked him, "Suppose I were the president of a major corporation and I became convinced of the superiority of your methods. What would you advise me to do, if I wanted to take advantage of them, starting tomorrow?"

Dr. Deming leaned forward, looked me straight in the eye in his unique way, and said, "Oh! You want someone to explain your job to you, is that it?"

Subsequently, I went to the library to look for definitions of the manager's job. A great deal has been written about management, but very few authors have defined the job operationally.

Many people define the manager's job something like this: The manager has to see that everything gets done that should be done and prevent things that shouldn't happen from happening. More succinctly, Harry Truman had a small sign on his desk that said, "The Buck Stops Here." That description is accurate, for in the end the manager is responsible for everything that goes on in his or her domain. Such broad definitions are not useful.

A more useful approach is to ask: "What are the essential responsibilities that a manager may not delegate?" These responsibilities define the core of the manager's job.

Dr. Deming has prepared a list containing fourteen points, which, in his experience, are essential to quality and productivity and cannot be delegated by a manager. This paper starts from Dr. Deming's fourteen points (although not in the order he gives). It is only a beginning on the task of defining the job of a manager. At the end I shall return to the question of what needs to be done to complete the definition. Deming's points are discussed extensively in his new book, *Quality, Productivity, and Competitive Position*, and several of his publications.

#### Provide Continuity and Consistency of Purpose

No one but the manager can set the goals and aspirations of the organization. Sometimes it is said, "We have to decide what business we are in." This is not enough. The manager must decide what kind of organization the company is to become. The manager must articulate the goals and strategies of the company in such a way that the public, the employees, the vendors, and the customers

understand what to expect from the company.

At the entrance to the Newport News Shipyards there stood a sign:

" We shall build great ships.  
At a profit if we can  
At a loss if we must  
But we shall build great ships. "

When the shipyard was purchased by a conglomerate, the sign was removed with the statement: "We do not intend to build at a loss." Later the sign was restored.

The manager who removed the sign articulated the goals of the company. But managers should realize that the goals will be interpreted by the workers at all levels and will determine how they behave. Goals that invite the workers to cut corners will not lead to high-quality, competitive products.

The manager's behavior sets the style for others to follow. Only the manager can decide if the performance of the organization is satisfactory. Only the manager can make the decision to improve it.

The manager must not only articulate a purpose for the organization. The manager must also do whatever is required to ensure that the purpose is followed with integrity, altering it as circumstances dictate.

The statement of purpose must be credible, operational, and inspirational. It should provide a basis for everyone in the organization to want to work for a common purpose.

Two executives stand out in my mind as examples of the two extremes. The late Joe Wilson, founder of the Xerox Corporation, was extraordinarily able in setting forth what he wanted the company to be. His death led to a discontinuity in this ability, which, in my opinion, has led to some of the difficulties experienced by that organization today.

At the other extreme, I recall a CEO who made the following statement to an assembly of his managers:

"Never forget, gentlemen: The purpose of this company is to make money. "

Not only is such a statement inadequate as a guide to decision making, it is an invitation to everyone to put his or her own career aspirations first, to jump ship at the earliest good opportunity, and to look outside the company for life's nonmonetary rewards. It is inadequate because it does not address the question, Are profits today more important than in the future? How are the employees to regard the company's future competitive position?

This way of providing guidance to a company can have unfortunate consequences, some of which have been discussed elsewhere.



In short:

The relations among all parts of the system

The training and education of all employees

On-the-job training

Supervisory training

Professional training

Statistical control of quality

Inspection methods

Feedback and control for quality

Materials acceptability

Many of these aspects may be delegated, of course, but only the manager can take the responsibility to harmonize the activities of the different parts of the system. Only the manager can judge the adequacy of the answers to such questions as these:

Are the specifications to the purchasing department adequate?  
Is the reward system for purchasing agents driving them to the lowest bidder regardless of quality? Are the purchased materials, instruments, supplies always the best for the job? Why not?

Is the information on which product specifications are based adequate? If the information is inadequate, who should take action? If the information is inadequate, who knows and acts?

One of the more common errors is to confuse quality of product with quality of process. It is often possible to obtain a high-quality product from a low-quality process, just by inspecting thoroughly enough and rejecting enough of the output. Of course, costs will rise under such a system. On the other hand, a high-quality process will produce high-quality output at a lower cost simply because there will be fewer delays, less rework, less wasted human effort, less wasted space, and less wasted material. In a high-quality process everything works right the first time. The work goes smoothly and productivity rises; not just the productivity of labor but also of capital and of management.

Another error is to fail to distinguish between high technology products and high technology production processes. In the manufacture of tissue paper, to cite an obviously low technology product, the manufacturing equipment of successfully competing companies will be of very high quality and technology. To compete in a market in which the cost of the raw material is a substantial fraction of the cost of the finished product, it is essential to run it efficiently, with statistical quality control. Otherwise the productivity of the capital investment will be too low to compete.

Unfortunately, this confusion between quality of product and quality of process causes many managers to believe that higher quality means higher cost. In their search for cost savings, they often indulge in false economies. It is especially unfortunate when

the manager can say, truthfully, "We have no complaints on the quality of our product." The issue is quality of process, not quality of product.

The worst case of all is when it is said, "People have always complained about that."

Ensure That Everyone in the Company, from the Chairman of the Board to the Lowest Level Employee, Understands Statistical Reasoning and Can Use Elementary Statistics

Of all Dr. Deming's points, this one is the most resisted at first and endorsed most solidly in the end.

"Those who fear sin the most,  
are those who have the least acquaintance with it."

Anon.

Modern systems of people and machines used for production, sales, distribution, and managing are subject to many disturbances. Any quantity that can be measured in connection with these processes will be found to vary. These variations combine in ways that can only be described and understood through the use of statistics.

It should go without saying that managerial decisions should be based on valid, relevant data. Managers, and all who are involved with gathering, discussing, and deciding on data, should be able to reason statistically. Is the drop in sales this month meaningful? With what is it to be correlated? Is the sudden increase in orders attributable to the new advertising or the weather? Is the increase in orders sufficient basis for working an extra shift? What faith shall we put into a proposed correlation between defects and materials purchased from a vendor who swears he is not at fault? People who do not understand even how to discuss such issues are a menace in these systems. Understanding variation is at the very heart of understanding the application of statistics to business.

Consider, for example, the related problems of inventory control, number of employees, and getting orders out on time. When an order is filled, each part of the organization will estimate the time required. This time estimate will be set at a level that gives a reasonable probability for meeting it. Just how much cushion is included will depend very much on the penalties for failure and the rewards for success.

For a delivery to occur "on time," the following events must each occur "on time":

The order must be written up--on time.  
The items to be made must be described--on time.  
Materials must be ordered--on time.  
Materials must be delivered--on time.  
Instructions to the workers must be given--on time.

Machines must be ready--on time.  
Workers must be ready--on time.  
Parts must be inspected--on time.  
The completed system must be inspected--on time.  
The system must be packaged for shipment--on time.  
The product must be delivered--on time.

If the product is to be produced on time, each step should be done on time. Unless each job is watched over very carefully and priorities in each department changed on a daily basis, if the probability of achieving the schedule at each stage is 0.95, for the eleven steps taken together the probability that the schedule will be met is:

$$(0.95)^{11} = 0.57$$

If each organization sets its own schedule at a more comfortable level, one in which 99 percent of the tasks are done on time, the probability of completing the entire task on time still only rises to 0.89.

If the quality of the process is defined to include the ability to meet schedules, it is clear why increasing the quality of the process reduces cost. The gains from getting control over the time of a process are much greater than indicated by just the throughput.

Inventory, floor space, record keeping, conferences of people spending time to fix things up are all reduced .

The essence of gaining such control is understanding the statistics of variation. No company could afford the army of statisticians it would take to study, in fine detail, all of the industrial processes of a company. Even if such an army were available, it could not possibly persuade the workers to adopt the changes that would be suggested from an analysis done by "outsiders." On the other hand, if the workers are themselves part of the observing team and participants in the analysis of the data, both the cost of observation and of implementation will be reduced. Managers must first be instilled with the belief that current levels of variation are unacceptable, and they can and must be substantially improved.

Too many people believe that these ideas apply only to the factory floor. But, as Lester Thurow keeps pointing out, the factory floor employs fewer and fewer workers and their productivity is a constant source of inquiry. On average the productivity of American factory workers is higher than the workers in Japan, though the Japanese are said to be gaining. Where we have a disadvantage is in the size of the office staff used to support the factory. Unless the productivity of these workers is addressed, the overall productivity of the organization will not increase. The concepts of statistical quality control used to increase productivity have been applied to banks, for example. They may be used in the service industries as well as factories. As economists, such as Lester

Thurow, keep pointing out, the work force is now more engaged in the production of services than of goods. Since it is goods we export, the inefficiencies in the service sector are added to the cost of what we sell. Therefore, the most rewarding applications of these ideas are likely to be in administrative areas.

The level of statistics that needs to be taught to the workers is not high. Based on Japanese and American experience, it probably will suffice if everyone understands the following statistical techniques:

1. How to read and construct a histogram.
2. How to read a process flow chart.
3. How to construct an Ishikawa ("fishbone") chart.
4. How to understand a Pareto chart.
5. How to read x-bar and R-bar charts.
6. Scatter plots (correlating x and y).

Each of these techniques may be taught in a short time, as part of on-the-job problem solving. Of course, these elementary tools are not enough. They should be supported by higher level abilities from consulting statisticians, either in-house or from outside.

#### Invite Employees to be Partners in System Improvement

Although the manager is responsible for the improvement of the system, the job cannot be done by the manager alone. To the extent that everyone in the organization understands statistical reasoning, the manager can make everyone else in the system a partner in the improvement process. The responsibility to observe and gather data can be delegated to the lowest possible levels. Suggestions for improvements will result, and where they can be adopted at the lower levels, the manager should install procedures to allow people at these levels to implement them. But the manager must remain involved in the process because proposed changes will often involve procedures that cut across departmental lines. If the tools for the job are inadequate or the materials are inappropriate, purchasing may need to change its policies or practices.

The workers are in the system. They can observe it and propose changes. Only the manager works on the system and can judge and implement the changes.

Improvements will not come without management involvement. They will be made on a project-by-project basis. Management must provide leadership or the workers will not be able to participate. When the workers discover "common causes" (as Dr. Deming calls those causes of defects that are in the system itself), they will need the help of management to remove them. And only the managers can initiate those actions that reveal the special causes, in which workers may need more training or better supervision.

There are many benefits that flow from this responsibility. The modern movement toward "quality of work life" improvements fall

naturally into place. But most of all, it will be possible to reach the record-breaking productivities that have been achieved only if the manager involves the employees as partners in improving the system, and not just the work.

#### Replace Mass Inspection with Quality Control

Only the manager can make the policy decision to place responsibility for quality on the workers and not on an army of inspectors. Sometimes, of course, there are legal requirements for inspection, as in some aspects of federal procurement. Wherever it is possible to do so, the inspection procedure should be delegated to the workers involved with the product, and they should be trained to carry out this function.

This philosophy should extend from purchasing through manufacturing, sales, delivery, and maintenance. It should be applied in the office as well. The office is already a complex system of people and machines. It, too, can be improved by this approach.

If everyone waits until something has gone wrong, the time to figure out what went wrong and how to fix it will be excessive and expensive. If time is spent seeing that things do not go wrong, time will not have to be spent fixing things. It is that simple.

Quality control procedures require a deeper understanding of each and every step of an industrial process. To commit to statistical quality control in place of mass inspection is to begin a never-ending search for improvement. Ultimately it will involve everyone in the observation and measurement of the statistical variations of the work under their control.

The first benefits will be the transfer of inspectors to the work force, the reduction of wasted effort, improved quality, and greater productivity.

#### Make Continuous Improvement a Goal of the Company Stop Using Numerical Targets and Slogans to "Motivate" the Workers

This is probably the hardest practice for American managers to give up. American managers are habituated to using slogans ("Zero Defects") and to "negotiating" performance improvements ("Managing by Objectives"). It appears heretical to suggest that the practice is itself counterproductive.

The technique does not bear up under scrutiny, however. As every soldier knows, the only target to which one should make a commitment is one that is clearly attainable. And once attained, it will be foolish to exceed it. Next time demands will be raised.

The reason most managers seem to like these methods is that they have an air of crispness and authority about them that sets the boss apart from the worker. "I gave my people tough targets, and by God, they met them. Shows what they can do when you put the

pressure on."

"I did my part. I set a goal. Now you do your part and meet it."

The output of a system is just that, the output of a system. Very few activities are entirely under the control of the workers in the system. The manager is (or should be) part of the system, not apart from it.

The slogan "Zero Defects" has no meaning for people searching out and correcting causes of defects. In general the people do not cause defects. The system causes them. Management can remove them; sloganeering cannot.

#### Teach the Employees to Be Problem Solvers: Set an Example

The manager should be able to identify the barriers to quality improvement (and cost reduction-- they amount to the same thing). The manager cannot do this alone and should teach subordinates to help with this process. This means the manager must be capable of being a "problem finder" and "problem solver" and teaching others how to define and solve problems. A good manager knows how to interpret statistical information to determine when the solution is to be sought in design of the product, maintenance, machines for production, training for workers, testing, materials handling, shipping, records keeping, marketing, sales, order handling, inventory control, or information systems. Possibilities for improvement exist in all of these activities (and more) and in the interfaces between them.

One of the important side benefits from teaching everyone to be a "problem finder and solver" (at their level) is that the organization becomes ready for innovation. As Utterback has shown, as an industry matures, its production processes tend to become fixed. There is greater and greater commitment to fixed hardware, fixed choices of materials, fixed procedures, fixed organizations, fixed processes, practices, and protocols. Everyone settles into a routine; bureaucracies are formed. When circumstances force a change, everyone resists.

On the other hand, if the organization is habituated to the constant search for improvement, for better ways, it will be much less resistant to the introduction of new ideas. Such a major cultural change in an organization takes years. Do not expect results overnight. It took the Japanese twenty to thirty years.

#### Institute Training Evaluate the Adequacy of Training

All too often workers are presumed adequately trained if no one complains. On the other hand, it may also be mistakenly assumed that more training is needed when in fact the process is not in control. In such cases the added training may not accomplish anything worthwhile.

Modern methods of training involve evaluation as well as

instruction. This means determining:

- If the workers understand how the characteristics of their output affect customer satisfaction and company cost.
- If the workers can use statistical methods at the appropriate level.
- If the workers understand the technology they are using, (welding, gluing, machining, measuring, word processing, and so on)
- If the workers are able to work together in groups.
- If the workers are capable problem solvers.

Modern methods are aimed not at sorting out the "good" from the "bad" and setting pay rates but rather at finding out whether additional training would be beneficial, and if so, of what kind.

Establish a "Quality Philosophy"

Only the manager can decide what level of quality is adequate.

In the emerging era of international competition, the levels of performance of products will be continually raised. Consumers will not accept defective workmanship, unsuited materials, poor maintenance, unreliability, delays, mistakes in handling and order filling, and unresponsiveness. Organizations that do not meet this challenge will simply disappear.

Every one in the organization must believe that the management is devoted to quality, or the organization will not produce quality output. Cost cutting in maintenance as a way to bolster a quarterly dividend will send an unmistakable message throughout the organization.

It takes time to build quality habits into an organization. It takes education and training. It takes managerial example. The concept must be translated into action at every level of the organization. The example must flow through the various levels of management. Therefore the top management must be involved in training the intermediate and lower levels of management and in seeing the reward mechanisms (promotions and salary) are consistent with this objective.

Because so many American managers neglect this responsibility in favor of the quarterly dividend, it will be an especially difficult challenge to change their habits. In my judgment we should learn to recognize their approach to management for what it is: bad management.

Why some boards of directors pay such huge salaries to executives who obviously, by their words and actions, have no interest in this part of their responsibilities is, for me, one of the great

dilemmas of our time.

The workers must feel that they are in a genuine partnership with the management in the quest of high quality.

#### Stop the Practice of Buying from the Lowest Bidder

The practice of purchasing from the lowest bidder as a means to stimulate competition among vendors is destructive to the quest for high quality. Only the manager can investigate and change these practices, for the behavior of the purchasing agents is determined by the reward system within which they work.

Purchasing agents should purchase on quality as well as price. Quality can be judged by examining the statistical quality control charts that should accompany every purchase. Such charts show the variability in the manufacturing process and therefore give an indication of how suited the purchased goods will be to the production process into which they go. This information should be the basis for joint discussions involving the vendor, manufacturing, engineering, and, on some occasions, the research staff (and often the company statistician) seeking opportunities for improvement. A smaller number of vendors involved in a cooperative effort to reduce costs and improve quality is much better than a swarm of vendors intent only on reducing costs and with no long-term interest in the success of the purchaser.

#### Drive Out Fear

If the workers believe that increased productivity means they will be fired, they will certainly resist productivity increases. Not until the company is demonstrably on the verge of bankruptcy will they accept changes. The only way for the management to enlist the workers' help will be to form a genuine partnership in which everyone--workers, supervisors, managers--everyone has the same job security.

Only the management can determine the priority it attaches to responsibilities to its four constituencies:

- The stockholders
- The customers
- The public
- The workers

In my opinion, the responsibilities should be in this order:

- The public
- The workers
- The customers
- The stockholders

The order in which these are regarded will be understood from the actions of management, and the workers will react accordingly.

The manager should strive toward a method of pay and rewards that helps the workers identify with the prosperity of the company. They should not only be unafraid of improving productivity, they should see, in a tangible way, how it benefits them.

### Conclusion

In my opinion it is time to define anew what we mean by "good management." The idea that management is to be judged from the quarterly or even the annual bottom line is too simplistic. It represents an abdication of responsibility. Chrysler's problems this year were laid down a decade ago, when the bottom line looked quite favorable. The whole system of rewards for executives needs to be reconsidered. Ideas like Thurow's who suggests that retirement benefits for executives should be keyed to profits after retirement deserves careful consideration. The rewards will reflect how well we think they are doing their jobs, and this calls for better definitions than we now have. I believe that most executives would welcome a change in the system, which rewards them for building something that has a good chance of outlasting them, and to their credit.

Today, under the pressure of Japanese competition, we can sense in American managers a renewed interest in productivity and quality. It is said in many quarters that not only must American managers change their ways, they must also change their attitudes, especially toward labor. Today's managers come mostly from colleges and universities and do not have experience on the factory floor. Nor do they often have experience at the lowest levels of the firm and the people who work there. The ultimate levels of quality and productivity will be achieved only by people who know how to work as a team, and that means having respect for one another. Years of adversarial relations must now be overcome, and this will require new initiatives on the part of leaders of both management and labor. It begins with a new respect for one another. But in the end, respect will not be enough.

The degree of trust and confidence required for people to participate in productivity and quality improvements requires more than mere trust. It requires caring and genuine affection. This may be the hardest change in self-image required. America may have to wait for a new generation of managers, for those who grew up and became successful under the old rules may not be able to change. Time is precious. Those who can make the transition should be helped to do so, now.

Technological  
Competitiveness and  
What to Do About It"

Testimony Before the  
Committee on Science and  
Technology of The U.S.  
House of Representatives

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Massachusetts Institute of Technology  
and  
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### Introduction

Mr. Chairman: My name is Myron Tribus. At present I am the Director of the Center for Advanced Engineering Study (CAES) at the Massachusetts Institute of Technology (MIT). I am also the Chairman of a special task force on technology of the National Society of Professional Engineers (NSPE).

My testimony today, insofar as it concerns the task force report on Technological Competitiveness, is in behalf of the NSPE.

As Director of CAES, I recently visited Japan to study first hand the application of modern managerial techniques for quality and productivity. When I speak about my findings there I speak as an individual reporter. My statements do not necessarily reflect the views of MIT.

It is necessary to begin my statement with such disclaimers because ours is a society in which lawyers and contentiousness are so prevalent. This too, is part of the national problem, but it is a subject on which I intend to say no more, the Congress being subject to this malady as much as general society.

Both the NSPE task force report and my report of the visit to Japan, which I am furnishing to the Committee, deal with different aspects of the same thing; the decline in US competitiveness in international trade and what to do about it.

The NSPE document deals with the problem at a macroeconomic level: It is concerned with how to develop cooperation among labor, management, academia, the government and the professions, without giving up the advantages of the free enterprise system and without creating massive bureaucracies.

The report of the visit to Japan is aimed at the microeconomic level: It is concerned with how to organize and operate a firm for quality and productivity, the essential ingredients of a competitive enterprise.

### NSPE Position on Technological Competitiveness

The task force members are all engineers of considerable experience, not only in industry but also in the political scene. We were fortunate to have them give so generously of their time over a year.

For the record, their names and affiliations are:

Myron Tribus, Massachusetts Institute of Technology  
Erich Bloch, International Business Machines Corp.  
Bruno Weinschel, Weinschel Engineering Company  
Alan Rosenstein, IJCLA and Pioneer Magnetics Corp.  
Fred Garry, General Electric Company  
Sam Florman, Kreisler, Borg, Florman, Constructors  
Richard Simpson, Former Administrator, CPSC  
Chris Kraft.

The NSPE position derives from the observation that the conditions of international competition have changed. Until a few decades ago the US had a favorable balance of trade. US industry once led the rest of the world in the adoption of advanced technology and was an acknowledged leader in mass production. US markets were the largest in the world and most US production went to our own market. More importantly, there was little competition from foreign producers. Although wage rates in other countries were usually lower than in the USA, our superior technologies of production were sufficient to offset the higher wages and outsiders were not able to compete in our markets.

Our forefathers found it necessary to develop an elaborate network of laws and regulations, starting with the Sherman Anti-Trust Laws of 1890, all having the aim to prevent collusion and to promote competition among domestic manufacturers.

Under these laws and regulations responsible businessmen are careful to avoid working together except under very special circumstances. I recall that during World War II, as a design and development officer in the Air Force, I visited Los Angeles to check up on some equipment. I telephoned to five different engineers at five different airplane companies and invited them to have dinner to discuss the development of a new kind of wing de-icer we were all developing. Even though it was war time, two of the engineers declined to attend because they were under strict orders from the company attorneys not to be seen discussing their design work with engineers from other companies. Even during the War they were afraid to be prosecuted for violation of these laws and regulations.

Meanwhile, foreign companies do not labor under such restrictions. Under the guidance of their governments, they "target" certain industries and pool their resources to attack certain segments of world markets.

Let me give you a specific example of how such a system works. The Japanese Ministry of International Trade and Industry (MITI) recognized that the 64K RAM was going to be a very important chip in the near future. The methods to fabricate such a device were still under research and development. With the guidance of MITI, a small cooperative laboratory was formed. Representatives of about a dozen electronics companies put up most of the money and sent their best people to this laboratory where they worked together for two years. When they had solved the most important development

problems, the laboratory was disbanded, the people returned to their former positions, and the different companies competed with one another again. The result was that the Japanese companies, having pooled their resources, especially scarce talent, were able to develop the 64K RAM at relatively low cost to each of them, invade the US market and obtain a dominant share. The challenge was not just how to make a 64K RAM. It was to learn how to make it with high reliability and at low cost. Any company wishing to achieve the same result would have had to spend about the same amount of money. When ten companies in the US each do the same thing separately, even if their individual efficiencies are greater, the net result is they require much more capital than competitors who share the cost. High tech industries are capital intensive and the pace of innovation is now so rapid that the advantages in pooling the cost of development are very difficult to overcome.

While US firms compete, Japanese firms belong to *kierotsu*, families of companies that are in similar endeavors. Their government encourages them to work together. Our government discourages cooperation.

The problem for the US microelectronics industry is detailed in a recent report in TECHNOLOGY REVIEW (Aug/Sept 1983, pg. 24) so I shall not elaborate on it here. Suffice it to say for now that similar forms of collaboration occur in other industries outside our borders, to the disadvantage of US industry.

With these remarks as a sketchy background, let me now turn to the substance of the NSPE Task Force Report.

The primary objective of our proposal is to enhance the competitive position of U.S. Industry in international commerce.

To achieve this aim requires a strategy. The essential elements of this strategy should include four main thrusts:

1. To assure adequate investment in modernizing our manufacturing capacity and in research, development and innovation.
2. Removal of barriers to the rapid translation of invention and innovation into world competitive products.
3. Increased attention to quality and productivity improvements in all our activities: manufacturing, services, academia and administration.
4. Continuous education of our labor force, professionals and managers so they may better deploy advances in technology.

At the outset our committee wanted to make it clear that we did not advocate centralized planning. We do not advocate having the Government identify "sunset" or "sunrise" industries. What is sought is a new basis for developing

cooperative efforts among government, business, labor, academia, and the professions.

Our objective is to promote new forms of free collaboration so that our many important resources may be used together.

Early in our deliberations we concluded that what was needed was an opportunity for people to cooperate, if they wanted to do so, but they should not be required to cooperate just because someone thought they should. In other words, we sought a permissive system, not a compulsory one, such as might occur in war time. We specifically did not want to ask the Government to give guidance.

Our task force spent a great deal of time studying the role of Government in helping our industries to be competitive. We concluded that Government has a special responsibility to be aware of the health and competitiveness of each industrial sector and of potential threats to its health. However, we also concluded that it is the responsibility of the private sector to help itself, wherever it can. There may arise circumstances when the Government and the public must step in and give assistance. Determining what form that assistance should take so as to enhance and not destroy our entrepreneurial abilities is the essence of the challenge.

We were also aware of an important phenomenon. Sometimes an industry is threatened, but the leadership in that industry is either unaware or is ready to abandon the industry. But many industries are too important to the economy to allow decisions on their future to be taken by a handful of people. For example, foreign competition in steel not only threatens steel companies, it affects other industries as well. It affects employment in many communities. Solutions too narrowly arrived at can do damage to the country as a whole, even if they are viewed favorably by one party or another.

If an external challenge occurs to an industry because of superior technology or superior use of technology and manpower, attempts to meet the challenge by legal or fiscal means (i.e., tariffs, subsidies, trade restrictions, etc.) will not cure the problem. They may even make it worse.

Unless the response goes to the heart of the problem and deals with the technological and infrastructure issues, it will merely postpone the day of reckoning, make the situation more difficult to deal with and place undue burdens on the rest of the economy.

Out of these considerations we conclude that what is needed is a way to help a threatened industry by bringing all the affected parties together, in a free atmosphere, to discuss their common problem and examine what they might collectively do about it.

For some time the task force pondered the kind of institution required to provide for such coming together. Upon further discussion we concluded that the question was not one of establishing an institution. Rather it was one of establishing a

new procedure. We finally concluded that if the appropriate procedure were followed, it did not matter what organization carried it out. We have therefore bypassed the question of whether the US needs or should have its own version of MITI. We believe that existing institutions, some private and some Governmental, could provide for the kind of forum we envisage. The important issue is one of process.

We concluded that a process which is not to compromise either the requirements of integrity inherent in making any technological decision and at the same time not deprive the rights of free people to respond creatively, should obey four important principles:

1. It should develop awareness in the parties most affected. They should not be taken by surprise by whatever is proposed.
2. Decisions should be based upon reliable and comprehensive data bases and upon analyses of unimpeachable quality.
3. Barriers to effective cooperation should be recognized, analyzed and removed.
4. Means for open and effective collaboration among the affected parties should be developed and fostered.

#### Developing Awareness

Government (any branch) and industry (any segment) should, together, sponsor forums in major economic sectors. These meetings should be prepared for the purpose of making the various parties in an affected industry (business, labor, professional societies, Federal, State and Local Governments and Academia) aware of the nature of the threat and the options available.

At these meetings it is essential that there be available a good data base from which to assess the facts and develop options. We believe that if an industry is threatened, there will be interest in attending such meetings. It is essential that there be available good analyses of the situation to reveal strengths and weaknesses of the US position. The state of technology, past, present and future should be discussed. Competitive position in regards to quality, productivity and worldwide share of market and the impact of alternative actions should be debated.

It is important that all parties involved be represented. We are aware that there have been many discussions in the past, but too frequently they have involved only a small segment of the industry and focussed too narrowly on issues of concern to the attendees.

#### Providing Data and Analyses

One of the keys to the success of such a conference is the integrity and comprehensiveness of the data base. The data base

should be designed with the forum in mind. The quality and character of the analytical work will be of equal importance. The Government and private sector sponsors should jointly endeavor to increase both the quality and the quantity of the data gathering and analytical work.

The nation has important resources in Academia, professional societies, national academies, and other not-for-profit organizations which could be used to provide objective analyses, assessment and data collection. The Federal Government now maintains many different data bases, but they are now largely uncoordinated and not designed to support forums of the type required. This is an important missing ingredient, which the Congress could rectify.

#### Fostering Collaboration

We cannot foretell what form of collaboration may be most useful for a particular industry. That is to be decided by the participants. However, it is possible to enumerate some of the forms of collaboration that may be required:

Cooperative research and development programs may be needed. Efforts such as the Microelectronics and Computer Technology Corporation (MCC) might be useful in some cases.

Attainment of reciprocal access to foreign markets may require the Federal Government to take an initiative. Close collaboration with industry (and affected labor) is important in such cases, at the same time that other affected parties are kept aware.

There may be important differences in infrastructure, as for example education, systems of taxation, transportation, etc.

Tax incentives for R&D may differ.

#### Organization is Not The Issue

As I said earlier, we finally concluded that organization is not the issue. PROCESS is the important issue. Meetings could properly be called by:

Office of Science and Technology Policy

National Research Council

Business Roundtable

Conference Board

A segment of Organized Labor

Various Professional Societies (especially NSPE)

## Industry associations

We do believe it might be useful to establish a small organization which would have the function of promoting such undertakings and giving advice and guidance to those who were conducting them for the first time. It would be important that those who ran the meetings adhered to the process, i.e.,

Developed awareness among all parties

Drew upon an adequate data base

Developed adequate analyses for discussion

Aimed at removing barriers to collaboration

Were prepared to assist in following through with action programs.

## Proposals for Action

The NSPE is now engaged in discussions with several groups in industries which are threatened by foreign competition. We hope to work closely with one or more such groups and to sponsor meetings of the type indicated.

We are also encouraging other groups to undertake similar initiatives.

We have been watching with interest some of the legislation being put forward by the Congress. In particular, we note that there are several bills now pending which come close to providing for the process we have identified. When the time comes to comment on such legislation, we shall press for the adoption of the process we have proposed.

## Other Conclusion

At first some may think that our committee, in calling for a new kind of forum, has merely documented the obvious. That may well be. But we note that there are no examples of the kind of meeting we propose. Instead we see conferences, hearings, discussions and symposia, each drawing a narrow set of participants, studying a narrow set of problems and proposing a limited set of solutions. So we conclude that a different kind of forum is needed.

Our committee also developed a list of eight changes in public and business practices which are needed to provide the incentives for the industrial vigor that will maintain or restore US competitiveness in all markets.

1. Public policy that increases capital availability by making the tax code more conducive to savings.

2. Establishing quality and productivity improvement as a central goal for US industry.
3. Negotiation of international trade agreements that provide fair and reciprocal access to markets.
4. Increased attention to science, mathematics and computer science in primary and secondary school programs.
5. Revision or extension of engineering curricula to include design and production knowledge in addition to fundamental science and mathematics backgrounds.
6. Cooperative R&D efforts between industrial companies and between industry and academia.
7. Giving equal weight to engineering problems in the councils and departments of Government as is now given to science.
8. National laboratories and other technical activities of the Government should be given a mandate to support industry where and when appropriate. A strategy for these activities should be jointly developed by industry and Government.

#### Conclusion

Mr. Chairman, the NSPE report also contains a brief discussion of the existing attempts by the US Government to provide a data base and a description of the Japanese Policy Information System. Their Policy Planning Information System is especially interesting. It provides an important competitive advantage. We should not be too proud to study it.

This concludes my remarks on the NSPE position paper.