

THURSDAY NIGHT LECTURE

PLANNING IN AN UNCERTAIN ENVIRONMENT

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Shortages are a bit like the weather—everyone complains about them, but no one seems to be able to do much about them. Short-lived shortages are so common that we have learned to endure them, perhaps in part because they usually affect only a small segment of the populace or a minor part of the economy.

If the affected groups happen to have a low political profile, we oftentimes do not even hear about the problem. The discomfort or economic strain that these groups experience may be severe, but if they don't have the economic or political "muscle," nothing much is heard of it.

On the other hand, a major shortage will receive high-level attention. If there is a danger that the national economy or safety is threatened, we are bombarded with information and instructions. Following any such event, the headlines are filled with speculation about the long-term possible danger of international boycotts or the consequence of exhausting a supply of a natural resource. While I don't wish to be insensitive to these issues—for there is no question that they represent real concerns—the real issue before this conference is how to reduce the impact of such events by careful forward planning.

The first step in solving any problem is to recognize that the problem exists, and this conference has appropriately highlighted the magnitude of the problem—namely, chronic material shortages.

The next step after recognition of a problem is to try to do something about it. It is easy to say that the marketplace will handle the problem, or that the Government should intervene in each case, or that we should have a national strategy that will preclude the development of such problems.

In fact, none of these answers are adequate. But what can we do? perhaps the answer will be nothing or only something very small; however, at the very least, an answer will be found only if we understand the total breadth of the problem. It follows, I believe, that the manner in which we go about searching for an answer is absolutely crucial. Thus, I would like to share with you

a few of my concerns about the way we examine these problems as well as the mechanisms we try to employ to prevent them.

We have become such a complex, interrelated society that actions taken by one element of our society can have unexpected consequences upon another element, particularly when the time that has intervened between the action and the consequences is more than a few weeks. The realization that the future can be adversely affected by today's decisions has led to increased efforts to establish a more systematic review of the possible consequences of many of the actions that are being proposed by both business and Government.

It is this concern for the future that has led to the requirement for environmental impact statements. This is just one of many efforts to urge a longer-term look at the consequences and a corresponding reduction in the risks associated with a planned action—in this case, the environmental consequences of an action.

The term "technology assessment" has been so well integrated into the common vocabulary that it is not unusual for the layman to feel that the long-term consequences of a proposed action are predictable with a high degree of accuracy.

While this awareness of the need to examine the implications of the technical issues is important and should be encouraged, I suspect that the very term "technology assessment" tends to create the false impression that most issues are dominated by the technical aspects of the problem. While most of us would probably subscribe to the view that the technical implications are important, we all too often do not ask how a particular action will affect our human relationships. This has sometimes been referred to as the "socio-technological" implications of an action.

Perhaps we should emphasize the human aspects even more by insisting upon a "humanistic assessment" of the various actions that are planned. The interdependency that exists between Government, industry, and individuals is quite explicit in many areas, but unfortunately it is very subtle in others. While we can see the direct effect of some actions with great ease, the less visible effects are more difficult to handle; hence, we would do well to recognize the subtleties of some of our other relationships, particularly when the results may not become visible for a long time into the future. The impact that such action can have upon the personal well-being of our society is important and must be considered more fully. This is both a people problem and a policy problem.

A few examples maybe of value in emphasizing the people-related problems of these materials issues. In the 1960's, it was perceived at the Federal level that a major deficiency existed in the

availability of the number of material scientists who were being trained in this country, This was indeed correct. As a result of this concern, a major effort was undertaken to expand the research and the educational capability for materials in a number of our major universities, Materials Research Laboratories were subsequently established, The perceived need for materials research of this fundamental nature has now diminished, but these laboratories are in existence, and are continuing to do excellent research and graduate outstanding people. Note that I said “the perceived need” for fundamental research has diminished, because there is a great effort underway to change the direction of these laboratories toward more applied activities. I suspect that the tendency to divert these laboratories is not well conceived, and ultimately will be found to be in error. The contributions of these laboratories to the solution of specific applied problems may not be great, but I think it is likely that the people being trained will contribute in a major way to finding long-term solutions to our long-term materials problems. Thus, it may turn out that the basic orientation of these laboratories is extremely beneficial to finding solutions to the long-term materials needs of this country.

To take a second example, our national laboratories—reservoirs of tremendous talent and capability—have found it difficult to move from the objectives of military and space agencies to the needs of the civilian economy, We have yet to learn how to help these laboratories move gracefully from an emphasis on nuclear weapons and defense to civilian, energy-related research, Of course, we could accept a major disruption in the careers of the people involved, if we were willing to ignore the human aspects of this problem. It is essential that we maintain a long-term perspective of our national needs. We must find ways to change our national institutions in a fashion that permits a continuity of interest while responding in a timely fashion to changing requirements.

Our technical disciplines are no more immune to these problems than are our formal institutions, Consider, for example, mining engineering and power engineering. Both of these disciplines once languished and had almost disappeared from our universities, with neither proper support for the research, nor an interest being displayed in the subject matter by the most talented and imaginative students. Now, we find a deficiency in students and an absence of genuine research in these disciplines. But we cannot train people for positions for which there are no future opportunities of employment. Neither can we afford to ignore important technical areas. This is a dilemma that we have yet to address fully, and in fact we have not found a way to

foresee our long-term needs for specially trained people.

In addition to the people aspects of these problems, there is also the issue of how we develop an understanding of the problem itself. If a technology assessment is to have long-term utility, I would suggest that the following guidelines be carefully followed.

- A clear distinction between “technological assessment” and “technological forecasting” must be maintained.
- A short time frame and a stable environment are critical if the assessment is to be useful.
- An adequate data base must be used if an accurate assessment is to be made,
- An objective assessment requires that no preassumed bias be allowed to penetrate the assumptions of the study,

It may be helpful to expand upon these points briefly. The assessment process tends to assume an existing technology and to explore the ramifications of implementing it. This assumes that the technology is reasonably well-developed. One cannot establish the technical facts by consensus votes. Hard data on the particular technology must be available, and generally must be agreed to by the experts if an assessment is to be useful. This does not mean that implications drawn from the data will be universally accepted. In fact, the conclusions may be controversial. After all, one often is dealing with sociological issues, and the ability to predict social events is at best imprecise. Far too often, assessing the social implications comes down to a matter of judgment, rather than to a prescribed means of making a prediction. But the technical data must exist—and must be valid—before any assessment should be undertaken.

Further, it is basically impossible to anticipate an unusual event, e.g., the OPEC embargo. Assessments are usually predicated upon an extrapolation of the current status. So, if the time frame is long, the chance that an unusual event will occur is great. This suggests that an assessment should be viewed as a living issue, with frequent review and updates to reflect recent unpredicted events.

Forecasting technological developments is subject to even more uncertainty than assessing the impact of technology. Technological feasibility can be established with a fair degree of certainty, but the probability of implementation is often not predictable. As a recent example, the Wankel engine was in production overseas and well on its way to implementation in North America when fuel economy became of increased importance. An engine that had been shown to be technically feasible suddenly became of questionable advantage in the product, when the basis

for assessment required that different values be assigned to the various criteria used in making the product decisions.

Thus, the distinction between assessment and forecasting relates closely to the time frame being considered. An attempt to assess the long-term consequences of an event generally is more akin to forecasting than to assessment because of the greater uncertainty in the conclusions and assumptions. A forecast must be viewed as having less credibility than does an assessment.

Furthermore, it is very tempting to use technology assessment as a tool for advocating a particular predetermined bias. It is easy to make the assessment process self-fulfilling by setting up the proper assumptions. The outcome of an assessment study will likely be quite different if one asks, "What are the consequences of Government intervention into the market area?" than if one asks, "How should the Government intervene to affect this market?" Either of these questions may be appropriate, but one must not expect a universal answer to all issues from a single study.

These concerns do not mean that it is improper to attempt technology assessment. What they do suggest is that it is important to maintain an awareness of the limitations of the process and to recognize the dangers inherent in making major long-term decisions based upon such assessments.

Perhaps one of the greatest difficulties with our system is the fact that many organizations act as if they were independent, only to find that their actions strongly influence the options other organizations could exercise. Let me give one small example. The federally legislated fuel economy standards for automobiles have stimulated many of the manufacturers to search for ways to reduce vehicle weight. The bumper system is one of the systems that has been carefully reviewed for possible weight reduction. But in considering what modifications are allowed by the damageability regulations, it is found that a simple constraint on bumper rentability may dictate that thin-gauge, high-strength, low-alloy steel may not be usable. I seriously doubt that the inclusion of this constraint on rentability was considered as having any impact upon fuel economy when this regulation was adopted. While this is just one example, we could list many more. This just emphasizes that we are a closely coupled society, and that we must be constantly aware of the possible impact of seemingly isolated actions upon other segments of our society. No wonder an adequate assessment is so difficult—if not impossible,

Let me turn now to what may strike you as being a non-existent problem, That is, who should do the assessment? It is well established that the Federal Government, private industry, and

the “not-for-profit” organizations regularly undertake assessments with technical input from staffs and individual consultants. But an entire component of the technical community is frequently excluded from such studies—the technical professional societies. This is such a glaring omission that I would like to dwell on it for just a moment.

While the professions can identify opportunities for new technical developments as well as potential dangers that may result from new developments, they seldom have any direct involvement in setting the objectives that are followed by a given segment of the populace or by the governmental agencies. They may not even be participants in the deliberations. This can be both a benefit and a frustration to the professional organization. The separation from the direct, decisionmaking process tends to remove the professions somewhat from the political process, and thus allows them to remain concerned with the technical content of issues, as well as with the more narrow concern for the well-being of their members, and the standards of performance of those members. But the separation can be a frustration, for the members may readily perceive of situations in which decisions are being made without proper concern to the technical issues and where the true, long-term consequences of the decisions are not being properly evaluated.

Thus, on the one hand, the profession can benefit from this detachment, but the public will suffer from the absence of professional involvement. On the other hand, to involve the professional organization in the details of the decisionmaking process transfers a responsibility to it that it finds hard to cope with, for few of the professional societies are organized to operate effectively in the political arena. Thus, it is predictable that many professional organizations often withdraw into the seclusion of the technical issues and refuse to participate actively in controversial issues. This often leads to decisions being made which have a future impact upon the well-being of the profession, upon subelements of the profession, or upon the people who benefit from the profession without proper consideration being given to all aspects of the problem being examined.

It seems to me that the regular inclusion of representatives of the professional societies in the technology assessment process should be a key objective of the organizers of the assessment, because the membership of the technical societies has a vast store of information that would be of immeasurable value to the assessment process. Further, this inclusion offers a significant avenue for realistic involvement of the societies in establishing a basis for the more general decisionmaking process.

Because the contributions to the assessment are made by individuals, it is paramount that the roles of individual members on the team be carefully examined. If appointed as an individual because of his personal expertise, the individual can speak for himself. If appointed as a representative of a professional society, an industry, or of an individual company, it must be clearly understood by all as to how that individual will obtain the consensus of the group he represents. Unless this process is carefully detailed, it is easy to be misled about the general acceptance of a set of recommendations it produces.

Finally, then, having talked about the assessment process and who should do it, I would like to review for a moment or two what we should expect the outcome of an assessment to be. Generally speaking, I do not believe that a technology assessment should identify a solution to a particular problem. Rather, it should examine the consequences of various actions; it should explore alternatives; it should identify areas where insufficient information or data exist; and it should indicate areas where further research is needed before an adequate assessment can be made. To identify a solution to a specific problem—the temptation being to invent—may be more satisfying to the participants or to the sponsor, but it is oftentimes less useful to the policy-maker, for as I mentioned before the manner in which the question is phrased often determines the answer. If the wrong question is asked, the study will be of limited value. Further, the assessment should be regularly reviewed and updated if it is to have long-term utility.

We must approach with caution those planning studies which suggest actions to manage our system so that shortages are eliminated—be they material, energy, or human. Our past “track record” is not all that good with such plans. Thus, a healthy skepticism is warranted. Further, many of our programs appear to be derived from studies that were based upon insufficient data and too much on the strict technical issues as known at that time. Too little attention was given to what I’ve chosen to call the “humanistic” issue. We can start programs, but find it hard to turn them off. We can start training people, but are less concerned about how to employ them. We can identify problem areas, but sometimes ignore the fact that we have too few people to search for meaningful answers.

We must attack these overall problems if we are to find ways of utilizing all elements of our society more effectively. The decisionmaking process must include not just the political and regulatory organizations, but also our professional organizations, and the disciplines they represent, and those organizations that are concerned about people.

We must never lose sight of the premise that facts must exist or be developed if a plan is to be well-founded. Speculation and conjecture are contrary to the basic assessment process.

Finally, our planning must include major efforts at examining alternatives rather than looking for a solution to a neatly stated problem. Unless we face up to these problems, we will waste resources, improperly utilize talented people, and be less than effective in finding the solutions to many of our complex problems. It is an awesome task to plan within the uncertainties of our time, but the need for success makes it worth the effort.