

Technology Assessment

Since 1966 many inquiries into the problems of technology assessment have been made by the House Subcommittee on Science, Research, and Development. In connection with these inquiries, the National Academy of Sciences, the National Academy of Engineering, and the Science Policy Research Division of the Library of Congress were commissioned to carry out three special studies dealing with different aspects of technology assessment. These reports served as a springboard for subcommittee hearings on technology assessment during the fall of 1969. The subcommittee heard testimony from many sources on mechanisms for technology assessment, related legal and political problems, and identification of selected areas of technology in which assessment is required immediately. Among the witnesses was Dr. William D. McElroy, Director of the National Science Foundation, who testified on problems of technology assessment as well as possible Foundation support activities. Because of the interest in this urgent and complex problem, highlights of Dr. McElroy's testimony follow.

The budgetary history of the past few years strongly suggests that, although science is truly an "endless frontier," there is a point beyond which the American people require something more than the pursuit of truth as an end in itself, without a proximate relationship to the worldly conditions of human life. The time has arrived, in my judgment, when the National Science Foundation must play a more active role in the formulation and recommendation of national science policy, for I would define "national science policy" as that which is concerned with the production, allocation, and use of scientific and technical resources—in the public interest. In particular, the Foundation must exercise a significant role in identifying the specific ways in which scientific research can contribute to efforts to cope with such major societal problems as environmental quality, urbanization and transportation, and to the international relationships of the United

States. It must thus be actively involved in recommending Federal and national policies on broad questions which, although not necessarily scientific in themselves, require an appreciation of the scientific factor in approaching sound decisions. And in support of this role the Foundation must further develop reasoned positions on such fundamental matters as the magnitude and distribution of the scientific research component of the Federal budget, needs for research in specific fields, opportunities for exploiting scientific events and developments in the national interest, and the means for meeting the needs for specialized scientific and technical manpower.

The national need for technology assessment activity on a greatly increased scale is appallingly evident. If technology is interpreted as a systematic means for altering the environment, natural or social, physical or biological, then understanding concerning the consequences of

the vast increases of technology that have occurred especially during this century, as well as those that can be foreseen, becomes a matter of vital necessity. But having said this, we immediately encounter a problem of almost insurmountable difficulty, one that is well illustrated by the reports of both Academies. These careful analyses suggest to me three somewhat interrelated aspects of the total problem.

Technology assessment is so complex a subject that it almost defies classification.

Assessments can be directed to the consequences of a technology; to the contributions of alternative technologies—singly or synergistically—in causing social changes that may be sought; to aspects of the biophysical environment that can be influenced in specific ways by technology; to the total effect of technol-

ogy on the life of an individual; or to combinations of these approaches. Which approach is chosen depends to a large extent upon the priority system that is used, and the system that is ultimately used for technological assessments also implies the priority system for the support of that fundamental science needed to make the assessments. This priority system would not replace that in use by the Foundation today, for there are many other purposes to be served; instead it would constitute an important supplement. But it would clearly be responsive to the needs of society for scientific research. For this reason alone I would consider the Foundation to be well advised to consider as diverse and varied an approach to technology assessment as possible, even though only a modest fraction of the Foundation's budget would be devoted to this activity.

The inadequacies of our techniques and data base almost render impossible a full assessment.

There is much that we must learn about the processes of technological change and how to forecast such change; about the ways in which scientific knowledge and understanding enter the process of innovation; about the behavior and dynamics of social systems; and about the legal, economic, or political responses to new technology. Without such knowledge, without the ability to predict—whether deterministically or statistically—there is little that we can do with confidence in the full development of a technological assessment. There is much that the Foundation does that has a bearing on technology assessment; but there is much that it doesn't do and that should be done.

Almost all technological assessments that have been made to date have been primarily concerned with the first order consequences of a technology.

Those who have sought either to exploit the technology in question or to restrict its use have sought primarily to determine its first order effects, that is, its technical, economic, or institutional feasibility or dangers. This is, however, only the beginning of a complex chain of considerations involving cost-benefit to society as a whole. There is an opportunity, therefore, for the Foundation, simply because it has no mission interests in the technologies in question, to support continuing assessments of the second, third, and higher order effects of specific technologies as they are exploited in today's environment. The important point is that we have begun to recognize that individual technologies are not atomistic in their effects on their surroundings, and that we must examine these effects before they can be given a clean bill of health for promotion—or prohibition.

The organizational analysis presented in the report of the National Academy of Sciences appears to be reasonable in most respects. I fully concur with the position that such a mechanism, although close to the sources of Executive decisionmaking, should retain its objectivity and its essential apolitical character in order to do its job.

- I agree that technological assessments should be sponsored through contracts with private organizations, and specifically I believe that private industry may play an important part in this activity. It may be appropriate for the Congress specifically to express its wishes on this matter.
- The urgency of the work to be done suggests that it will be necessary for the Foundation to seek proposals, and to initiate research either through sole source negotiation or through competition on a merit basis, for research necessary to resolve scientific matters related to a technological assessment.

THE ROLE OF THE FOUNDATION

A most significant contribution of the National Science Foundation in the complex area of technology assessment would be in the development of the scientific basis that can contribute to such assessments wherever they may be made:

- Examination of the implications of new scientific discovery with respect to the range of options available in potential technology, as well as the implications of newly emerging technology.
- The generation of both the scientific knowledge and the methodologies specifically needed to find solutions to high priority national problems that have been identified through technological assessments.
- Study of the complex dynamics of social, legal, political, and other systems, their mutual interactions, their processes and rates of adaptation to technological change, and the ways in which new or existing technology can best be used to accelerate or inhibit the responsiveness of these systems.
- The development of better tools for monitoring and studying the environment, for appraising the character and directions of technological advance, and for measuring the state of the larger systems that are influenced by technological developments. ■

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