TECHNOLOGY ASSESSMENT IN THE AMERICAN POLICY PROCESS

by

WILLIAM L. CHAPPELL, JR.

A DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in
the Department of Political Science
in the Graduate School of
The University of Alabama

UNIVERSITY, ALABAMA

1977

ACKNOWLEDGEMENTS

There are a number of people who deserve recognition for their contribution to the completion of this dissertation. I first wish to acknowledge the assistance of the members of my committee, Dr. Daniel W. Pound, Dr. Stephen Staub, Dr. William H. Stewart, Dr. B. W. Ponder, and Dr. Julian O. Doughty. Gratitude is especially due to Dr. Pound, both for help in developing and focusing my interest in the relationship between technology, society, and politics and, as chairman of the committee, for much valuable encouragement, advice, and coordination. Dr. Staub's suggestions for the case study approach used in this study were central to its design and his expertise in the area of public policy was particularly helpful. I also profited from Dr. Stewart's comments, both editorial and substantive, throughout the dissertation. Dr. Doughty's and Dr. Ponder's efforts were truly invaluable, both because of their willingness to participate in the kind of multidisciplinary analysis of technologically-related policy which is essential to furthering understanding of this study's subject. The help of these gentlemen is deeply appreciated; I could not have completed the dissertation without it.

I also owe recognition to several organizations which responded to requests for information. The Environmental Defense Fund, the National Audubon Society, and the ACS/NIH Organ Transplant Registry

were particularly helpful. Also replying in some fashion were the National Farmers' Union, the Sierra Club, the Manufacturing Chemists' Association, the Drug, Chemical and Allied Trades Association, and the National Wildlife Federation.

Finally, I wish to express my great appreciation for the interest shown by my friends at the University of Alabama and my colleagues at Columbus College. I am of course deeply endebted to Delane, my wife, for her support and encouragement during this undertaking and throughout my graduate career.

W. L. C.

May, 1977

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

MAN, TECHNOLOGY, SOCIETY AND GOVERNMENT: AN OVERVIEW AND INTRODUCTION

From the earliest times, technology has been a significant factor in human life and human society. Perhaps because of its omnipresent interpenetration of man's activities, the relationship of technology to the individual and society has received little overt attention for most of human history. At times, such as during the Industrial Revolution, both popular and scholarly notice has been taken of technological impacts, but inattention has been more characteristic. It may be argued that contemporary society represents a departure from this pattern. Not only is there a substantial body of scholarly inquiry into the subject but the revolutionary increase in the number and scope of technological applications seems to have resulted in notice being taken of the relationship by a wider segment of society. The specter of nuclear warfare has for the last three decades provided constant notice of modern technology. On a more mundane level, air and water pollution and energy problems have raised the same point. The success of such popular writings as Toffler's Future Shock[1] and Reich's The Greening of America[2] demonstrates that the

---

[1] Alvin Toffler, Future Shock (New York: Random House, 1970).

[2] Edward Reich, The Greening of America (New York: Random House, 1970).

impact of technology on society is the subject of greater interest and attention than had formerly been the case.

It is the purpose of this study to examine one aspect of technology in modern society, in particular, the ways in which decisions about technologically-related societal developments are made in the political system of the United States. The salient questions to be addressed and the procedures to be used are discussed in more detail below. It is necessary to first explain the foundations upon which this inquiry is based. These preliminary considerations include the specification of what is meant by "technology," the nature of the relationship between this phenomenon and human society, and why the relationship is a matter of interest for government as a social institution.

Defining Technology

As is frequently the case in the social sciences, definition in this area is a matter of imposing order on a complex universe for purposes of analysis rather than recording a naturally-occurring distinction. For the purposes of this study, "technology" is operationally defined as consisting of the class of phenomena in which man purposefully and knowledgeably uses physical devices and substances to extend his capacities. This definition draws heavily on Marshall McLuhan's perception of technologies as "extensions of man."[3] According to this perspective, mechanical technologies may be seen as extensions of human muscle, telecommunications as extensions of the visual and auditory senses, and

---

[3] McLuhan, Understanding Media: The Extensions of Man (New York: McGraw-Hill Book Company, 1964).

electronic data processing as extensions of the memory and calculation capacities or the human mind.

It may be noted that this definition is more restrictive than the common formulation of technology as the knowledge of means.[4] Among its advantages are a more precise denotation of phenomena and, by virtue of including a "hardware" component, a closer resemblance to the common usage of the term. The broader definition lacks precision in that it includes applications of resources which extend to social phenomena as varied as language and bureaucratic organization.

The more inclusive perspective is also of interest, however. For this study, the term "technique" is used to denote the entire realm of organization for purposeful activity. This use, which conforms to the applications of the term by Jacques Ellul and Robert M. MacIver, refers to a broader class of phenomena, of which technology as defined here may be said to constitute a subcategory.[5]

It should be emphasized that information for the use of devices and substances is an indispensable component of technology. As used below, "a technology," "technological system," or "technological application," refer to given configurations of devices and substances together

---

[4] Albert H. Teich, "Introduction," Technology and Man's Future (New York: St. Martin's Press, 1972), p. xii; Lynton Keith Caldwell, Environment: A Challenge for Modern Society (Garden City, New York: Natural History Press, 1970), p. 141.

[5] Ellul, The Technological Society, trans. by John Wilkinson (New York: Vintage Books, 1964), pp. vi, xxv, 3; MacIver, The Web of Government, rev. ed. (New York: The Free Press, 1965), p. 4.

with the information for their use. "Technologically-related policy" is used to refer to governmental actions which deal with the phenomenon of technology.

Technology and Science

It is useful to distinguish between the terms "technology" and "science," though the two are sometimes used interchangeably. Commonly, "science" refers to knowledge about physical or social phenomena. The activities involved in the accumulation of such knowledge may also be connoted by the term. Science is sometimes held to be the source of technological applications, though it is accurately observed by some writers that, historically, technology has proceeded independently of the science of its day, in the realm of craftsmen and mechanics.[6] For example, the knowledge of how to build a working steam engine preceded the development of systematic understanding of the physical properties and processes involved in the operation of the machine. This is not to say, of course, that all technology is independent of science. It may be argued that at the present time it is indeed characteristic for scientific knowledge to precede and provide the basis for technological developments.

Man, Technology, and Society

Man and technology have been interrelated since prehistory. Though it would be anthropologically respectable to argue that the ability

---

[6] Leland J. Haworth, "Desirable Initiative and Appropriate Self-Restraint," Science and Policy Issues: Lectures in Government and Science, ed. by Paul J. Piccard (Itasca, Illinois: F. E. Peacock Publishers, Inc., 1969), p. 117; A. Rupert Hall, "Cultural, Intellectual, and Social Foundations, 1600-1750," Technology in Western Civilization, ed. by Melvin Kranzberg and Carroll W. Pursell (2 vols.; New York: Oxford University Press, 1967). I, 110-113.

and practice of using tools is the sine qua non of humanness, it is not necessary for present purposes to do so. One may thus avoid exceptions such as limited tool use by chimpanzees and environmental alteration by ants. Similarly, whether using tools or some other factor is the essentially unique quality of the human species is not at issue. For the purposes of this discussion it suffices that man has in fact employed the knowledge of using material things to attain desired ends for thousands of years. For man to live without doing so is barely comprehensible. Among the oldest applications are weapons, agricultural implements, and tools for shaping these objects.[7]

It may also be taken as characteristic that man usually lives in company with other humans. Again it is unnecessary to address the question of the social nature of the species. Life in society has been characteristic. Technology thus assumes a social character from the earliest times and, it may be argued, has become more significant with increasing societal complexity. Improved achievement of ends through technological extensions increases in importance as individuals with differing specialties become interdependent to a greater extent. Whether specialization or technology is the primary factor is unanswerable; it may be speculated that an interactive relationship is characteristic. Whatever the configuration, the premise that society and technology are inseparable seems unquestionable.

---

[7] Melvin Kranzberg and Carroll W. Pursell, "The Importance of Technology in Human Affairs," in Kranzberg and Pursell, Technology, I, 11-26.

Technology and Government

Defining "government" has not been overly popular in political science of late, though it is a theoretical endeavor which enjoys a long history. Government has been considered in various ways, for example, as a manifestation of divine will, as the unfortunate but necessary means of protecting man's natural rights, and as the instrument of the ruling class. Perhaps the most recent generic definition is that employed in the systems approach, that is, that government and politics make up the social system which is uniquely capable of enforcing allocations of value on society as a whole.[8] This formulation is useful for examining the government-technology relationship because of the scope of responsibility and capacity for action which it connotes, as discussed below. At this point it suffices to say that, however government is defined or delineated, it must stand in some relation to the significant factors in its society. Government, as a collection of individuals in roles and structures defined by law and custom, in a state of isolation from the rest of society is incomprehensible. It is conceptually impossible that such a set of individuals would constitute a government.

If, then, government must have some relationship to significant factors in society, and technology is one such factor, government-technology interaction is unavoidable. This may take the form of encouraging technological developments or regulating them, both of which have been practiced by many governments throughout history. At the least, governmental non-action confers legitimacy on this form of social change. The United States government, for example, at the present time promotes

---

[8] See Chapter III for a discussion of this approach.

some technologies, especially those related to military and space exploration uses. Others are regulated, such as the communications industry. Little or no action is taken with regard to some technological applications, though the regulatory process expands on a more or less continuous basis.

In the literature which expresses interpretations of the nature of technology's impact on society government frequently plays an important role, though the significance of individuals and private groups is also recognized. A discussion of the variety of perspectives from which the technology-society relationship is viewed is presented below.

Technology and Society: The Nature of the Relationship

The visibility of technology as a societal factor seems related to the velocity of technological change. Thus, the rapid innovations of the Industrial Revolution may perhaps be credited with the attention of Karl Marx to the phenomenon, as well as that of Comte and others.[9] The developments in technology during this century, already mentioned above, have stimulated much consideration of technology and society and the relationship has been characterized in a number of ways. William Kuhns suggests that approaches to technological impacts on society may be classified according to their emphasis on either man or technology as the primary, or controlling, factor. Both the "man-technology" school and the "technology-man" perspective contain pessimistic and optimistic

---

[9] Sanford A. Lakoff, "Scientific Society: Notes Toward A Paradigm," in Piccard, Science and Policy Issues, p. 52.

characterizations.[10] Each of these categories is considered below, to be followed by discussion of a third perspective on the relationship, one which emphasizes mutual interaction between technology and society.

The "technology-man" perspective emphasizes technology itself as the motive factor in social change. Society is therefore a product of technology. Pessimistic observers see this as undesirable and eventually disastrous for man as man. That is, they see, or foresee, the human species becoming more machine-like, bereft of individuality and freedom, an adjunct to technological devices. Just as machine parts are interchangeable, so will individuals become. Cogs and gears or electrical switches perform efficiently and correctly; deviation, or "freedom," in such devices is counter-productive and should be minimized. So it will be with man, according to this perspective. A major exponent of this point of view is Jacques Ellul, who, as noted above, includes technology within the broader class of technique, encompassing other purposefully organized activity as well.

The optimistic viewpoint is based on the premise that, while technology does motivate change in the directions described above, it is not omnipotent. Man, if possessed of awareness and ingenuity, can avoid these consequences or at least mitigate them. Lewis Mumford and B. F. Skinner may be included in those using this perspective.

---

[10] William Kuhns, Environmental Man (New York: Harper & Row, 1969), pp. 18-26. In addition to this work and the specific references below, this discussion relies on William Kuhns, The Post-Industrial Prophets: Interpretations of Technology (New York: Weybright and Talley, 1971); Victor C. Ferkiss, Technological Man: The Myth and the Reality (New York: George Braziller, 1969); and Teich, Technology and Man's Future.

Identification of a third type of "technology-man" thought not specified by Kuhns seems justified. The writers expressing it describe at length the changes which technological innovation has wrought on society but reach conclusions primarily concerned with society's unawareness of the changes which are taking place. Marshall McLuhan's claim of the unnoticed revolution borne of widespread adoption of new communications media and Alvin Toffler's description of a society changed by the very velocity of change itself provide examples of this type of thought.

Those who take the "man-technology" point of view agree that technology is a significant force in society but see it as a force directed by the human element. That technological change is thus desirable and progressive is frequently said to have been the predominant attitude in Western societies before the "ecology boom" of the 1960's. The notion that all change is progress and all progress is good is characteristic of this kind of thought. For example, the President's Task Force on Science Policy stated in 1970:

> Our national purpose will become ever more critically dependent upon the excellence of our science and technology . . . advancing our scientific and technological capabilities . . . is vital to all national goals and purposes.[11]

This report cited "anti-science" attitudes but attributed them to "widespread lack of perspective and understanding" regarding the role of science and technology in "past and future improvement in the human condition."

---

[11] "Science, Technology and National Goals," in Teich, Technology and Man's Future, pp. 21-22.

More future-oriented expressions of optimism include the expectations of Buckminster Fuller and Richard Landers that technological change will be controlled by man in ways which will vastly improve his condition and capabilities. A more guarded optimism is displayed by Victor Ferkiss, who expects that man will conquer technological change by developing a new philosophy which will enable him to deal with it in a satisfactory and even uplifting manner.

Pessimists of the "man-technology" school do not fear that machines will dominate man but that some men will use machines to dominate and control other men in ways not available to dictators of the past. Perhaps the most well-known of these is the novelist George Orwell, whose 1984 provides an image of a tightly monitored and controlled totalitarian society where individual liberty, even in thought, is efficiently suppressed. The control is less harsh but no less complete in the anti-utopia portrayed by Aldous Huxley in Brave New World. Finally, Herbert Marcuse describes a totalitarian world which depends not on hidden cameras or tranquilizing drugs but on the complete and efficient organization of society itself in a way which prevents the emergence of serious opposition to the social establishment.[12]

The Third Perspective

The views discussed above emphasize either man or technology as the motive factor in social change. It is also possible to take a third

---

[12] George Orwell, 1984 (New York: Harcourt, Brace, 1949); Aldous Huxley, Brave New World (Garden City, New York: Doubleday, Doran & Company, Inc., 1932); Herbert Marcuse, One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society (Boston: Beacon Press, 1964).

perspective which emphasizes the interactive nature of technology-society relationships. This view is central to the concept of technology assessment, the major subject of this study.[13] This approach includes the recognition that technological developments have social impact, in possibly, but not necessarily, undesirable directions. The essence of technology assessment is the premise that the effects of technology on society can be identified, analyzed, evaluated, and counteracted, if necessary. Man is affected by technological change but is capable of recognizing such effects and has the option of attempting to interact with them purposefully rather than receiving them passively. In technology assessment's rationale there is no confidence that man will not be impacted upon by unintended technological effects nor that whatever he does to promote technological change will be beneficial for society. Instead, man is an active, self-directing component of the relationship when he chooses to be but he must act on the basis of information and understanding.

Government is an indispensable component in the concept of technology assessment. Other interpretations of the man-technology relationship include a governmental role, to be sure, such as that of the agent of oppression, promoter of technologically-borne benefits, or as a part of the societal mechanism operating according to the dictates of technological determinism. In most formulations of technology assessment, it is assumed that government must take the responsibility of acting for society in such a manner as to minimize detrimental effects and maximize

---

[13] Albert H. Teich, "The Movement Toward Control: Technology Assessment," in Teich, Technology and Man's Future, pp. 195-196.

benefits. Though study and evaluation may take place outside of government, action which prevents or dilutes undesirable consequences must come from the set of institutions and roles uniquely responsible for and capable of acting in the interests of society as a whole.

As usually proposed in the literature on the subject, technology assessment is an activity advocated for the national government, which, it is argued, should take the responsibility of identifying, evaluating, and acting on significant technological factors in society. A detailed examination of the concept, including the history of its development as a specific proposal, is undertaken in Chapter II. It is argued in that chapter that the concept as a specific proposal for a governmental program is confronted by certain difficulties because of the political environment in which it must be implemented. These include the limitations involved in the emphasis on assessment as a proposed activity of the national government, especially the legislative branch; in the impact of political factors on the process; in the reliance on institutionalization as a means of insuring utilization of expert information; and in the potential significance of assessment for the policy process itself.

In order to facilitate evaluation of the position of assessment activities in the political environment, a survey of the literature on public policy is undertaken in Chapter III. This discussion provides several alternative explanations for assessment's role in policy-making. These are tested for applicability and explanatory value in Chapters IV, V, and VI, which contain case studies of governmental decision-making on technologically-related matters. Specifically, the cases include analyses of the ban on the pesticide DDT, a proposal for a national data center to consolidate and process statistical information gathered by the

federal government, and the redefinition of criteria for determining death which resulted from advances in medical technology, in particular, the development of organ transplantation capacities. Finally, Chapter VII contains conclusions on the nature of technologically-related policy, especially the role of technology assessment activities in the process, and a discussion of the implications for society of the success or failure of technology assessment.

CHAPTER II

TECHNOLOGY ASSESSMENT

In this chapter technology assessment is considered in detail, beginning with an overview of the concept. The emphasis here is on technology and the political system as interactive sectors of society. Technology assessment is evaluated below as one perspective in that relationship, including the concept itself, its implementation, its achievements, and its limitations. It is argued that assessment at this time constitutes an imperfect instrument for societal control of technological developments yet is a subject which warrants further research because of its real and potential importance for society.

As discussed in the introductory chapter, there can be little doubt that technology is a significant factor in society and in societal change. For some observers the relationship is one of technological dominance while for others man is completely in control of his technological creations. Technology assessment is based on an intermediate view of the man-technology relationship. Implicit in the concept is the assumption that technological developments have a profound influence on society, in both intended and unintended ways, but also present is the significant premise that man can control and channel the effects of technology. Thus man is acted upon but is also capable of counteraction and prevention of technological consequences deemed undesirable.

The concept is discussed at greater length below, but, stated simply, the rationale of technology assessment is that it is possible to observe the effects of technology, including causal relationships. With the knowledge of what follows from a given technological application, it is possible to evaluate effects and counteract them or prevent similar events in the future if they are found to be undesirable. Man can be the mover in the society-technology relationship if he develops the necessary knowledge and methods. If he does not, there is a danger of being the object of undesired changes. Because of the pervasive influence of technology and the magnitude of its effects the assignment of a central role for government, as the set of institutions and roles uniquely responsible for society in its entirety, is unavoidable.

The effects of technology can be observed in every section of human society. Thus one may assess technology on several bases. The effects of technological applications on the physical world are, of course, an initial consideration, both in intended and in unforeseen manifestations. Given applications can be evaluated on their economic effect, that is, the benefits which they yield for a given investment in resources, or cost. More inclusive economic effects may also be assessed, such as the impact of technology, or the lack thereof, on a nation's international economic situation or on the productive capacity of a nation or economic sector.

Social effects may also be the subject of assessment. The changes in societal relationships following from technological developments have long been studied by anthropologists, usually in simple societies. In developed societies also technology impacts on such factors as the educational system, family relationships, and status

structures. The culture of a society may be affected as values change because of societal changes and because of increased or altered social options resulting from technology. Even politics and power relationships may be influenced, in terms of new resources available, increased capacity for communication, and changes in the political position of some sectors of society resulting from new applications of technology. Technology assessment, according to its rationale, should take all such factors into account in shaping technology and its effects into socially desirable consequences.

Conceptually, it is possible to formulate an ideal process for the application of technology assessment to its purpose of controlling technological effects. First, the existing situation should be assessed. That is, the effects of technology in the present are identified and evaluated. Evaluation, of course, implies assigning desirable or undesirable connotations to the consequences identified. Second, there must be some consideration of future developments in technological impacts. For application to society, as differentiated from assessment for purposes of study only, assessment requires consideration of the future, at least the near future. Past technological impacts may be assessed but they cannot be changed.

This step involves technological forecasting, of course. In its simplest form this may consist of assuming that the future will closely resemble the past, a premise called into question by the rate of technological and social change during the twentieth century. Forecasting, as an explicit attempt to anticipate technological developments, is a discipline with a slightly longer history than assessment. It is concerned with both exploratory forecasting, or the future direction of

current trends, and with normative forecasting, the specification of factors necessary for achievement of a desired state of affairs. A number of methods are employed, from statistical trend extrapolation in several forms to the structuring of intuitive judgments about what will take place in the future. Forecasters evaluate their undertakings not in terms of absolute accuracy but as an aid to planning to accommodate a variety of future developments. As its practitioners admit, forecasting is not an exact science. Thus consideration of the future dimension is not a guarantee of absolute reliability yet the attempt is essential to the application of assessment as it is conceptualized.[1]

A third step in the process of using technology assessment requires adoption of policies designed to maintain or strengthen desirable effects and to eliminate or alleviate undesirable ones. This is, of course, based on knowledge of the existence of effects, their evaluation, and the causal relationships involved. Finally, the process should be completed by a further assessment to determine the effectiveness of policies and to provide a basis for their adjustment. Thus, conceptually, assessment constitutes a process whereby man controls the effects of technology on society.

The literature on technology assessment contains a number of definitions which differ in various respects. The major elements are

---

[1] See Joseph P. Martino, Technological Forecasting for Decision-making (New York: American Elsevier Publishing Company, 1972); and Erich Jantsch, Technological Forecasting in Perspective (Paris: Organisation for Economic Co-operation and Development, 1967). In addition to these detailed accounts a useful statement on the limitations of forecasting is found in Olaf Helmer, "An Agenda for Futures Research," Futures, VII (February, 1975), 6.

contained in the following formulation, which states that technology assessment is:

> the process of studying the social, economic, political, and physical consequences of the application of a present or emerging technology.
>
> It can be defined as a systematic analysis, where all impacts and implications, direct or indirect, real or detrimental, of a technology are defined, evaluated and measured, and the cause-effect relationships identified. The results of a Technology Assessment should include alternative solutions to a problem, ranked according to the social cost-benefits, and recommendations for policy changes, control or mitigation options, or initiatives.[2]

Several points in this definition deserve emphasis. First, the process is intended to aid policy-making by providing alternative courses of action weighted according to the net social benefits and costs expected to result from them. A second aspect to be noted is that assessment is conceptualized as an extremely comprehensive process, concerned with a wide scope of technological impacts. Not only is the complete range of consequences to be identified and evaluated but all sectors of society and its environment are to be considered. Less visible but certainly present is a third point, that assessment is an activity involving the application of knowledge to the phenomenon of technological impacts on society. The central role of expertise is indicated by the characterizations of assessment as a process of "studying," "systematic analysis," and identifying "cause-effect relationships."

Conceptualization of assessment is a relatively simple task; it is a rational procedure for gathering information, applying it, and

---

[2] Bodo Bartocha, "Technology Assessment: An Instrument for Goal Formulation and the Selection of Problem Areas," in Technology Assessment in Dynamic Environment, ed. by Marvin J. Cetron and Bodo Bartocha (New York: Gordon and Breach Science Publishers, 1973), p. 339.

making adjustments based on observation of applications. In practice, however, the complexities of the physical, social and political worlds make implementation of the concept a much more difficult matter. In order to examine the capabilities and limitations involved in doing so it is necessary to look at the development of the concept and attempts at implementation. A first consideration is the development of assessment as an explicit goal of a movement involving governmental and academic proponents of the concept. Second, the capacities for assessment which have been developed require evaluation. The innovativeness of the concept is a third factor to be examined, because consideration of similar types of behavior is instructive regarding the present explicit attempt to apply assessment. Finally, the limitations of assessment at the current time and the value of the concept despite its problems are considered.

The Assessment Movement

The idea of explicitly attempting to develop the capacity to apply expert information to technological impacts for the use of policymakers may be said to have originated with former Congressman Emilio Q. Daddario, then chairman of the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U. S. House of Representatives.[3] The term "technology assessment" was apparently first

---

[3]The account of Congressional action on assessment relies on the following: Vary Taylor Coates, "Technology and Public Policy: The Process of Technology Assessment in the Federal Government: (unpublished Ph.D. dissertation, George Washington University, 1972), Chapter 1; Derek Medford, Environmental Harassment or Technology Assessment? (New York: Elsevier Scientific Publishing Company, 1973), Chapter 2; and David M. Kiefer, "Technology Assessment: A Layman's Overview," in Cetron and Bartocha, Technology Assessment, pp. 3-33.

used in a 1966 report of the committee. The assessment movement is frequently dated from 1967, when Daddario introduced a bill which provided for a presidentially-appointed Technology Assessment Board with the functions of identifying, evaluating, publicizing, and dealing with technological impacts. He stated that Congress urgently needed information on technology and its effects and characterized his proposal as a device to stimulate discussion on the subject. Pursuant to this end, the subcommittee held a seminar on assessment in September, 1967, with a number of academicians as participants.[4]

Discussion of the concept and its relationship to Congress continued in 1969, when the committee published three major studies it had requested earlier. The Science Policy Research Division of the Congressional Research Service, Library of Congress, produced Technical Information for Congress, consisting of case studies and general observations on technologically-related Congressional actions.[5] A second report was submitted by a panel of the Committee on Science and Public Policy (COSPUP) of the National Academy of Sciences. This work focused

---

[4] See U. S., Congress, House, Committee on Science and Astronautics, Technology Assessment, statement of Emilio Q. Daddario, Chairman, Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U. S. House of Representatives, 90th Congress, 1st Session, 1967 (cited hereafter as Daddario, Statement), p. 3; and U.S., Congress, House, Committee on Science and Astronautics, Technology Assessment Seminar, proceedings before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, 90th Congress, 1st Session, September 21 and 22, 1967 (cited hereafter as Technology Assessment Seminar).

[5] U.S., Congress, House, Committee on Science and Astronautics, Technical Information for Congress, report to the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, 92nd Congress, 1st Session, 1969 (cited hereafter as Technical Information). The document cited here is a 1971 revised edition.

on the conceptual and methodological requirements and restraints associated with assessment. It recommended "internalized" assessments, performed by agencies already making decisions relating to technological applications.[6] The third report, submitted by the Committee on Public Engineering Policy (COPEP) of the National Academy of Engineering, approached the subject by performing three model assessments. Its recommendations emphasized the need for an assessment mechanism independent of the decision-making process.[7] Information from these reports and from other sources was considered by the subcommittee in its 1969 hearings on the concept and the possible institutionalization of technology assessment.[8]

The outcome of the 1969 hearings indicates that the external approach to assessment was favored by the subcommittee. A bill was drafted providing for a Technology Assessment Board composed of members of Congress, ex officio representatives from the executive branch, and public representatives appointed by the President. A Director, chosen by

---

[6] U.S., Congress, House, Committee on Science and Astronautics, Technology: Processes of Assessment and Choice, report of the National Academy of Sciences to the Committee on Science and Astronautics, U.S. House of Representatives, 1969.

[7] U.S., Congress, House, Committee on Science and Astronautics, A Study of Technology Assessment, report of the Committee on Public Engineering Policy, National Academy of Engineering, to the Committee on Science and Astronautics, U.S. House of Representatives, 1969.

[8] U.S., Congress, House, Committee on Science and Astronautics, Technology Assessment, hearings before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, 91st Congress, 2nd Session, November 18 and 24, December 2, 3, 4, 8, and 12, 1969 (cited hereafter as 1969 Hearings).

the Board, would operate an Office of Technology Assessment, with the duties of carrying out assessment tasks for presentation to the appropriate organs of Congress. Extensive hearings were held on the proposal in 1970 and resulted eventually in H.R. 18469.[9] The new bill also featured a Board and Office of Technology Assessment, with the duty of initiating assessments to be carried out by the National Science Foundation and the Congressional Research Service. Though reported favorably by the whole committee and accompanied by a similar bill in the Senate, the proposal was not acted on further in 1970.

Apparently, legislators increasingly perceived a need for more information about technological impacts and, perhaps, the importance of such impacts as a political issue grew. During the next session of Congress the same legislation was reintroduced and became law in October, 1972, having been amended. As enacted, the legislation created a bipartisan Technology Assessment Board of six Senators, six members of the House of Representatives, and a non-voting Director. The Office of Technology Assessment, under the Board and Director, has the responsibilities of "providing early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress."[10]

---

[9] U.S., Congress, House, Committee on Science and Astronautics, Technology Assessment - 1970, Parts I and II, hearings before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, 91st Congress, 2nd Session, on H.R. 17046, March 13, 14, 16, 17, 28, 29, May 20, 21, 27, June 2 and 3, 1970 (cited hereafter as 1970 Hearings - Part I and 1970 Hearings - Part II).

[10] On the final stages of action by Congress, see "Technology Office" Congressional Quarterly Almanac, XXVII (1972), 692-694; and Laurence H. Tribe, "Technology Assessment and the Fourth Discontinuity," Southern California Law Review, XLVI (June, 1973), 624.

Thus far, there have been few indications that the creation of the Office of Technology Assessment (OTA) has revolutionized technologically-related policy-making. Some of its documents, for example, demonstrate nothing more than narrow-range considerations of a single factor, such as economic cost-benefit analysis or effectiveness of pollution prevention devices, worthwhile as such, but falling short of the expectations of the assessment movement.[11] The symbolic value of the OTA is probably substantial for the movement, however. In addition, the reports and testimony associated with Congressional inquiry into the subject constitute a major contribution to the assessment literature.

Though the primary emphasis of the movement has been on Congress, technology assessment capabilities in the executive branch have also received attention. The National Academy of Public Administration issued a report on the subject in 1970 and there have been several post hoc characterizations of existing executive branch activities as "technology assessment."[12]

Other manifestations of the assessment movement include academic interest in the subject, including college courses on assessment and

---

[11] See, for example, U.S., Congress, Office of Technology Assessment, A Review of Alternative Approaches to Federal Funding of Rail Rehabilitation (August, 1975); ibid., The Financial Viability of Conrail (September, 1975); and ibid., Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures (July, 1975).

[12] U.S., Congress, House, Committee on Science and Astronautics, A Technology Assessment System for the Executive Branch, report of the National Academy of Public Administration to the Committee on Science and Astronautics, U.S. House of Representatives, 1970; Alan H. Kaplan and Robert H. Becker, "Technology Assessment and the Food and Drug Administration," in Technology Assessment: Understanding the Social Consequences of Technological Applications, ed. by Raphael G. Kasper (New York: Praeger Publishers, 1972), pp. 175-187; and Vary Taylor Coates, "U.S. Executive Agencies and Technology Assessment," in Cetron and Bartocha, Technology Assessment, pp. 497-517.

university-sponsored seminars.[13] The substantial literature on assessment is itself an indication of interest. Writings include both conceptual and methodological considerations. In the following section the literature is discussed, with a necessary emphasis on methodological needs rather than accomplishments.

Toward A Technology Assessment Capability

The literature contains substantial agreement on the general form of an assessment mechanism. Because of assessment's comprehensive nature, contributions from experts in a wide variety of fields are considered essential. It is agreed that these individuals should be chosen on an *ad hoc* basis for the assessment task and that leadership and coordination are central factors. Necessary resources of time and money are held to be significant, cost being estimated at one hundred thousand dollars or more and time at, preferably, one year.[14]

There is also some consensus on the sequence of operations conceptually required for an assessment. The lists vary in detail but a general description of the sequence thought proper may be constructed. Assuming that a problem area has been assigned, usually conceded to be a political function, an assessment team should:

---

[13] Medford, *Environmental Harassment or Technology Assessment?*, pp. 311-312. Kasper, *Technology Assessment*, is a collection of papers presented at a series of seminars in 1969 and 1970 at George Washington University.

[14] See *A Study of Technology Assessment*, pp. 30-37; Bartocha, "Technology Assessment: An Instrument," p. 349; Joseph F. Coates, "Interdisciplinary Considerations in Sponsoring Technology Assessments," in Cetron and Bartocha, *Technology Assessment*, p. 514. Problems of coordination and time are illustrated in Steven Ebbin, "Jamaica Bay/Kennedy Airport: Anatomy of a Technological Assessment," in Cetron and Bartocha, *Technology Assessment*, pp. 295-335.

(1) Identify the problem to be assessed;

(2) Gather data on the problem;

(3) Identify technological impacts and affected parties;

(4) Evaluate the impacts on the affected parties;

(5) Compare policy options on the basis of (4); and

(6) Communicate findings to appropriate decision-makers.[15]

Examination of the literature indicates that conceptual delineation is considerably easier than the development of methodological capabilities required for successful completion of assessments.

In connection with the first two steps in the process, there seem to be few contributions in the assessment literature. On these points the expertise of the disciplines auxiliary to assessment is relied upon. Data gethering also faces problems specific to assessment, several of which are discussed below in connection with impact identification and evaluation. It may be noted that the difficulties discussed below relate especially to assessment of social and political effects. Economic cost-benefit analysis and physical consequences are subjects on which the relevant disciplines offer relatively reliable information, though limitations exist, as is discussed in a later section.

With regard to identification of impacts and affected parties, the major methodological response has been the development of comprehensive lists of possible impacts and potential affected parties. Bodo Bartocha, for example, suggests basing such a system on a framework of

---

[15] This list is formulated from those in Bartocha, "Technology Assessment: An Instrument," pp. 344-346; the statement of Chauncey Starr in 1970 Hearings - Part II, p. 344; Louis H. Mayo, "The Management of Technology Assessment," in Kasper, Technology Assessment, p. 88; and Gabor Strasser, "Methodology for Technology Assessment: Case Study Experience in the United States," in Cetron and Bartocha, Technology Assessment, p. 915.

societal, environmental, and individual factors deserving of consideration. The formulation offered by Donald Overly contains sixty-seven variables to be monitored, under the categories of demographic, social, political-legal, technological, and ecological impacts.[16] Though complex, such systems can be manipulated, of course, if the data are available. As to how the requisite monitoring and data gathering are to be accomplished, the assessment literature contains two points of consensus. First, some system of social indicators is needed to reflect the emergence of technological impacts. This idea is not original with assessment proponents and there is an independent literature on the subject, of course. The second point of agreement is that such a system of indicators is not currently available.[17]

The problem of a monitoring system is exacerbated by the requirements of the evaluation phase, that is, some means of determining the relative significance of impacts on affected parties. Systematic analysis in this area of assessment is generally held to require quantification of impact significance. This capacity is needed for accurate monitoring, for determining the existence and degree of change, and to

---

[16] Bartocha, "Technology Assessment: An Instrument," pp. 343-344; Donald Overly, "Introducing Societal Indicators into Technology Assessment," in Cetron and Bartocha, Technology Assessment, pp. 577-580.

[17] See, for example, Marvin J. Cetron, "Some Modest Conclusions in Technology Assessment," in Cetron and Bartocha, Technology Assessment, p. 1034. On social indicators, including the serious problems involved in setting up such a system, see Raymond A. Bauer, ed., Social Indicators (Cambridge, Mass.: The M.I.T. Press, 1966); Peter Henriot, "Political Questions About Social Indicators," Western Political Quarterly, XXIII (June, 1970), 235-255; and Dennis L. Little, "Social Indicators and Public Policy: Some Unanswered Questions," Futures, VII (February, 1975), 41-49.

facilitate the later step of comparison between alternative courses of action. The apparently analogous devices of economic indicators and cost-benefit analysis use monetary values for this purpose.[18]

Assessment, on the other hand, is generally held to require consideration of non-economic impacts. Many of the effects of technological applications discussed in the assessment literature and in more general works on technology relate to values not easily stated monetarily. Such effects as death or injury are relatively objective and are quantifiable but other technological impacts involved concern more abstract phenomena, such as aesthetic values, rights, freedom, and human happiness.[19]

One response to this problem has been the elaboration of methods for monitoring and analyzing objective but non-monetary effects. One such attempt, primarily conceptual, involves a grand formula based on such terms as leisure time available to members of society, the stock of real goods, and available living area, with the purpose of quantifying the total state of society at a given time.[20] Its application has not

---

18 Marvin J. Cetron and Donald N. Dick, "Measurement and Technology Assessment," in Cetron and Bartocha, Technology Assessment, p. 643; and Franklin P. Huddle, "The Social Function of Technology Assessment," in Kasper, Technology Assessment, pp. 159-161.

19 A Study of Technology Assessment, pp. 5, 29; J. Seetzen and H. Sauer, "Technology Assessment in Germany," in Cetron and Bartocha, Technology Assessment, p. 232; Medford, Environmental Harassment or Technology Assessment?, p. 33; Kiefer, "Layman's Overview," p. 17; and the statement of Don E. Kash, 1969 Hearings, p. 120.

20 Seetzen and Sauer, "Technology Assessment in Germany," pp. 223-237.

yet been demonstrated, apparently. More concrete manifestations of this approach deal with death, personal injury, or group injury as impacts and suggest some potential for success in quantitative monitoring.[21]

Translation of effects like death or injury into a framework for comparison with other effects encounters significant problems. Attempts usually involve trying to value death or injury economically, because monetary value is the most obvious device for comparative valuation.[22] For example, one such application discusses at length the cost of accidents in terms of life earnings lost, insurance costs, legal expenses, and so forth, but adds that this is "perhaps" too simple a view of the value of human life. The possibility is noted that an individual will pay more to avoid likely death than he would otherwise earn in his remaining lifetime![23] Since this occurrence seems entirely possible, it is likely that establishing an equivalence between objectively occurring but subjectively valued impacts and some common valuation system, such as monetary cost, faces substantial problems, in policy implementation if not among analysts.

Further problems beset efforts to establish a means of evaluating impacts on values which are essentially subjective. Aesthetic concerns,

---

[21] See Chauncey Starr, "Benefit-Cost Studies in Socio-Technical Systems," in Cetron and Bartocha, Technology Assessment, pp. 799-831; C. Sinclair, "Technology Assessment in Great Britain," in Cetron and Bartocha, Technology Assessment, pp. 35-73; and Clarence H. Danhof, "Assessment Information Systems," in Kasper, Technology Assessment, pp. 7-21.

[22] The difficulties involved are noted T. J. Gordon and H. S. Becker, "Utilization of Cross-Impact in Technology Assessment," in Cetron and Bartocha, Technology Assessment, p. 663. Use of economic values is defended in Jantsch, Technological Forecasting in Perspective, p. 200.

[23] Sinclair, "Technology Assessment in Great Britain," pp. 48-58.

human rights and freedom, and individual satisfaction or happiness may be regarded as legitimate categories for impact consideration yet are difficult to quantify, to say nothing of translating them into a common, comparable value system.[24] One approach to the difficulty, basic to the social indicators idea, involves taking certain objective factors as indices to specified subjective ones. The accuracy of such a procedure seems questionable at present.[25] Rendering values comparable would remain a problem even if satisfactory indices could be identified and monitored.

In another attempt to deal with problems of evaluation, some students of assessment utilize the "matrix approach." It uses the cells of a square or rectangular matrix to represent interactions between technological events, national goals, or other items of interest in an effort to provide systematic treatment of all possible interrelationships. The significance of interactions is estimated by the analyst or analysts, using a scoring system of some sort. The values obtained are subjective but are replicable and quantitative, according to matrix

---

24 It should be noted, perhaps, that Jantsch, Technological Forecasting in Perspective, p. 37, considers "happiness" a "trivial formula" for analytical purposes; nevertheless, it still crops up in some discussions of technological impacts.

25 Mark Schneider, in "The 'Quality of Life' and Social Indicators Research," Public Administration Review, XXXVI (May/June, 1976), 297-305, compares objective surrogate indicators and subjective evidence from opinion polls and finds little resemblance between the accounts of the state of society resulting from the two methods.

users, thereby facilitating analysis and comparison.[26] Whether such an approach is limited to expert estimation or if it can be extended to accommodate subjective valuation by a wider group, perhaps through opinion sampling, has not received attention at this point. It should be noted that, despite its users' cautionary statements, subjective quantification perhaps results in the danger of a spurious reliability being attributed to matrix analyses.[27]

The next step in the assessment process after valuation is that of comparing alternative policy options in terms of net social benefit or cost. Most of the problems encountered at this stage stem from obstacles to quantitative valuation of impacts. Optimum comparability requires reference to identical or similar measurements of value, not presently available for reasons discussed above. Methodological efforts dealing with comparison usually follow the example of cost-benefit analysis. Some comprehensive formulae are available, designed to total costs, direct and indirect, for balancing against intended and unintended benefits, thus providing a conceptual means of comparing net social

---

26 This technique is described in the following, all in Cetron and Bartocha, Technology Assessment: Cetron, "Some Modest Conclusions," p. 1034; Marvin J. Cetron, "The Trimatrix--An Integration for Technology Assessment," pp. 673-707; Marvin J. Cetron and Lawrence W. Connor, "A Method for Planning and Assessing Technology Against Relevant National Goals in Developing Countries," pp. 239-270; Cetron and Dick, "Measurement and Technology Assessment," pp. 641-661; Gordon and Becker, "Utilization of Cross-Impact," pp. 663-672; and Christine A. Ralph, "A Macro Assessment Methodology," pp. 709-730.

27 See Medford, Environmental Harassment or Technology Assessment?, p. 8; and Kenneth E. Boulding, "Reflections on Planning: The Value of Uncertainty," Technology Review, LXXVII (October-November, 1974), 8.

benefit or cost for each of several alternative courses of action.[28] While of use in conceptualizing the methodological requirements of assessment, specific applications seem to have limited utility in the absence of some means of rendering valuations comparable.

In addition to problems already discussed, a technology assessment capability is limited by factors affecting the fields of knowledge on which assessment depends for information. The difficulties faced by the social sciences in achieving highly reliable knowledge about social phenomena are widely recognized. The reliability of information in the physical sciences is limited in ways which receive less attention.[29] This is visible, for example, in the lack of "scientific" consensus on the effects of technological applications. The supersonic transport debate provides an illustration of disagreement between individuals of equal qualifications in the sciences. The same phenomenon can be observed in many similar disputes, of course.[30]

Difficulties of this kind make up what may be called the complexity problem, also termed the "everything is related to everything

---

28 See, for example, Strasser, "A Methodology for Technology Assessment," pp. 905-937.

29 See Technical Information, p. 13; and the statement of James Buzzell, in 1970 Hearings - Part II, p. 864. A noteworthy corrective to the usual view of the sciences as progressive accretions of absolutely reliable knowledge is provided in Thomas S. Kuhn, The Structure of Scientific Revolutions, Vol. II, No. 2, International Encyclopedia of Unified Science (Chicago: University of Chicago Press, 1962).

30 See Joel Primack and Frank Von Hippel, "Scientists, Politics and SST: A Critical Review," Bulletin of the Atomic Scientists, XXVIII (April, 1972), 24-30; Technical Information, p. 509; and Arthur H. Purcell, "Bringing Science to the Congress," Technology Review, LXXVII (March-April, 1975), 12.

else problem."[31] At its base is the very nature of the physical and social worlds, in which many factors interrelate with and impact to each other. Cause-effect relationships are difficult to identify, classify, and evaluate with certainty. The problem is especially acute when technology assessment's emphasis on such relationships for all sectors of society is considered. For an example of the complexities involved, one need only consider the difficulty which an early-twentieth century assessor of automobile technology would have had in foreseeing unintended effects on social values, housing patterns and urban development, and air quality.[32] While most proponents of assessment would probably agree that truly comprehensive assessment is not presently possible, it is likely that they would also contend that the immensity of the task does not preclude attempting to deal with it.

Because of the limitations on knowledge in auxiliary disciplines as well as its own unique methodological requirements, the capacity of technology assessment as an explicit attempt to specify on a very comprehensive scale the impacts of technological developments must be regarded as somewhat limited. It may be accurately objected that the field is new. As a movement embodying an effort to purposefully develop a capacity to perform its stated functions, technology assessment is an innovation. It is argued in the following section, however, that many types of past activity, both within government and external to it, are

---

[31] The phrase is that of Walter A. Hahn, in "The Future of Technology Assessment in Policy Formulation," in Cetron and Bartocha, Technology Assessment, p. 1018.

[32] Raymond L. Bisplinghoff, "Foreword," in Cetron and Bartocha, Technology Assessment, p. x.

generically identical to technology assessment. Consideration of this phenomenon is useful in examining both the origins of the assessment movement and the environment in which it must operate.

Assessing Technology as a Type of Behavior

It can be demonstrated that there are at least two important classes of behavior which constitute assessment, that is, evaluation of importance or value, of technological devices, in addition to the specific meaning attached to the phrase "technology assessment" in the literature discussed above. These may be labelled, for present purposes, first-order and implicit-comprehensive assessment. Assessment in all of the senses noted is based on the same rationale and operates under similar constraints.

Assessment depends on a rationale basic to a great deal of human behavior. This is the premise that, in the world of phenomena comprehended by human perception, certain kinds of events follow other specified kinds of events, within a range of predictability sufficiently narrow to allow purposeful action. The use of the cause-effect relationship is basic to human orientation to social and physical environments. It lies at the base of technology itself, as the applications of certain means to attain a desired end.[33]

---

[33] See Kenneth E. Boulding, "The Role of the Social Sciences in the Control of Technology," in Teich, Technology and Man's Future, pp. 263-274. It should perhaps be noted, following David Hume, that causality is not observed but inferred from observations of time sequences of events. Nevertheless, the hypothesis of cause and effect is workable enough to allow organization of the world within manageable limits. See David Hume, A Treatise of Human Nature, Book I, Part III, Section VI, in The Philosophy of David Hume, ed. by V. C. Chappell (New York: The Modern Library, 1963), pp. 78-84.

Knowledge of the perceptible world in the physical and social sciences is based on the further assumption that causes and effects may be observed and categorized according to their similarities. Through one's observations, and the communicated observations of others, information of a usable reliability about the observed phenomena may be accumulated. In assessment, the use of this process takes the form of gathering observations about effects which follow causes identified as technological. Information thus gained serves as the basis for purposeful initiation of causes leading to desired effects. The premise that human activity can impact on physical and social phenomena is central to assessment in its specific and generic senses. Thus, the activity of the assessment movement in particular may be characterized as seeking the "technology-to-coordinate-technologies," because of its purpose of applying knowledge to achieve chosen ends.[34]

That the knowledge gained in the manner described is not of perfect reliability has already been noted. Interaction of phenomena in the physical and social worlds occurs in an extremely complex manner and complete understanding of relationships is yet to be achieved. For example, the technology of chemical pesticides is based on the knowledge that the release of certain substances into the environment is followed by a decline in the number of insects in the area. In the case of DDT there is considerable evidence that other effects follow in a longer time perspective. The substance is absorbed by marine life and accumulates to successively higher levels in fish feeding on that life and in

---

[34] Todd R. LaPorte, "The Context of Technology Assessment: A Changing Perspective for Public Organization," Public Administration Review, XXXI (January-February, 1971), 68-69.

birds feeding on fish. Eventually the chain of effects includes impairment of reproductive capacity in fish-eating birds.[35] All of these events are consequences of the same cause, or many repetitions of the same cause, yet all except the first and intended consequence went largely unnoticed for two decades.

Knowledge of some sequences such as that described above allows division of effects or consequences into classes useful to the observer, though not occurring in nature. Effects which occur in a relatively short time are termed "first-order" and are usually purposefully sought. Events occurring later and possibly involving interaction with additional factors unrelated to purposeful application are termed "second-order" and are less frequently considered in choices relating to purposeful use. It is in the latter category that the great limitations to knowledge are encountered. The example cited above deals with the physical-biological world; the greater range of unpredictability existing in the social world renders it more difficult to comprehend. Human perceptions, emotions, and purposeful actions allow a greater range of possible consequences than do interactions of physical forces and substances.

Assessment or evaluation of technology in terms of first-order consequences may be said to be as old as technology itself. Devices may be discovered accidentally but continued use involves some evaluation of usefulness. A primitive man might accidentally discover the superiority of flint over wooden implements or no tool at all but continuation would require some judgment of the desirability of the consequences of its use. Though the assessment literature does not give much attention to the

---

[35] James L. Pyle, Chemistry and the Technological Backlash (Englewood Cliffs, N. J.: Prentice-Hall, 1974), pp. 132,138-139.

idea, this basic kind of assessment is the mechanism by which technological applications become important enough to be considered the saviors or destroyers of society. Until the advent of truly independent devices, such as the malevolent robots and computers of science fiction, technology is applied by individuals, either alone or in groups of varying complexity, on the basis of an assessment of some kind. This holds true for flint and iron, plows and tractors, the wheel and the steam locomotive, and the abacus and the electronic computer. It is by aggregations and accretions of choices regarding the net value of devices that the technological sector of society changes.[36]

First-order assessment may be said to include activities of manufacturing and marketing of technological devices. Assessments are made in terms of the utility perceived by prospective purchasers, this in turn affecting the desired ends of those engaged in manufacturing and marketing.[37] Some of the most intense attention given to first-order assessment may be found in market analysis and advertising research. A completely economic interpretation of first-order assessment should be avoided, however. Though productivity is frequently a factor in such evaluation, not all technological applications are entirely economic.

---

[36] See the statements of Howard R. Bowen and Melvin Kranzberg, Technology Assessment Seminar, pp. 4 and 76; and Everett M. Rogers, Diffusion of Innovations (New York: The Free Press, 1962), p. 1.

[37] Danhof, "Assessment Information Systems," pp. 9-11; Bowen, in Technology Assessment Seminar, p. 4; and the statement of Milton Katz, in 1969 Hearings, p. 174.

This is illustrated by recreational technology and by technological adoptions based on novelty and convenience.[38]

Even in assessment of technology relevant to economic productivity, there are other criteria of choice. The substantial literature on the diffusion of innovations, of long standing in some disciplines but seldom noticed by the assessment movement, indicates that individual choice is affected by many factors, social and psychological as well as technological and economic.[39] This may reflect a second-order consideration in terms of an innovation's effect on one's community standing or psychological comfort in the presence of change. The decision still focuses on the individual as potential user. The limited comprehensiveness of first-order assessment, in terms of effects and of individuals affected, is its primary characteristic.

This most basic sort of assessment activity is of interest for this study because the phenomena dealt with by decision-makers are the composite result of first-order assessment and decision in many cases. The impacts of automobile technology, for example, including air quality and urban growth patterns, came about because of numerous decisions to utilize the technology in question. Action taken to change situations identified as undesirable must also take this into account, either by altering the criteria of first-order decisions or by removing the

---

38 Huddle, "Social Function," p. 152; Tribe, "Technology Assessment and the Fourth Discontinuity," pp. 641-642; and Ellul, The Technological Society, p. 15.

39 Rogers, Diffusion of Innovations, provides an extensive discussion of the phenomenon, as well as an account of the literature in this area.

technological application in question from the realm of the user's choice.

A second major category of assessment-type behavior has as its distinguishing characteristic an increased comprehensiveness. This may include consideration of second-order effects as well as examination of impacts on a wider sector of society than is the case with first-order assessment. As manifested in behavior, implicit-comprehensive assessment is distinguished from the efforts of the assessment movement by the absence of the explicit label "technology assessment." The term "partial assessment" has also been used to refer to the same phenomenon but is rejected here because explicit assessments are quite difficult to make on a truly "comprehensive" basis and hence are partial themselves.[40]

For conceptual and analytical purposes, assessments of the implicit-comprehensive type may be classified on the basis of the actor undertaking the assessment. Two major subcategories of usefulness are those of "private" and "governmental" assessment, though the distinction may be difficult to apply in cases such as governmentally-financed university research.

One type of private comprehensive assessment, particularly evident in the last fifteen years, is that which may be called "publicist." It is performed by non-governmental actors who collect and make public information about technological effects with the purpose of increasing awareness of such impacts and, not infrequently, of persuading others to act on the basis of the information and arguments presented. On a very general level, the novels of Huxley and Orwell represent assessments of

---

[40] See Bartocha, "Technology Assessment: An Instrument," p. 337.

this type.[41] More identifiable as assessments of particular technologies are such writings as Rachel Carson's Silent Spring and Ralph Nader's Unsafe At Any Speed, which identified second-order hazards associated with pesticide and automobile technologies, respectively.[42] Manifestations of this type emphasize detrimental effects and therefore may be further labelled as "polemic." They are comprehensive both in terms of the range of effects and the scope of affected parties.

Assessments of the polemic variety are frequently answered by another type of private publicist assessment. This may be called the "exculpatory," because it emphasizes the beneficial effects of a criticized technology. Carson's book, for example, was answered quickly and sharply by pesticide manufacturers who assured the public that the hazards of pesticides were few and insignificant in comparison with the great benefits they allowed in food production, a first-order consequence but one comprehensive in terms of effects on the entire society.[43]

There may also be private assessments which can be classified as "scholarly," that is, produced by individuals with academic credentials in some field. These assessments by definition have the appearance of objectivity, though disagreement between qualified individuals may lead

---

41 See Kiefer, "Layman's Overview," p. 8; and Melvin Kranzberg "Historical Aspects of Technology Assessment," Proceedings of the Engineering Foundation Research Conference on "Technology Assessment," Proctor Academy, Andover, N.H., August 4-8, 1969, in 1969 Hearings, p. 384.

42 See Bartocha, "Technology Assessment: An Instrument," p. 337; "Layman's Overview," p. 8; Kranzberg, "Historical Aspects," p. 385; and Richard A. Carpenter, "Technology Assessment and the Congress," in Kasper, Technology Assessment, p. 32.

43 The case study on the DDT controversy in Chapter IV examines this phenomenon in more detail.

to charges that scholarly assessments are actually polemic or exculpatory in nature.

Governmental implicit-comprehensive assessments are those performed by public agencies or officials. The aura of roles charged with responsibility for society as a whole is such that polemic or exculpatory motives are difficult to identify with any objectivity, though such characterizations may be made by opposing parties in controversies over governmental assessments. Useful subcategories here are "operational" and "investigatory" assessments.

Operational assessments are those embodied in decisions which implicitly involve evaluations of the net worth of a technological application but are made without explicit investigation of beneficial or detrimental effects.[44] Investigatory assessments have the examination of such effects as an avowed purpose, though the comprehensiveness of any actual investigation may be in question, of course. For examples of the two types, consider transportation policy in the United States. Numerous decisions resulting in the predominance of highways over public transportation have certainly had an impact on technological development and the occurrence of second-order consequences yet were apparently made on diffuse assumptions regarding benefits and costs. An investigatory

---

[44] The role of government as sole sponsor of some technologies too costly for private development, such as space exploration and modern weapons systems, raises the question of whether or not this type of assessment is, in some cases, more accurately considered as an example of first-order assessment. For the purposes of this study, however, the distinction is rejected because such actions are by the definition of government comprehensive in the range of affected parties considered. See Boulding, "The Role of the Social Sciences," p. 271; Carpenter, "Technology Assessment and the Congress," p. 31; and Harold P. Green, "The Adversary Process in Technology Assessment," in Kasper, Technology Assessment, p. 55.

assessment of the same phenomenon might take the form of inquiry into exhaust pollution, possibly undertaken by a Congressional committee, an advisory panel, or the Environmental Protection Agency.

Governmental assessments of both types have been conducted for a long time and have been the basis for many kinds of policy action. One form is the policy of inaction, or allowing the market mechanism to perform the assessment function. This is occasionally urged as a present-day alternative, but most students of assessment agree that the market operates primarily in short-term, first-order consequences and is insufficient for the protection of societal interests.[45] There is also considerable agreement that pure market regulation has been rare. For example, long-standing legal doctrines of liability influence the assessment calculations of manufacturers and marketers. More direct regulation is not uncommon, of course, and there is substantial consensus that the present system in the United States is a mixture of market and public assessment mechanisms.[46]

Overt, positive assessments in the United States have a long history and may be found in all parts of the governmental structure. Presidential initiatives and Congressional authorizations for weapons systems or highway construction constitute operational assessments. Regulation of communications or drugs, for example, by Congress,

---

[45] Statement of Larry E. Ruff, 1970 Hearings - Part II, p. 364. More typical of the movement's attitude are the views of Daddario, Statement, pp. 7-8; and Harold P. Green, "The Role of Law and Lawyers in Technology Assessment," in Cetron and Bartocha, Technology Assessment, p. 630.

[46] Statement of Milton Katz, 1969 Hearings, pp. 174-175; Daddario, Statement, pp. 7-8; Carpenter, "Technology Assessment and the Congress," p. 30; and Bowen, in Technology Assessment Seminar, p. 4.

regulatory agencies, or executive agencies partakes of investigatory assessment and there are, of course, more explicit investigations. A frequently cited example of the age of this type of activity is the 1830's study on preventing steamboat boiler explosions, commissioned by Congress.[47] A notable development in such activity is marked by the passage of the National Environmental Protection Act of 1969, in particular the provision requiring federal agencies to submit environmental impact statements on their programs to the Council on Environmental Quality. These documents constitute assessments of particular configurations of technological applications.[48] A generalization about activity of this type worthy of note is that many investigatory assessments have been motivated by disasters or crises. Examples include the loss of the submarine Thresher and the 1965 power blackout in the northeastern states.[49]

In summary, government agencies have been assessing technology for a considerable period of time, in one way or another, as has been recognized in the assessment literature. The primary reason cited by the assessment movement for its initiation and development is not that such activity has not taken place but that it has been insufficient to optimize societal benefits from technology or even to minimize risks. The next section considers these motivating factors in some detail.

---

[47] Cited by Daddario, Statement, p. 10.

[48] Tribe, "Technology Assessment and the Fourth Discontinuity," p. 624.

[49] Daddario, Statement, p. 10; Kiefer, "Layman's Overview," p. 4; and Vary Taylor Coates, "U.S. Executive Agencies," p. 510.

Why A Technology Assessment Movement?

The basic justification for an explicit technology assessment capability is that the mechanisms which have performed this function previously are becoming increasingly inadequate. According to the proponents of assessment, a purposeful, explicit, systematic, comprehensive, and even dedicated effort is required to enable government, especially the national government and especially Congress, to fulfill its responsibilities to society in connection with technological change and technological impacts. There are more problems requiring effective, coordinated action and they are more serious than in the past. Assessment, according to its advocates, represents the needed innovation.[50]

A number of aspects of the present situation have been identified as problems requiring innovative response. The rate of technological change and levels of technology utilization are said to be higher than ever before. The accuracy of these generalizations is illustrated by such trends as exponential growth in fossil-fuel consumption and a decreasing time lag between the invention and the application of technological innovations.[51] Technological capacity is another consideration; weapons technology is vastly increased in capability since the

---

[50] Carpenter, "Technology Assessment and the Congress," pp. 30-32. Cetron, "Some Modest Conclusions," p. 1033; Raphael G. Kasper, "Introduction," in Kasper, Technology Assessment, p. 3; Kiefer, "Layman's Overview," p. 19; and A Technology Assessment System for the Executive Branch, p. 4.

[51] Bartocha, "Technology Assessment: An Instrument," p. 357; Kash, 1969 Hearings, p. 119; remarks of George M. Woodwell, proceedings of the Engineering Foundation Research Conference on "Technology Assessment," Proctor Academy, Andover, N.H., August 4-8, 1969, in 1969 Hearings, p. 407; and Robert U. Ayres and Susan C. Simon, "Technology Assessment and Policy-Making in the United States," in Cetron and Bartocha, Technology Assessment, pp. 733-734.

advent of nuclear weapons, for example. Space exploration and electronic data processing illustrate similar dramatic changes. That technologies of greatly expanded capabilities are increasingly government-sponsored is said to contribute to the urgency of the situation.[52]

Another element emphasized in justification of assessment is that non-technological factors have changed in such a way, possibly because of technological applications, that technology-related problems are magnified. Population growth and increasing urbanization may be said to multiply difficulties already existing.[53] Finally, changing attitudes may mean that situations not perceived as problems previously are now seen as such. Many environmental issues may be interpreted in this way and, according to some, represent a "luxury" available only in a largely affluent society.[54]

The likelihood that problems exist in all of these forms and are made more serious by their interaction adds to the urgency felt by assessment advocates. Society is said to be endangered in a variety of

---

[52] Joseph F. Coates, "Interdisciplinary Considerations," p. 277; Carpenter, "Technology Assessment and the Congress," pp. 30-31; and Harold P. Green, "Adversary Process," p. 55.

[53] Bisplinghoff, "Foreword," p. xi; Carpenter, "Technology Assessment and the Congress," p. 30; and Huddle, "Social Function," p. 153.

[54] See Coates, "Interdisciplinary Considerations," p. 277-278; Richard A. Carpenter, "Technology Assessment--A New Responsibility," proceedings of the Engineering Foundation Research Conference on "Technology Assessment," Proctor Academy, Andover, N.H., August 4-8, 1969, in 1969 Hearings, p. 364; and Leon Green, Jr., "Technology Assessment or Technology Harassment: The Attacks on Science and Technology," in Kasper, Technology Assessment, pp. 195-221.

ways. The argument that life itself is endangered, familiar from the ecology movement, is less commonly used than the warning that there are increasingly serious social dysfunctions. Others see the crisis as most acute regarding man's ability to deal intellectually with his changing technological world.[55]

Clearly, the first basic premise of the assessment movement is that the United States currently faces technologically-related problems which are historically unique. A second assumption is that the improvement of government's capacity to deal with such difficulties depends on securing more and better information about them. The assessment movement also displays substantial consensus in emphasizing the role of Congress. Doubtless this is due in part to the Congressional origins of the movement. It also incorporates the view that Congress is or should be the predominant policy-making organ of the national government.

There has been recognition that the executive branch could profit from greater resources of expertise regarding technology and there has been consideration of assessment mechanisms for this purpose, as noted above. Executive assessment, however, is usually de-emphasized on the grounds that the executive branch is inherently involved in advocacy of programs and therefore is unable to provide the required dispassionate weighing of evidence.[56] The relative dominance of the President and Congress may enter into discussions on this point, also.

---

[55] Mayo, "Management of Technology Assessment," p. 71; Gerd Wallenstein, "Toward A Humanized Technology--How Rational Is Technology Assessment?," in Cetron and Bartocha, Technology Assessment, p. 415; and Tribe, "Technology Assessment and the Fourth Discontinuity," pp. 617-660.

[56] See Charles V. Kidd, "Technology Assessment in the Executive Office of the President," in Kasper, Technology Assessment, p. 126; and Emilio Q. Daddario, "Science Policy: Relationships are the Key," Daedalus, CIII (Summer, 1974), 135-142.

Other ways of institutionalizing assessment have been suggested, such as the creation of a "devil's advocate" agency to seek out, publicize, and oppose policy actions with undesirable technological impacts. Another proposal is that tort law be updated so that the Judicial branch can become a more effective locus of assessment activity. Others, however, reject reliance on the courts because the judiciary is regarded as inherently reactive and unable to provide the needed initiative in dealing with the serious problems at hand.[57]

In addition to the Congressional focus of the assessment movement, it should be noted that there is an implicit assumption that the national government is the proper and most effective actor in technologically-related matters. This is understandable because of the national scope of the problems cited and perhaps because of the generally predominant role of the federal government in the assumption of new responsibilities for the last four decades.

In short, then, assessment is justified because pressing problems facing society require action by the national government to avoid unnecessary social costs and to secure maximum benefits from technology. The assessment movement represents an attempt to develop resources of expert knowledge about things technological, in response to faults of the past. Decisions on technologically-related matters have previously suffered from a lack of information, an insufficient time perspective, and a lack of foresight. They have been reactive and crisis-oriented

---

57 Green, "Adversary Process," pp. 49-62; Milton Katz, "The Function of Tort Liability in Technology Assessment," in 1970 Hearings - Part I, pp. 261-337 (reprinted from University of Cincinnati Law Review, XXXVIII (1969), 587-663); and Mayo, "Management of Technology Assessment," p. 81.

rather than prospective and preventative. The solution presented by the movement consists of an institutionalized source of expert information for Congressional use. Though the Office of Technology Assessment has been in existence too short a time to warrant too rigorous an evaluation, the very design of the assessment movement's solution may be examined.

The Sufficiency of the Movement's Solution

It is not the purpose of the discussion below to demonstrate that technology assessment is unworkable. Rather, it is argued that assessment, as designed by its proponents, may not be sufficient to operate effectively in its political environment.

One area of uncertainty is whether or not the movement's focus on Congress is realistic in terms of the frequently-conceded predominance of executive initiative in the legislative process. In addition, this emphasis does not recognize the significant levels of assessment activities performed by regulatory agencies and the courts. It may also be objected that, while the national government indeed performs a great many functions relative to technologically-related policy, state and local governments may still be significant. State policies may be the only ones applicable for some technological effects at a given time or may serve as precursors of national action.

Another question deserving of consideration is that of the sufficiency of providing expert information. Political considerations may preclude its use because of matters of personal influence, constituency relations, interest group representation, or ideological commitments. Information may not merely be ineffective; there is the

possibility that it will be used in a justificatory way to legitimize decisions made on more political grounds. Nothing is built into assessment to preclude such occurrences, except the attempt to render assessors sufficiently independent that the use of recommendations for political purposes will be post hoc rather than the goal of the assessment organization.

A third area of interest is that of the efficacy of institutionalization as a means of insuring access to policy-makers. Co-optation of assessors for political purposes is involved here as well as the question of whether or not institutionalization is a sufficient guarantee of access. Earlier examples suggest that it is not, including the institution of a Presidential Science Advisor and an Office of Science and Technology in the Executive Office.[58]

Finally, there has been limited consideration of the potential effects of institutionalized assessment on the policy process itself. The movement's literature addresses the relationship of assessment to democracy to some degree. One form of doing so is the characterization of assessment as a tool for revitalizing democracy by restoring Congress to its proper place in the system. Other manifestations focus on a participatory element in the assessment process, involving the public through such devices as public hearings and membership on advisory

---

58 See Daddario, "Science Policy," pp. 134-142; and "Science Advice for the White House," Technology Review, LXXVI (January, 1974), 8-19.

boards. There is also recognition that this solution does not satisfactorily resolve the problems inherent in this area.[59]

In summary, technology assessment as presented by its advocates faces serious obstacles. The limitations of auxiliary disciplines in turn inhibit the development of a sophisticated, truly comprehensive technology assessment capability. This is true with both the physical and social sciences, though the problem is more serious in connection with the latter. Assessment faces methodological problems of its own, primarily having to do with difficulties of measuring, evaluating, and comparing societal values which are not easily expressed in quantitative terms. A final set of obstacles can be seen in the discussion above of the political environment of assessment. These are major factors to be considered in evaluating the chances for success of the movement's solution. To discount assessment completely would nevertheless be a mistake.

The premises of technology assessment appear to be quite accurate. Technological developments do impact on society, sometimes in unforeseen and undesirable ways. While there is evidence to support an argument that the assertion of purposeful human control is a futile endeavor, the effort nevertheless seems worthwhile. Technology in a very real sense is man's creation. There is not yet a machine which can take the initiative in its own development. Control must therefore be adjudged possible and desirable. When technological changes affect

---

[59] See James D. Carroll, "Participatory Technology," Science, CLXXI (February 19, 1971), 647-653; Erasmus H. Kloman, symposium ed., "Public Participation in Technology Assessment," Public Administration Review, XXXV (January-February, 1975), 67-81; and Leon Green, Jr., "Technology Assessment or Technology Harassment," p. 196.

society in undesired ways, the human factor in the aggregate is in control, therefore, the members of society in the aggregate represented by government should be able to assert control and direct technological change in more desirable ways. If, then, technology assessment is a socially beneficial concept but faces significant problems of implementation the logical course is to seek means of improving its capacity.

The limitations which assessment inherits from the physical and social sciences are beyond the capacity of the student of assessment to alter significantly. Indeed, these problems face all purposeful action in society. Similarly, the methodological problems of assessment are formidable, though further developments in the efforts discussed above may achieve more useful levels with time. The political environment seems to be a fruitful place for further research into the relationship of the political system and the technological system. Since governments have been making technologically-related policy decisions for many years, or, indeed, since there have been governments, data collection and analysis in this area should prove of value. Many of the obstacles to assessment seem to derive from incomplete consideration of political factors; therefore, a rigorous examination of such factors in technologically-related matters should be useful in, perhaps, designing more effective means of access for information into the political system. This tactic in all probability offers more potential for improving the government-technology interrelation than does an attempt to change the political system to accommodate assessment.

In the remainder of this study, an attempt is made to address this topic by inquiring into the class of phenomena made up of policy decisions on technological applications and involving governmental and

private comprehensive assessments. A first undertaking is examination of the study of public policy in general for hypotheses regarding the likely location, behavior, and influence of assessors. Second, data on technologically-related policy-making in three cases involving a variety of technological applications and political actors are analyzed. Finally, the analyses of these cases provide a basis for generalizing about the role played by assessment activities in actual policy-making on technological applications.

CHAPTER III

THE STUDY OF PUBLIC POLICY AND ANALYZING TECHNOLOGICALLY-RELATED POLICY

In this chapter the literature in political science on public policy is reviewed as an adjunct to examining technologically-related governmental action. The purpose is not to search for conclusions on the specific type of policy under examination but rather to seek generalizations about the nature of the policy process which will indicate the likely location and role of technology assessment activities. A first consideration is an examination of the broad outlines of research on policy, including its orientations, methods, and current level of accomplishment. This is followed by a discussion of specific explanations of policy-making's salient features in the United States and identification of factors which can be expected to be significant in technologically-related policy. Finally, the approach to analyzing policy which is taken in this study is described.

The Study of Policy

In a certain sense, all political science consists of policy research, insofar as it is concerned with real or potential governmental activity. Specifically relevant research occurs in several forms, only one of which is "policy analysis," the most recent school of study in this area. Two major emphases in the study of policy may be identified, the prescriptive and the descriptive. These are concerned, of course,

with proper policy-making and with the phenomena observable in actual policy-making, respectively.

Prescriptive policy research takes two forms. One is the prescription of specific policy actions, an attempt to apply expertise to the goal selection of governmental actors. This is perhaps one of the oldest manifestations of scholarly attention to the subject, one which has re-emerged to some degree in demands for "relevance" in political science and in the argument that students of politics should adopt and advocate normative positions regarding policy issues.[1] It is difficult to separate such approaches from non-analytical advocacy. This kind of prescription is of interest, potentially, for the present study but it constitutes a part of the object of analysis and offers limited assistance in analyzing technologically-related policy.

A second type of prescription in scholarly approaches to policy is of more interest for present purposes and is discussed at greater length below. Briefly, the "policy science" school prescribes not what policy actions should be taken but how the policy-making process should operate. It is based on the assumption that the achievement of a desired goal is a matter susceptible to expert knowledge and that a "science" of making policy can be and should be developed. This is of interest for this study because of its obvious resemblance to technology assessment

---

[1] On the older literature of this kind, see Austin Ranney, "The Study of Policy Content: A Framework for Choice," in Political Science and Public Policy, ed. by Austin Ranney (Chicago: Markham Publishing Company, 1968), p. 10; and Lewis A. Froman, Jr., "The Categorization of Policy Contents," in Ranney, Political Science and Public Policy, p. 42. The case for prescription of policies is made by, for example, Duncan MacRae, Jr., in "Scientific Communication, Ethical Argument, and Public Policy," American Political Science Review, LXV (March, 1971), 38-50.

itself, which is sometimes regarded in the assessment literature as a subfield of policy science.[2]

Descriptive approaches to policy are more useful for this study than either prescriptive form of policy research. The former are, of course, involved with attempting to describe and explain the workings of the policy process and as such provide insight into the more specific area of technologically-related policy-making. This kind of research is inherently empirical, whereas prescriptive approaches may not be. A major point of distinction between the two is the different treatment of goals. This and other important facets of the descriptive type of approach are illustrated by the definition of policy usually employed by its practitioners.

Typical of descriptive definitions are: "Policies are actions taken by governments" and "Public policy is whatever governments choose to do or not to do."[3] Thus, for purposes of identifying the phenomena of interest to the student of policy, the occurrence of action or non-action which affects society is more significant than the intentions of policy-makers. Whether or not intentions are successfully carried out

---

[2] Hugh Folk, "The Role of Technology Assessment in Public Policy," paper presented at the 1969 meeting of the American Association for the Advancement of Science, Boston, Massachusetts, December 29, 1969, Appendix Q of 1969 Hearings, p. 511.

[3] Ira Sharkansky, "The Political Scientist and Policy Analysis," in Policy Analysis in Political Science, ed. by Ira Sharkansky (Chicago: Markham Publishing Company, 1970), p. 1; and Thomas R. Dye, Understanding Public Policy (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972), p. 1. Definitions emphasizing purposeful pursuit of goals are used by Ranney, "Study of Policy Content," pp. 6-7; and Robert H. Salisbury, "The Analysis of Public Policy: A Search for Theories and Roles," in Ranney, Political Science and Public Policy, pp. 152-153.

is a meaningful subject of analysis, of course, but the unintended results of governmental action are also significant for the study of policy.

There are certain problems associated with the use of this kind of definition. In particular, it may be criticized as failing to narrow the scope of phenomena for analysis. The universe of actions not taken by a given governmental actor is, of course, almost infinite. If policy actions are also defined to include any official behavior which carries governmental sanction, as seemingly they must, the range of positive policy actions is extremely large.[4] Most policy research, certainly, is concerned with actions impacting on broad sectors of society, but these must be regarded as different in degree, not kind, from more restricted policy actions. Nevertheless, as long as one does not claim to study all policy by examining only major policy actions, the use of the definition seems to offer no insurmountable conceptual difficulties. The formulation discussed here is used in the remainder of this study for several reasons. It is useful for consideration of decisions not to take action on a given situation. The definition is also helpful for examining the relationship between the intended effects of actions and their actual, and possibly unintended, consequences. Discussion of particular aspects of descriptive policy research is undertaken in a later section of this chapter, following a more detailed examination of the "policy science" perspective.

---

[4] See Dye, Understanding Public Policy, p. 2; Sharkansky, "The Political Scientist and Policy Analysis," p. 1; Vernon Van Dyke, "Process and Policy as Focal Concepts in Political Research," in Ranney, Political Science and Public Policy, pp. 25-27.

Policy Science: Rational Prescription

The policy science approach to public policy, as noted above, does not seek to prescribe what should be done but rather how it should be done. A statement by one of its major proponents is illustrative of this approach:

> My objectives are (1) to advance the study of public policymaking as a major topic of the social sciences and of human thought in general, and (2) to contribute to the improvement of public policymaking.
>
> My basic thesis is that there is a significant gap between the ways individuals and institutions make policy and the available knowledge on how policies can best be made.[5]

This adequately describes both the purpose and the basic premise of the policy science literature. It constitutes a purposeful effort to apply knowledge, supposedly already available, to the process of governmental decision-making in order to maximize the effectiveness of that process.

More specifically, the ideal process of the policy science advocates involves the inclusion of several logically ordered steps in policy-making. Once a goal is selected for action, alternative strategies for achieving it can be formulated. Relevant data are collected and applied to these options in order to determine the relative net value of each. Such weights may be based on the significance adjudged by policy-makers, analysts, or the value preferences of a larger sector of society. Comparison of policy options allows the choice of the alternative which will result in the desired end at the greatest net cost. The policy scientist, if the term may be used, has the role of

---

[5] Yehezhel Dror, Public Policymaking Reexamined (San Francisco: Chandler Publishing Company, 1968), p. xi.

preparing such an array of alternatives for the decision-maker, who retains the prerogative of choosing between them.[6]

The parallels between the policy science model of rational policy-making and the concept of technology assessment are obvious. Both are designed for use by decision-makers. Both involve the application of expert information to the decision process and both assume the existence of the necessary expertise for effective use. With regard to informational requirements, policy science is not as comprehensive in scope, perhaps, as assessment, yet the range of auxiliary disciplines is as great. In addition to problems similar to those faced by assessment, it may also be argued that knowledge of the policy process has not yet reached the level expected by the proponents of rational policy-making. Factors related to this difficulty are discussed below in the context of descriptive policy research.

The resemblance between policy science and technology assessment is worthy of note; there are differences, however. With regard to the actualities of decision-making on policy, the policy science school recognizes to some degree, perhaps an insufficient one, that the model prescribed differs from reality to a significant degree.[7] It is not as clear that the advocates of technology assessment have an understanding

---

[6] Dror, Public Policymaking Reexamined, p. 154; and Dye, Understanding Public Policy, pp. 26-27.

[7] See the statements on political feasibility and related matters, for example, in Harold D. Lasswell, A Pre-View of Policy Sciences (New York: American Elsevier Publishing Company, Inc., 1971), p. 81; and Yehezkel Dror, Ventures in Policy Sciences: Concepts and Applications (New York: American Elsevier Publishing Company, Inc., 1971), pp. 85-89 and 257-263.

that their prescribed solution may not work as intended, a point discussed in the preceding chapter. There is some realization in the policy science literature that rational policy-making is an ideal model and it is not yet embodied in actual policy processes. The assessment movement, however, may be more accurately characterized as expecting the designed assessment mechanism to become effectively operational shortly after being established.

The value of prescriptive policy research for this study is essentially negative. Discussions of rational policy-making have stimulated consideration of the reasons why actual processes do not conform to ideal ones. The descriptive analyses embodied in such discussions are perhaps more useful for present purposes than the prescriptions to which they have reacted. The list of reasons why policy-making is not rational easily can be made quite lengthy. Some factors have already been discussed in Chapter II. Limitations in the physical and social sciences' knowledge and the difficulties associated with goal selection and with the comparative valuation of factors outside the economic sphere are among these.[8]

Other factors which limit the rationality of the policy process are perhaps more unique to political decision-making. Included are such matters as basing decisions on personal or partisan political motivations rather than societal maximization, though given the absence of

---

[8] This discussion, including the material below, relies substantially on Dye, Understanding Public Policy, p. 29; Thomas R. Dye, Policy Analysis: What Governments Do, Why They Do It, and What Difference It Makes (University, Alabama: The University of Alabama Press, 1976), pp. 97-98; and Charles E. Lindblom, "The Science of 'Muddling Through,'" Public Administration Review, XIX (Spring, 1959), 79-88.

some means of determining the one best way of solving a problem it is perhaps pedantic to fault decision-makers for using those cues available to them.[9] Some forms of political "expediency" may be justified on the basis of democratic ideology, also. Another consideration is that the interrelatedness of the process may make multiple agreement necessary for program implementation. An optimum course of action which is clearly indicated to only one actor in such a situation may well not be adopted because needs in other sectors may be more highly valued by other participants in policy-making.

In the face of uncertainty, not uncommon given the current state of knowledge, the policy-maker is perhaps encouraged to continue past policies or make only incremental changes. This approach has advantages of political feasibility, also. The same pattern of behavior may follow from an understandable reluctance to abandon current programs which represent substantial investments of funds, of prestige, or of symbolic importance. All of these factors, of course, contribute to departures from the rational model.

Finally, limitations are to be found in the characteristics of human decision-making. The range of options in many situations approaches the infinite, at least conceptually. It seems likely that the limits of time and of mental capacity preclude scanning the entire range of alternatives for the one optimum course of action. It is more

---

[9] An example of the interaction between expertise and expediency is given by Dye, Policy Analysis, pp. 7-13, in an account of policy evaluation in the Headstart program and a guaranteed income experiment.

characteristic to search until a satisfactory option is identified, perhaps not the best but one which falls within some range of acceptability.[10]

The factors which have been identified as predisposing policy-making to differ from the rational model of the process are of value in studying technologically-related policy. Because the policy science approach so closely resembles technology assessment, it may be expected that similar phenomena can be found in relation to assessment activities. In particular, consideration of why policy-making is not rational is relevant to the question of the efficacy of providing expert information to achieve desired characteristics in policy-making.

Descriptive Approaches: Policy Analysis

In this section and the one which follows the object of analysis is positive rather than negative. Here the literature is reviewed for the purpose of identifying possible explanations of technologically-related policy-making, including cues to the significant variables to be considered and the patterns of interaction which would be most characteristic. Descriptive approaches may be considered in two categories, one of which is the currently popular undertaking labelled "policy analysis." The other consists of a collection of materials from research and theoretical efforts in political science which, whether explicitly or implicitly, have significant import for understanding the process of making public policy. These are discussed in the next section.

---

[10] On this view of decision-making, see the summary of Herbert Simon's work in the area, in John M. Pfiffner and Frank P. Sherwood, Administrative Organization (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1960), pp. 385-390.

The policy analysis literature deserves first consideration, not because of its chronological position but because it should perhaps be regarded as the most accomplished attempt at analysis in this area. The "new dimensions" of the approach include:

> . . . a primary concern with explanation rather than prescription; sophisticated comparisons of the policies of different communities, states, or government agencies; the search for economic, social, and historical, as well as political and governmental features to aid in understanding the policies that governments choose; and an effort to accumulate research to build theories about policy.[11]

The methodology of policy analysis is empirically based and most applications emphasize quantification to a high degree, though there is some recognition that "softer" data may be usefully analyzed. Its rationale owes a great deal to the concept of the "political system," a pervasive influence in the discipline of political science for the last decade.[12] A more detailed discussion of this concept is useful, not only in understanding the predominant perspectives of policy analysis but also in evaluating its achievements and its limitations.

The basic notion of the systems approach is familiar to most students of political science, of course. In its foremost explication,

---

[11] Sharkansky, "The Political Scientist and Policy Analysis," p. 2; see p. 3 on the utility of "soft" data. See also Dye, Policy Analysis, p. 3; and Dye, Understanding Public Policy, p. 6.

[12] This may be seen in, for example, Sharkansky, "The Political Scientist and Policy Analysis," p. 6; Thomas R. Dye, "A Model for the Analysis of Policy Outcomes," in Sharkansky, Policy Analysis in Political Science, pp. 22-24; Ira Sharkansky, "Environment, Policy, Output and Impact: Problems of Theory and Method in the Analysis of Public Policy," in Sharkansky, Policy Analysis in Political Science, pp. 67-68; and Ranney, "Study of Policy Content," pp. 8-9.

that of David Easton, the phenomenon under analysis is the system in society which is concerned with making authoritative allocations of value for the whole society. The political system, thus defined, is conceptualized as interacting with an environment of other social systems. The primary categories of interaction are inputs, outputs, and feedback. Figure 1 offers a graphic presentation of the concept. Briefly, the system receives inputs, both demands for actions and supports for the system, processes them in the conversion phase, and produces outputs in the form of policy actions. The interaction of outputs with the environment is reported through the feedback loop, thus conceptualizing adaptive behavior on the part of the system.[13]

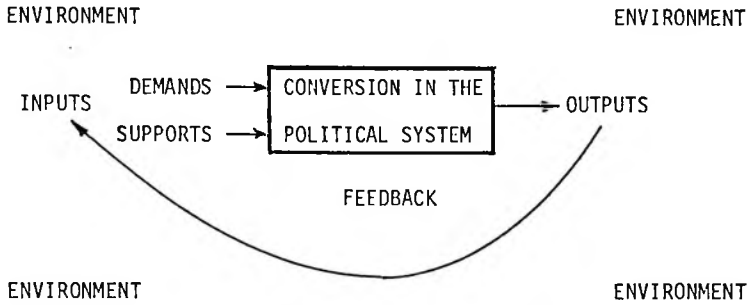
Though frequently termed "systems theory," the conceptualization falls short of explanatory theory's requirements. Its primary value lies in providing a systematic set of very general categories which may be used to order additional concepts and possibly data, on a very generalized level, relating to the study of politics. Policy analysis follows Easton in having as an ideal the systematic accumulation of explanations resulting, hopefully and eventually, in a rigorous predictive theory of politics.[14] More particularly, a great deal of the research in policy analysis is based on the fundamental concepts of the systems approach. That is, it is concerned with examining relationships between environmental conditions, presented as inputs, or in cases of

---

[13] Easton's A Systems Analysis of Political Life (New York: John Wiley & Sons, 1965), pp. 17-33, contains a summary of the interactions involved.

[14] See Easton, Systems Analysis, pp. 3-16.

Figure 1: EASTON'S CONCEPT OF THE POLITICAL SYSTEM



Source: David Easton, A Systems Analysis of Political Life (New York: John Wiley & Sons, 1965), pp. 30 and 32.

extreme precision, as surrogates for inputs, and outputs. A second major conceptual emphasis is concerned with the effect of outputs on environmental conditions, though it seems to have received less attention in terms of research.[15]

Methodologically, analyses of input-output interaction usually take one of two forms. Most common is the use of statistical correlation techniques to identify relationships between environmental conditions and outputs. A newer technique, causal modelling, is an extension

[15] On the systems-oriented analytical perspective, see Dye, Policy Analysis, pp. 1, 5-6; and Dye, Understanding Public Policy, p. 4. For cautionary statements on operationalization, see Sharkansky, "The Political Scientist and Policy Analysis," p. 7; and Eugene Webb, Donald Campbell, Richard Schwartz, and Lee Seechrest, "Approximations to Knowledge," in Sharkansky, Policy Analysis in Political Science, pp. 83-114. On output-oriented research, see Sharkansky, Policy Analysis in Political Science, Part 6; and Dye, Policy Analysis, Chapter 5. Research in this area seems to be much more case-oriented than examination of input-output relationships.

of the same approach. Both require the representation of outputs, or policies, in quantitative terms. Thus, the usual approach to inputs emphasizes objective, measurable factors in the population which constitutes the environment of the political system under examination. Similarly, outputs are most frequently represented in terms of budgetary allocations for given programs, such as welfare services or education. For example, Thomas R. Dye, a leading figure in policy analysis, finds that state welfare expenditures are explained, statistically, to a higher degree in terms of the per capita income of a given state than by any other factor.[16]

Several observations are in order regarding the dominant emphasis of policy analysis, as described above. First, it is quite understandable that the statistically-oriented empirical methodology of policy analysis leads to a focus on representing policy in terms of expenditures. This is a result, apparently, of the state of knowledge regarding significant societal factors which are not easily expressed in non-monetary values. The lack of a common system of comparative valuation in such matters affects policy analysis just as it does technology assessment, as discussed in the preceding chapter.[17]

Second, it should be noted that all policy differences are not expressed in budgetary figures. Civil liberties, for example, are an

---

[16] Dye, Policy Analysis, Chapters 2 and 3, offers a useful account of research of this type. On causal modelling, see Dye's discussion of path analysis, in Policy Analysis, Chapter 4.

[17] See Sharkansky, "The Political Scientist and Policy Analysis," p. 3; and Robert H. Salisbury, "The Analysis of Public Policy: A Search for Theories and Roles," in Ranney, Political Science and Public Policy, p. 155.

important area of policy which defies budgetary measurement almost completely. One might attempt a surrogate in expenditures for public defenders, or something of this kind, but this would still be inadequate as an approximation of the state of governmental actions regarding civil liberties.[18] In addition, it may be that equal expenditures yield quite different policy contents. One may speculate, for example, that 1930's defense expenditures for cavalry horses by Poland did not have the same effectiveness as equivalent German expenditures for tanks. Ira Sharkansky offers a more mundane example in the field of education. Equal expenditures may be spent in respective schools for athletic equipment or textbooks, resulting in a somewhat different educational policy content.[19]

A third observation concerns the methodology which predominates in policy analysis. Correlation techniques are certainly of value in such research. It is, however, wise to keep in mind that correlation establishes only correlation; it suggests that causal relationships exist.[20] In some manifestations of policy research it seems likely that

---

[18] An attempt of this kind may be found in Thomas R. Dye, "Inequality and Civil Rights Policy in the States," Journal of Politics, XXXI (November, 1969), 1080-1097, in the form of a civil rights score based on the number of laws of certain types in effect in states; this still leaves their precise content and their application in question.

[19] Sharkansky, "Environment, Policy, Output and Impact," p. 65. The same article, pp. 64-65, considers the problem in general, as does Ira Sharkansky, "Government Expenditures and Public Services in the American States," in Sharkansky, Policy Analysis in Political Science, pp. 115-135.

[20] See Richard I. Hofferbert, "Ecological Development and Policy Change," in Sharkansky, Policy Analysis in Political Science, p. 164; Dye, Policy Analysis, pp. 73-76; and Lasswell, Pre-View of the Policy Sciences, p. 74.

research and inquiry end with finding a significant statistical relationship.

The last point above raises a question perhaps best stated in "systems" terms. Much policy analysis research focuses on "inputs" and "outputs." The conversion of the former into the latter is a subject which seems to draw less attention and research. The conversion process, sometimes called the "black box," remains a mystery in large part to policy analysis. There are, to be sure, statements that investigations of this phase of the system's operations are important and should be undertaken.[21]

There are some attempts to deal with the conversion process in the policy analysis literature. Usually, these employ the structure of the political system, formal or informal as a variable relating to the conversion process. Thus, there are attempts to correlate policy outputs, in quantitative terms, with such variables as inter-party competition or forms of municipal government. Whether such factors make a difference in policy output is a matter of dispute. Some relationships have been identified which appear to be significant. Critics, however, argue that significant differences are removed when socio-economic factors are held constant.[22]

Policy analysis is thus somewhat limited in its attempts to look into the "black box" of the conversion process. Unfortunately for the

---

[21] Hofferbert, "Ecological Development," pp. 150, 164-165. See also the discussion below on the "process" - "content" distinction.

[22] Dye, Policy Analysis, Chapters 2 and 3, identifies a number of research efforts of this type and argues that the structural variables considered are not actually of great importance.

purposes of this study, technologically-related policy is not in many cases amenable to the dominant approaches of policy analysis. Its outputs are sometimes expressed in budgetary terms, such as research and development expenditures, but more commonly take the form of regulatory actions or non-actions, the significance of which is not reflected in expenditures. For example, two drug regulation agencies may spend the same amount of money yet behave differently when interpreting and enforcing relevant laws and regulations. Expenditures between states for activities of this kind may be similar yet legal restrictions may be markedly different in the two units.

For several reasons, this study must be concerned with a greater emphasis on the interactions which the systems approach conceptualizes as the conversion process. One factor involved is that analysis and explanation, assumed here to require no justification as objectives, are more complete when the entire process is examined. Another consideration is that the purpose of the study is not served by confining investigation to input-output relationships while leaving the interaction mechanism unspecified.

There are, nevertheless, some observations and approaches of policy analysis which are useful for this study. The significance of the socioeconomic environment for analysis of large numbers of policy decisions deserves investigation. This is facilitated in the case studies in later chapters by variation between states of the United States in some manifestations of technologically-related policy.[23]

---

[23] On the comparative study of policy between states, see Thomas R. Dye, Politics in States and Communities (2d ed.; Englewood Cliffs, N.J.: Prentice-Hall, 1973), pp. 2-4.

Also of interest is the central concept of the policy process as interactive with its environment. The situations regarded as problems in the technological sphere and the impacts of policy actions taken in response both take place conceptually in the environment of the system. The interactions, especially the effectiveness of policy actions, are significant for the study of technologically-related policy. Finally, the policy analysis literature contains some useful material which falls outside the dominant methodological emphasis discussed above.

In particular, there are several attempts to categorize policy conceptually on the basis of demand patterns and the type of resulting policy. For example, Robert Salisbury and John Heinz argue that decision costs, in terms of information and other factors, and the unified or fragmentary nature of relevant demand patterns are significant variables for the type of policy actions. Briefly, it is posited that decisions involving high costs will take either regulatory or self-regulatory forms, depending on the respective fragmentation of demand patterns. This has particular relevance for technologically-related policy because, as discussed in the preceding chapter, policy in this area is likely to be characterized by difficulties in securing reliable and comprehensive information.[24]

The question of why policy analysis has not proceeded further into the mechanics of the conversion process arises unavoidably in the

---

[24] Robert Salisbury and John Heinz, "A Theory of Policy Analysis and Some Preliminary Applications," in Sharkansky, Policy Analysis in Political Science, pp. 39-60. Another example is the treatment of political culture in Daniel Elazar, "The States and the Political Setting," in Sharkansky, Policy Analysis in Political Science, pp. 171-185. This material, which originally appeared in Elazar's American Federalism: A View From the States (New York: Thomas Y. Crowell Company, 1966), is definitely outside the mainstream of policy analysis.

context of this discussion. In the section which follows, this topic is considered, to be followed by a review of the literature which does attempt such an undertaking.

Descriptive Approaches: Models of the Policy Process

The failure of policy analysis research to explain the conversion phase of system operation is sometimes presented in the literature in terms of policy "process" and "content." It is stated that older approaches emphasized the former, while concern with the latter is innovative and, perhaps, of greater importance. If policy analysis is concerned with explanation, however, it is difficult to see how some consideration of procedures involved in policy-making can be avoided.[25] Professor Dye discusses "linkages" in policy-making at one point but uses the term to refer to significant sets of environmental variables. It is unclear how "linkage" knowledge which does not deal with individual actors in some fashion can be regarded as comprehensive, unless a rigidly deterministic system is postulated. This is denied in the policy analysis literature, however.[26]

---

[25] See Ranney, "Study of Policy Content," p. 3; Dye, Understanding Public Policy, p. 3; and Vernon Van Dyke, "Process and Policy as Focal Concepts in Political Research," in Ranney, Political Science and Public Policy, p. 24.

[26] Dye's discussion of linkages is found in Understanding Public Policy, Chapter 11. On the individual basis of political behavior, see Heinz Eulau, The Behavioral Persuasion in Politics (New York: Random House, 1963), p. 14. Dye denies that his intent is to portray a deterministic system in Policy Analysis, p. 55. Where Dye addresses the question of significant actors he seems to find the elite model the most convincing; see, for example, Understanding Public Policy, Chapter 12. See also Thomas R. Dye and L. Harmon Zeigler, The Irony of Democracy: An Uncommon Introduction to American Politics (2d ed.; Belmont, Cal.: Wadsworth Publishing Company, Inc., 1972) and the discussion of the elitist model below.

It is argued here that a consideration of decision-makers in some manner is a necessary part of a comprehensive explanation of public policy. From this perspective, it is apparent that a major obstacle, perhaps the most formidable one, to the development of an empirically-based predictive theory of policy-making lies in the nature of human decision-making. This phenomenon lies at the center of the subject under examination, since actions or failures to act are unavoidably made by some individual actor or by a group or sequence of them.[27]

Human decision-making, unfortunately, cannot be explained in a rigorous manner at the present time. Even if a great deal is known about the individual in question, including his background and his behavior in similar circumstances, it is difficult to predict how he will act in the future, or, indeed, to explain why he has behaved in a certain manner in the past. Individuals themselves may well be unable to explain all of the factors and the relative weights assigned to them which have entered into the making of a given decision.

The inability to formulate a rigorous theory in this area is explained in part by the difficulties posed by investigation of the subject. Though experimental research may use volunteer subjects in highly structured examinations of decision-making, one would encounter great difficulty in securing the cooperation of governmental policy-makers in such an undertaking. Even observation of such an individual in actual decision-making situations is usually not possible, in part

---

[27] See Eulau, Behavioral Persuasion, p. 14. Yehezkel Dror, quoted in Van Dyke, "Process and Policy," pp. 35-36, finds macro-level problems the more formidable. This is probably more representative of the dominant trends in research on policy than the view presented here.

for personal and political reasons. When observation is possible, the assignment of criteria for the decision must still be a matter of informed conjecture, as direct observation of such factors is not possible.[28]

There has been some in-depth research on decisions, of course. Usually, records of events and recollections must be relied on to a substantial degree. The number of decisions which can be examined in this way is severely limited by the resources required for such investigations. This not only limits the portion of the universe of decisions which has been analyzed but may also result in an unrepresentative emphasis on decisions of great drama or importance. The more routine decisions made by policy-makers still may be of more aggregate importance than the single question of, for example, whether to intervene in Korea or not or what should be done about Soviet missiles in Cuba. A further complication is that policies may result from a series of decisions or from decisions made at a number of points in the policy apparatus which are uncoordinated with each other.

It seems likely that the reasons cited above explain why research into the "black box" has been somewhat limited and less common in policy analysis than emphases on inputs and outputs. The nature of the phenomena in question also explains why at the current stage of inquiry one must make use of models, or approximations of the significant features of reality, rather than rigorous theories of the workings of the conversion process. Such models are usually empirically based, that is, their concepts have identifiable referents in the observable

---

28 See Eulau, Behavioral Persuasion, pp. 112-122.

world of political interaction, but are not to be characterized as empirical theories with highly reliable powers of explanation and prediction. Several such models are considered below in terms of their utility for the analysis of technologically-related policy.[29]

Incrementalism. The incremental model of policy-making is concerned with generalizing about the nature of governmental decisions. As presented by Charles Lindblom, it posits that decisions at any given time will take the form of marginal adjustments to earlier decisions. Change thus occurs by increments rather than on a wholesale basis. Reasons for this approach to policy decisions are several. Such a perspective reacts to unknown factors by staying within the realm of the familiar to at least a substantial degree. It is also concerned with limiting costs by valuing current investments over possible new initiatives. The costs of obtaining information and the cost of securing political consensus on policy are minimized by changing the known and agreed-upon course of action only minimally. Thus, decisions tend to be made on "the margin" in most cases.[30]

There seems to be substantial agreement that Lindblom's formulation reflects the reality of the policy process to a considerable degree. Though it is most obviously applied to research on budgeting, its utility is not confined to this area, though the literature is

---

[29] See Dye, Understanding Public Policy, pp. 35-36 and Chapter 2; this useful inventory of descriptive models is relied upon to a considerable degree in the discussion below. It will be noted that two of Dye's models, the systems approach and the rational model, are treated in different contexts in this chapter.

[30] Lindblom, "Science of 'Muddling Through'," pp. 79-88; and Dye, Understanding Public Policy, pp. 30-32.

limited. It may be noted that, even in analyzing appropriations, the concept is not without its problems in application.[31] Nevertheless, though incrementalism is not perfectly explanatory, it offers certain cues to the understanding of the behavior which makes up the policy process. For reasons already noted, the analysis of technologically-related policy cannot be entirely quantitative. Thus, though the incremental model has value for the current study, it must be used in a more qualitative, though still empirical, manner. This is especially true in decisions relating to the imposition of regulation, whether a positive action or a negative one is taken.

Whether or not decisions tend to be made on the margin seems to have particular relevance for the present inquiry. Many technologically related matters exhibit change so rapid and so different from the past that significant areas of discontinuity result. The phenomenon of incremental decision-making may lead to failure in solving problems which require innovative and non-marginal approaches. It may also have a detrimental effect on the efficacy of providing expert information, because criteria relating to limited change may take priority over a solution prescribed by assessment activities. On the other hand, change does take place in the incremental model. It is possible that conflicts involving a lack of consensus on goals may be more satisfactorily handled by gradual change, of a certain minimum velocity,

---

[31] See Ira Sharkansky and Augustus B. Turnbull, III, "Budget-Making in Georgia and Wisconsin: A Test of a Model," in Sharkansky, Policy Analysis in Political Science, pp. 225-238; Dye, Understanding Public Policy, Chapter 11; Dye, Policy Analysis, pp. 39-41; and John J. Bailey and Robert J. O'Connor, "Operationalizing Incrementalism: Measuring the Muddles," Public Administration Review, XXXV (January-February, 1975), 60-66.

perhaps, than by high-cost political conflict over a totally new policy option. This feature seems worthy of consideration in certain types of policy-making situations.

Other models of the policy process differ from the incremental in that their focus is on the significant actors in the process, whereas that of the incremental model is on the characteristics of decision-making, whoever the governmental actor may be. Considered below are the institutional, the pluralist, and the elite models. Each is discussed in a conventional sense; special elaborations which have particular relevance for technologically-related policy are considered in a later section.

The Institutional Model. This model of the policy process emphasizes the role of governmental institutions, or formal structures, and their functions in the political system. Description of such institutions is of course a long-standing undertaking in political science, though it has frequently been regarded as an end in itself, as a complete inventory of political reality rather than as an approximation of the significant factors. The former characterization is now regarded as too exclusive of political interactions and of non-institutional actors to be regarded as adequate. The institutional model, however, may serve a useful function in the analysis of the policy process.[32]

That the institutional model is empirically based is without doubt; that it is exhaustive must be denied. Its value lies in the fact that institutional arrangements serve to structure interactions to a

---

[32] Dye, Understanding Public Policy, pp. 32-35.

significant degree. Understanding legal constraints is necessary in analyzing policy actions. It may also be helpful to consider the impact on the behavior of individual decision-makers which results from their perceptions of official roles. Though, as noted above, the policy analysis literature offers no clear answer on the point, it is still a respectable hypothesis that institutional arrangements affect the content of policy as well as the process of policy-making.[33] This must be demonstrated in any given analysis, of course.

In the study of technologically-related policy, the institutional model suggests some potentially important factors. It is a complaint of the assessment movement that pre-assessment policy-making suffered from a lack of coordination, among its other faults. Thus, institutional arrangements which contribute to fragmentation should be sought and their effect on actual policy decisions evaluated. Because the technology assessment movement emphasizes the sufficiency of institutionalization as a means of insuring the effective access of expert information to the policy process, the role of institutionally-defined actors in the making of technologically-related policy is also of interest. The performance of other institutions may be an indication of the effectiveness to be expected of the Office of Technology Assessment. It may also be possible to distinguish between types of institutions on the basis of their effective influence on policy action. At the very least, it must be expected that the structuring of relations will be of some importance in describing and analyzing policy-making in the area considered by this study.

---

[33] Ibid., Chapter 8, is an example of the application of this model. On policy analysis research in this area, see Dye, Policy Analysis, Chapters 2 and 3.

The Pluralist Model. The pluralist, or group, model of the policy process, in contrast to the institutional one, emphasizes actors who may not be defined by official governmental roles. According to this interpretation, the important interactions in the political process are those which occur between groups representing the common interests of their members. Groups of varying degrees of organization compete against each other for scarce resources and government institutions play the role of referee to insure that conflict is maintained within acceptable limits. Government is also the scorekeeper of the contest. It registers the relative strengths of groups or coalitions by awarding desired values to one or another protagonist. Public policy changes in the perspective of the group model are the result of adjustments in the relative strengths of groups or coalitions.[34]

It may be noted that this process may be given a prescriptive orientation by some of its proponents. That is, group conflict may be valued because it serves the purpose of limiting power by checking one group against another. A further virtue may be found in the representation of individuals by groups with which they affiliate, which thus provides a democratic element which may be lacking elsewhere.[35] There is,

---

[34] Dye, Understanding Public Policy, pp. 23-25, offers a summary of the approach. Group theorists are quite numerous; for examples, see Earl Latham, "The Group Basis of Politics: Notes for a Theory," American Political Science Review, XLVI (June, 1952), 376-397; and Robert A. Dahl, Pluralist Democracy in the United States: Conflict and Consensus (Chicago: Rand McNally and Company, 1967).

[35] Dye argues, in Policy Analysis, Chapter 2, that such a prescriptive attitude has been responsible for a "myopia" in policy research which has resulted in dismissing the importance of environmental variables. See also Dye and Zeigler, Irony of Democracy, Chapter 1; and Darryl Baskin, "American Pluralism: Theory, Practice, and Ideology," Journal of Politics, XXXII (February, 1970), 71-95.

of course, a considerable and venerable literature which departs from this interpretation. The sociologist, Robert Michels, found that organizational control tends to become concentrated in the hands of a few leaders. If this view is accepted, and it is supported empirically by research on modern organizations, then the approach may be termed that of "plural elites." Professional organizations constitute a significant category of interest groups in which this phenomenon has been documented. Because of the reliance on expert knowledge of such groups, their oligarchical tendencies are of particular interest for technologically-related matters.[36] This idea is discussed in a later section on interpretations of politics which are especially oriented toward technology and its effects on society. For the purpose of analyzing the conversion process, however, it is not necessary to espouse either view completely. For explanatory purposes, the central feature of group theory is the assumption that the interactions of groups are the most significant political phenomenon.

Though the democratic or elitist nature of the pluralist model is disputed, there is no difficulty in identifying empirical referents for the concepts used in the group approach. Some analysts claim a high degree of explanation from the application of this model, however, it

---

[36] Michels' classic study is Political Parties: A Sociological Study of the Oligarchical Tendencies of Modern Democracy, trans. by Eden and Cedar Paul (Glencoe, Illinois: Free Press, 1949; originally published in 1915). On the concept of plural elites, see Dye and Zeigler, Irony of Democracy, pp. 11-13. The oligarchical tendencies of some large organizations are discussed in Seymour Martin Lipset, "The Law and Trade Union Democracy," in Private Government: Introductory Readings, ed. by Sanford A. Lakoff (Glenview, Illinois: Scott, Foresman and Company, 1973), pp. 88-123; and Eliot Friedson, Profession of Medicine: A Study of the Sociology of Applied Knowledge (New York: Dodd, Mead and Company, 1970), pp. 27-28.

seems hampered by the lack of a means to measure group strength accurately enough to predict a policy outcome on a given issue.[37] Even if the approach is rejected altogether, it is undeniable that a multitude of organized groups are active in American politics. The model is useful in identifying a set of potentially significant actors in the policy process and the notion of policy as an equilibrium point or compromise between groups offers an interpretation of conversion in the political system. Though it may be determined that groups are not the sole actors, they may still be found to be significant phenomena in policymaking.

In relation to technologically-related policy, the group model has several potential applications. If it indeed prevails in the policy process, one may expect technology assessments to be used as weapons in the conflict of groups, a marked departure from the ideal of expert knowledge implementation foreseen by the advocates of assessment, though some writers on assessment have foreseen the possibility. Even with a relatively objective source of assessment, if the group model is an accurate representation of political realities, the pressures of specialized interests can be expected to eclipse expert information as the

---

37 A typical overstatement of the model's value may be found in William C. Mitchell, "The Structural Characteristics of Policymaking," in Policies, Decisions and Organization, ed. by Fremont J. Lyden, George A. Shipman, and Morton Kroll (New York: Appleton-Century-Crofts, 1969), p. 51. The usual application of the model is in the form of a narrative description of group involvement on a certain issue and interpretation on the basis of informed judgment rather than rigorous methodology. Illustrative examples include Dye, Understanding Public Policy, Chapter 7; and Theodore C. Marmor, "The Congress: Medicare, Politics and Policy," in American Political Institutions and Public Policy, ed. by Allan P. Sindler (Boston: Little, Brown and Company, 1969), pp. 3-66.

basis for policy decision.[38] Another implication of the group model is that government is reactive, not innovative, clearly a generalization of import for technologically-related policy and particularly for assessment, if this view is accurate. These effects, or partial manifestations of them, offer potential explanations and identification of significant actors which are of use for the case studies of technologically-related policy which are undertaken in later chapters.

The Elite Model. A final model of general applicability to be considered is that of elite control of the political system. Its basic premise is that societies may be divided into those who rule and those who do not. Though symbolic recognition may be given to the masses, through elections and the like, such participation is in reality meaningless. Policy decisions reflect the judgement and attitudes of the elite, a group variously defined. As usually presented, the conspiratorial interpretation is rejected and the elite is presented as a limited-access group whose decisions may well have a high, if paternalistic, regard for the well-being of the masses. Elections do not matter since the choice is really between elite members who, in the United States, share a basic consensus on such values as constitutionalism, civil liberties, private property, and free enterprise

---

38 Hugh Folk, in "The Role of Technology Assessment in Public Policy," p. 512, states: "Anyone with the ability to pay $300 a day can find a qualified expert who will testify to anything." See also John Manley, "Congressional Staff and Public Policy-Making: The Joint Committee on Internal Revenue Taxation," in Sharkansky, Policy Analysis in Political Science, pp. 239-258.

economics. Government officials may, according to the interpretation of the model, be included in the elite or merely serve as administrators of its decisions.[39]

The empirical referents of elitism are not as easily identified as those of the group model. Elite members, especially non-governmental ones, would understandably have a low visibility, as would their interactions with government. There is evidence, however, sufficient to indicate that this explanation of the policy process is worthy of consideration. Demonstration, for example, that the prevailing values in the area of civil rights have been those of the more educated members of society rather than those of the masses suggests at least a degree of accuracy.[40] It may also be demonstrated that American leaders display a basic consensus on many issues, though the same phenomenon may also be used to illustrate the "rules of the game" under which pluralistic combat is carried out. In analyzing the policy process, this model may be useful in dealing with those issues in which mass apathy or popular antagonism occurs in contrast to prevailing policy action. Because it posits the paramount importance of a group smaller and more homogeneous than the population at large, the elite model offers a feasible explanation for "changes of mood" in the country, an amorphous

---

[39] Dye, Understanding Public Policy, pp. 20-22; and Dye and Zeigler, Irony of Democracy, pp. 3-25. Floyd Hunter, Community Power Structure: A Study of Decision Makers (Garden City, New York: Anchor Books, 1953) is a classic application of the concept in the study of community power. On older writings in the area, see the discussion of Gaetano Mosca and Vilfredo Pareto in James A. Bill and Robert L. Hardgrave, Jr., Comparative Politics: The Quest for Theory (Columbus, Ohio: Charles E. Merrill Publishing Company, 1973), pp. 143-173.

[40] See Dye, Understanding Public Policy, Chapter 3. Dye and Zeigler, Irony of Democracy, is a more extended example of applying the elite model.

but apparently perceptible phenomenon, for example, in relation to the Vietnam War and the ecology movement.

In the analysis of technologically-related policy, this model may be useful when the process displays characteristics of the type described above. The place of assessment in such a policy process may be interpreted in several ways. Expert information may play several roles. The possibility that the providers of such information may become a significant part of the elite is considered at greater length below. In the context of more conventional interpretations of the elite model, it seems apparent that assessors would play a subordinate role to the elite. Two possibilities must be considered in relation to this point. An elite cognizant of the technological hazards identified by the assessment movement and others seems to offer a very friendly environment for the effective application of expertise.[41] If, however, other values are regarded as superior, assessment information should be ineffective or suppressed when in conflict with more highly rated factors. Elite use of polemic or exculpatory assessments seems a likely occurrence as well, with supposedly expert information being used as a device of justification and control.

The discussion to this point on the group and elite models has centered on their more conventional applications. There are other elaborations of the same basic perspectives which have special relevance for technologically-related policy.

---

[41] This possibility, as well as that of "technocracy," is noted by Jeffrey D. Straussman, in "Technocratic Counsel and Societal Guidance" (paper prepared for presentation at the 1973 Annual Meeting of the American Political Science Association, New Orleans, Louisiana, September 4-8, 1973), pp. 2, 22-24.

Models of the Technological Polity

A New Pluralism? This interpretation of the political system is based on the premise, already discussed, that the level of technological usage and new forms of technological application have drastically changed the nature of society. Among the salient characteristics of "post-industrial" society, to use one name given the phenomenon, is a revolutionary increase in societal complexity.[42] One aspect of this development is an expansion of large, complex organizations in size and scope of activities. This is accompanied by a magnified role for experts in various fields of knowledge. The concept of "plural elites" obviously has great applicability in a situation of this kind, perhaps more than in a conventional context.

One interpretation, focusing on the size and importance of modern organizations, is labelled the "new pluralism." Peter F. Drucker argues that society is increasingly dominated by large organizations, both public and private, but feels that these power centers may be checked if awareness of their power and function is maintained. He states:

> . . . each organization, the government agency included, must be held to its own specific task and must be forced to keep its authority, as well as its responsibility, within the narrow and strictly interpreted limits of the task. For a pluralist society, strict adherence to specific purpose and narrow boundaries is the first law of liberty.[43]

---

[42] On the term, see Daniel Bell, The Coming of Post-Industrial Society: A Venture in Social Forecasting (New York: Basic Books, Inc., 1973), pp. 37-40.

[43] Peter F. Drucker, The Age of Discontinuity: Guidelines to Our Changing Society (New York: Harper & Row, 1968), p. 256. For a smaller interpretation, see Adolf A. Berle, Jr., Power Without Property: A New Development in American Political Economy (New York: Harcourt, Brace & World, Inc., 1959), p. 88.

Apparently for Drucker the scale of the actors is the most important feature of the new pluralism. He expects the behavior of the system to resemble the old pluralism for the most part. Others see a significant role for new elites within the framework of a new pluralism.[44]

The characterization of pluralism considered by Corinne Gilb may be termed a "new feudalism," a label suggested by her extended comparison of medieval and modern society. Gilb concentrates on the role of professional groups in American society, of which the organized medical and legal professions are a precursive example. The justification of expertise is used by such groups to demand and secure institutional status, which grants them a high degree of control over their area of work. This rationale may be expected to gain in currency in an increasingly technology-oriented society. While Gilb concentrates on the role of the professions, it is possible to extend the analogy of feudalism to include labor unions and corporations. The latter, in particular, are marked by increased size and greater penetration of their employee's lives.[45] The resulting image is one of a society in which large organizations, like feudal nobles, have a high degree of control

---

44 See Zbigniew Brzezinski, Between Two Ages: America's Role in the Technetronic Era (New York: The Viking Press, 1970), pp. 258-265; and Theodore Geiger, The Fortunes of the West: The Future of the Atlantic Nations (Bloomington: Indiana University Press, 1973), pp. 257-259. Such interpretations may be considered either as elaborations on the plural elite theme or in the context of a "new elitism," a concept discussed below.

45 See Geiger, Fortunes of the West, pp. 230-231. On the topic generally, see Lakoff, Private Government. The conceptual problems involved in the phenomenon are discussed in Martin Sorin, "The Boundary Between Public and Private Policy-Making: A Reply to Mark V. Nadel," Journal of Politics, XXXVIII (February, 1976), 159-163.

within their functional areas, analogous to the fiefs of medieval Europe. Though owing at least nominal allegiance to government, as the source of their legitimacy, these organizations are in effect sovereign within their own realm.[46] It will be noted that this conception of pluralism differs from the conventional group model and Drucker's formulation in that the new feudalism emphasizes co-existence of organizations in mutually exclusive spheres rather than competition.

Both of these conceptions of technological pluralism have some empirical referents, at least, in the existence of numerous large and complex organizations. It is of interest for the present study to analyze technologically-related policy in the context of these models. The major questions involved are those of the significance of large organizations, the degree to which organization checks organization, and whether or not a high degree of self-regulation is granted to organizations within their area of expertise.

A New Elitism? The possible relationships between a conventional elite and technological knowledge have already been discussed. There is also the possibility that an elite system will be changed by the increasingly technological nature of society. One of the more obvious ways in which such a development could be manifested is the emergence of those with technological expertise as the dominant elite group in society. The idea of scientists and engineers running society

---

46 The analogy is described in Corinne Lathrop Gilb, Hidden Hierarchies: The Professions and Government (New York: Harper & Row, Publishers, 1966), pp. 3-24. Its basic accuracy on feudalism may be seen by comparing Gild's discussion with historical accounts, such as Carl Stephenson, Medieval Feudalism (Ithaca: Cornell University Press, 1942).

is an old one, especially in a prescriptive form.[47] "Technocracy," as it is frequently termed, also offers a valid descriptive explanation which deserves investigation.

Technocracy in an actual political system may be expected to take the form of a process in which those with the requisite expert information make all decisions, or the most important ones. Consistent with various formulations of elite theory, such an elite could either be located within government or outside of it, or could operate extra-officially, with those in governmental roles acting to implement decisions actually made elsewhere. In either sense, its most visible index would be a pattern of decisions reflecting the consensual value system of the experts.[48]

One's interpretation of technocracy will vary according to the definition of technology used. According to the operational formulation adopted for this study in Chapter I, a technocratic elite would involve those with expert knowledge about the use of physical devices and substances for various extensions of man's abilities. If a broader interpretation is used, an enlarged elite group must be considered. In the latter case, those who are accomplished in the use of "techniques,"

---

47 The concept goes back to the early nineteenth-century thinker Saint-Simon, at least. See Jean Meynaud, Technocracy, trans. by Paul Barnes (New York: The Free Press, 1964), Chapter 4: and W. H. G. Armytage, The Rise of the Technocrats: A Social History (London: Routledge and Kegan Paul, 1965), pp. 65-66.

48 See Meynaud, Technocracy; and Straussman, "Technocratic Counsel," especially pp. 21-22. The emergence of technocracy is denied in Dror, Design, p. 39, and affirmed in Ellul, The Technological Society, pp. 274-275.

in the sense discussed in Chapter I, would also be a part of the elite, along with those more usually considered scientists and technical experts.[49]

A second form of a "new elitism" may be identified which has as its distinguishing characteristic an emphasis on the role of experts in technique. This model of society and politics may be labelled "managerial society." The elite group, according to this interpretation, consists of those with knowledge of organizational and management skills, both in government and in business. Inclusion of both is explained on the basis that the distinction between public and private institutions is of decreasing significance. Thus, individuals in similar fields of expertise have more in common by virtue of their knowledge, training, and attitudes than they have differences because of being employed by governmental or non-governmental organizations.[50] John Kenneth Galbraith describes a metamorphosis in the economic system which contributes to this development. He argues that previous elites have been based on land (feudalism) and money (capitalism), while modern society displays an analogous reliance on knowledge which makes its practitioners the dominant class. The expertise involved includes organizational skills and is represented by the managers who have replaced entrepreneurs and stockholders in the control of large corporations.[51]

---

[49] This is the sense in which Meynaud uses the term. See Technocracy, p. 9.

[50] See James Burnham, The Managerial Revolution (Bloomington: Indiana University Press, 1960; originally published in 1941), especially pp. 77-82; Geiger, Fortunes of the West, pp. 37-38; and Brzezinski, Between Two Ages, pp. 258-265.

[51] John Kenneth Galbraith, The New Industrial State (New York: Signet Books, 1967), pp. 57-70. See also Berle, Power Without Property, pp. 8, 51.

In analyzing policy actions, the influence of a managerial elite may be expected to take the form of decisions consistent with the values and perspectives of experts in various social techniques. With regard to this group, as well as more narrowly-defined technological experts, it may be speculated that such values would include belief in the efficacy of expert knowledge and the value of rational, efficient goal achievement. The nature of the new elite models of society suggests that it is in just such an environment that the ideal role of assessment would find its most comfortable home, since the possibility of conflict between technological knowledge and other values of the elite is less likely here than with more traditional conceptions of elitism.[52]

In summary, the review in this chapter of several models of the processes and actors significant in determining what government does offers a number of cues for the study of technologically-related policy. Each offers identification of potentially important processes and actors and potential explanations of the working of the policy process. As a final concern of this chapter, the basic approach taken in this study will be briefly considered.

The Approach of This Study

The primary form of studying policy used in the following chapters is the case study. Though it is accurately observed in the policy analysis literature that case studies do not offer the breadth of examination which is desired for the establishment of a general empirical theory of policy-making, there seems to be no other way to attempt

---

[52] See Meynaud, Technocracy, pp. 186 and 207-216; and Straussman, "Technocratic Counsel," pp. 24-27.

explanations of the conversion process in the political system.[53] Case studies constitute micro-level empirical investigations which are necessary for the eventual development of comprehensive explanations of policy processes. Though care must be taken in generalizing from such studies, because of the differing circumstances in each case, such activity is nevertheless worthwhile. Policy-making, indeed all political interaction, displays interaction of a great number of factors. Though this may be conceptually untidy in the search for general empirical theory, it is nevertheless a part of the phenomenon under examination. In this writer's opinion, the complexity of the situation must be accounted for at some point, rather than being defined out of the object of investigation. At the present stage in the discipline, the case study seems to offer the only means of doing so, though there may be methods for productively dealing with the aggregate conclusions of numbers of case studies.[54]

The studies below are empirical in orientation, though not altogether quantitative. An effort is made to present as complete a description of the relevant processes as is possible, though there are significant barriers to observing the inside of the "black box," as

---

[53] Dye, Understanding Public Policy, p. 6. For contrary views on the value of the device, see Dror, Design, p. 96; Eulau, Behavioral Persuasion, pp. 121-127; and Allan P. Sindler, "Preface," in Sindler, American Political Institutions, p. iii.

[54] See the approaches of this type used in John Walton, "A Systematic Survey of Community Power Research," in The Structure of Community Power, ed. by Michael Aiken and Paul E. Mott (New York: Random House, 1970), pp. 443-464; and Claire W. Gilbert, "Community Power and Decision-Making: A Quantitative Examination of Previous Research," in Community Structure and Decision-Making: Comparative Analyses, ed. by Terry N. Clark (San Francisco: Chandler Publishing Company, 1968), pp. 139-156.

discussed above. For this reason, conclusions on some points must be somewhat tentative, with the reasoning and factors involved in a given interpretation being explained.

Each of the case study chapters follows the same basic procedure. First, the technology involved is described, followed by an examination of the situations associated with it which have been identified as problems. The identity of social and political actors involved in assessment activities and in decision-making is a third concern, together with their interactions. This takes the form of a narrative of a political "debate" or "controversy" associated with a given technological application. It should be noted, however, that this does not mean that analysis is limited to crisis situations, since in either or both the background of policy actions or their outcome a more "normal" sequence of policy-making is observable.

The next major feature of each case study is the analysis of policy-making. It is at this point that the relevant points identified in this chapter in relation to policy science, policy analysis, and the descriptive models of the policy process are applied to particular phenomena. This enables conclusions to be drawn regarding the characteristics of technologically-related policy-making. These are formulated for each study and, in the final chapter, are compared and used as a basis for generalization about technologically-related policy, with particular reference to the role played by assessment-type activities in the making of such policy.

CHAPTER IV

THE DDT BAN: ADVERSARY ASSESSMENT

In this chapter the decisions leading to the prohibition of the sale of the pesticide DDT in the United States are examined as an example of technologically-related policy. The heated ten-year controversy from the publication of Silent Spring in 1962[1] to the 1972 ban on DDT pronounced by William Ruckelshaus, Administrator of the Environmental Protection Agency, is a fitting case to analyze first. The debate over DDT as an environmental pollutant is representative of a number of similar public policy issues which have arisen in the last decade. It is representative because of the tactics used and the impact of expert information in the policy process. As one of the first such issues, it may be argued, the DDT controversy influenced later events involving similar factors.

As it involves technology assessment in particular, the case of DDT offers mixed evidence about the role which is played by expert information in the policy process. It is argued below that institutionalized assessment was not a crucial factor in the outcome of the controversy. Rather, assessments were characteristically most effective as weapons in group conflict.

---

[1] Rachel Carson, The Silent Spring (Boston: Houghton Mifflin Company, 1962).

Analysis of this issue indicates that the pluralist model offers the greatest explanatory value in the case of DDT policy and that the role of assessment was affected by this characteristic of the policy-making process. While expertise had some influence it did not operate as the ideal model of technology assessment dictates that it should.

The study begins with a description of DDT pesticide technology and its development to proportions significant enough to attract attention to its environmental effects. This was a function of diffusion through first-order assessments. A second step consists of a brief narrative treatment of the emergence and resolution of the public issue of DDT use. Assessment activities are identified and discussed as a third topic, followed by analysis of policy-making in the case and, finally, an evaluation of the role played by assessment.

DDT Pesticide Technology and How it Grew

Technology has been defined for the purposes of this study as the knowledgeable use of physical devices and substances by man to extend his capacities. The capacity involved in this case is the ability to control the natural environment to achieve a more desirable state by eliminating organisms considered to be "pests." Such organisms are not delineated biologically but rather are designated as undesirable because of a perception that their presence is detrimental to human activities.[2] In the present case, the species targeted as undesirable are those kinds of insects which either carry diseases harmful to man,

---

[2] Edward H. Smith, "Pesticides in the Environment: A Statement of the Problems," in Environmental Problems, ed. by Billy Ray Wilson (Philadelphia: J. B. Lippincott, 1968), p. 87

such as malaria, typhus, or encephalitis, or damage crops, both food and fiber, to an extent considered significant. Annoying sound, sight, or touch from insects is a third and less important factor.

The physical substance used in DDT pesticide technology is a compound called dichlorodiphenyltrichloroethane (DDT). The substance, which does not occur in nature, was first synthesized in 1874. Knowledge of its use for achieving a desirable end was not developed until 1938, however, when a Swiss chemist discovered that the compound was insecticidal. After an insect absorbs or ingests DDT in sufficient quantities convulsions occur and death results. For example, a DDT level of five parts per billion (ppb) is lethal to the anopheles mosquito larva.[3] The method of application consists of releasing DDT into the environment in quantities sufficient to produce the result of significant reductions in the level of insect life. This operation involves other technological applications, of course, such as the machinery used, but these are not important for the purposes of this study.

The demonstrated effectiveness of DDT in crop protection in Switzerland in 1939, and further tests by the United States government, resulted in its adoption by the military as an insecticide during World War II. Successful control of a typhus epidemic in Naples in 1943-1944 was widely publicized, thus disseminating favorable first-order assessment information. Civilian use was authorized in September, 1945.[4]

---

[3] Pyle, Chemistry and the Technological Backlash, pp. 129-130; and James C. Leary, et. al., DDT and the Insect Problem (New York: McGraw-Hill, 1946), p. 64.

[4] Leary, et. al., DDT and the Insect Problem, pp. 65-69.

Figure 2 illustrates the domestic use of DDT in the United States. To be noted is the relatively rapid adoption of the technology from 1945 to 1950, when the initial entry on the graph indicates use of over fifty million pounds. This and the subsequent high utilization of the pesticide represent the aggregate of many first-order assessments. In terms of its direct effects DDT has many advantages as a pesticide. It is cheap, effective for many species of insects, simple to apply, and safe to handle. Uses of DDT included home applications, public health programs, forestry, and agriculture, the last of which represents the largest proportion of consumption. Agricultural use represented fifty-nine per cent of all pesticide consumption in this country in 1966.[5]

It should be noted that DDT consumption began to decline steadily after 1960. This probably represents a declining effectiveness because of insect resistance developed through natural selection over several generations in various species. Other pesticides were used to replace DDT, so that total pesticide use continued to rise while DDT consumption declined.[6] The fact that DDT did not become a subject of public debate until long after it reached a high and constant level of

---

[5]U.S., Environmental Protection Agency, Production, Distribution, Use and Environmental Impact Potential of Selected Pesticides, by Rosmarie von Rumker, Edward W. Lawless, and Alfred P. Meiners (Washington, D.C.: Government Printing Office, 1975), p. 23.

[6]See Ibid., p. 13, for production of all synthetic organic pesticides, 1962-1972. On resistance, see George W. Irving, Jr., "Agricultural Pest Control and the Environment," in The Survival Equation: Man, Resources, and His Environment, ed. by Roger Revelle, Ashok Khosla, and Maris Vinovskis (Boston: Houghton Mifflin, 1971), p. 482. It can be argued that anti-DDT publicity contributed to the decline. However, the National Audubon Society, which would seem to have an interest in supporting this interpretation, agrees with the explanation above, in a letter from Robert C. Boardman, Director, Public Information, to the writer, April 30, 1976.

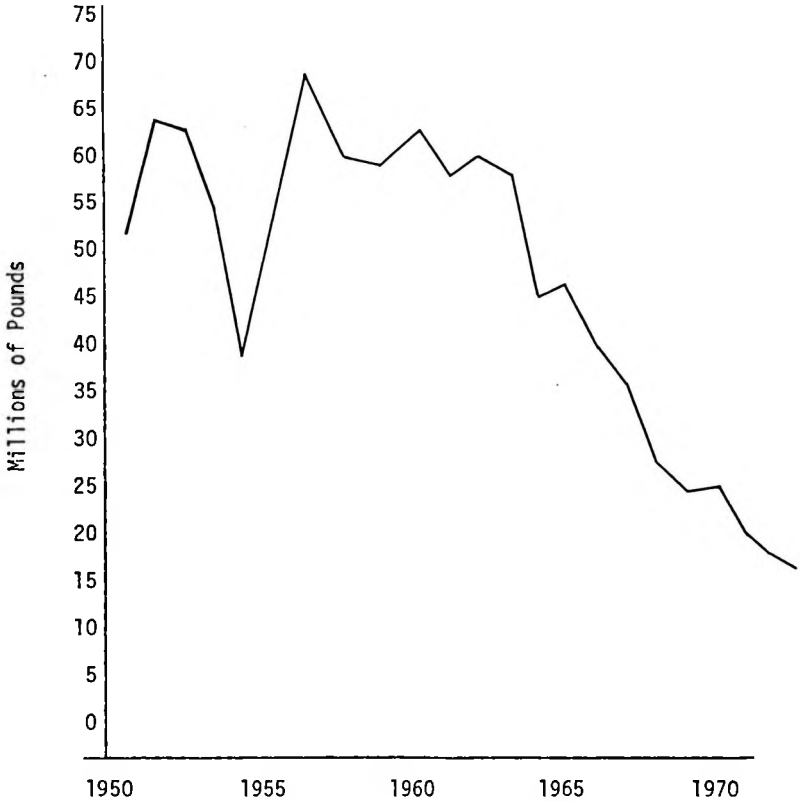


Figure 2. Domestic Consumption of DDT, 1950-1972 (from Environmental Quality, Sixth Annual Report of the Council on Environmental Quality, December, 1975, p. 369).

use is explained by factors other than DDT consumption itself. Rather, the information available about the pesticide and the valuation placed on such information provide the key element in the emergence of DDT as an issue.

The data at issue are concerned with the second-order effects of DDT, that is, those which occur in a manner not readily apparent in

connection with purposeful application. Designation as "second-order" is analytical, not natural. The indirect effects, like the direct, follow from the properties of the compound and the manner in which it is used. It may be noted that all of the factors discussed below are not agreed upon by all observers, even those with "scientific" credentials.

One set of second-order consequences occurs in a relatively direct and observable fashion after application but apparently was discounted or not noticed because of attention to direct effects. DDT does not, of course, seek out and kill "bad insects." Rather, it is released into the environment where the primary effect, in terms of first-order assessment, is a reduction in the number of pest insects. The compound is toxic to most insects; it may therefore kill beneficial ones. Also, DDT may kill non-insect organisms in the concentrations used for insecticidal purposes. The initial government tests of the compound, for example, indicated that DDT could be lethal to fish.[7] This kind of second-order effect was probably not noticed by many users of DDT or was adjudged insignificant in relation to the direct consequences of the pesticide's use. The latter seems to have been the case with government assessors during World War II.

Other indirect effects are more difficult to observe, partly because a longer time span is involved. Disagreement within the scientific community is more evident regarding these phenomena, as well. The chemical properties of DDT are such that it is insoluble in water

---

[7] William A. Niering, "The Effects of Pesticides," in Wilson, Environmental Problems, pp. 104-105; Smith, "Pesticides in the Environment," pp. 91-93; Pyle, Chemistry and the Technological Backlash, p. 138; and Leary, et. al., DDT and the Insect Problem, p. 14.

and highly soluble in oils. DDT has a tendency to persist in the environment for a long period of time. When ingested by organisms the pesticide becomes concentrated in fatty tissues. Metabolic action has little effect, except to change DDT to a related compound which is itself toxic to insects.[8] When organisms containing these substances are eaten by predators the pesticide content is largely retained in the body of the latter, resulting in "magnification" in food chains. Data on a section of Lake Michigan illustrate the phenomenon. Sediments from the lake were found to contain .0085 parts per million (ppm) DDT, while crayfish and other invertebrates had .41 ppm. Fish which fed on these organisms had DDT residues of 5 ppm and herring gulls, which fed on the fish, were found to have 3,200 ppm in the fatty body tissues.[9]

The occurrence of residues does not seem to be a matter of dispute but the effect of their presence is the subject of contention. A number of studies have linked DDT residues to an enzyme action in birds which results in weakened eggshells and reduced reproductive rates. Laboratory experiments with animals, primarily mice and rats, have indicated that DDT in substantial amounts can produce cancer and birth defects. Whether these findings have any significance for human health

---

[8] Pyle, Chemistry and the Technological Backlash, pp. 131-132, 137; and Smith, "Pesticides in the Environment," pp. 93-94.

[9] These figures are presented by Pyle, Chemistry and the Technological Backlash, p. 132. Additional examples of magnification are cited in the text and bibliography of Cleaning Our Environment: The Chemical Basis for Action, a report by the Subcommittee on Environmental Improvement, Committee on Chemistry and Public Affairs, American Chemical Society (Washington, D.C.: American Chemical Society, 1969).

is a matter of dispute.[10] It appears to be accepted that humans in this country during the period of extensive DDT use had DDT residues of 10 to 20 ppm from direct absorption or ingestion in or on food. Observational and experimental studies have not shown that residues at then current levels were harmful to human health.[11] Speculation that these residues had some harmful effect was common, however, in discussions of second-order consequences of DDT during the controversy over the pesticide's use.

DDT As An Issue

As noted, DDT use did not emerge as a controversial issue for almost two decades after its introduction. This does not mean that no policy action had been taken relevant to the pesticide. As an initial point, it may be argued that the government's first-order assessment served to legitimize DDT. More clearly identifiable as a policy action is the passage of the Federal Insecticide, Fundicide and Rodenticide Act of 1947 (FIFRA), apparently in response to the rapid growth of synthetic

---

10 See Jack L. Radomski, "Pesticide Highlights--The Sixties: Pesticides and Carinogenesis [sic]," in Pesticides and the Environment: A Continuing Controversy, ed. by William B. Deichmann (New York: Intercontinental Medical Book Corporation, 1973), pp. 15-18. For an example on bird reproduction, see Charles F. Wurster, Jr., "DDT Residues and Declining Reproduction in Bermuda Petrel," Science, CLIX (March 1, 1968), 979-981.

11 Cleaning Our Environment, pp. 20, 231-235; Griffith E. Quinby, Wayland J. Hayes, Jr., John F. Armstrong, and William F. Durham, "DDT Storage in the U.S. Population," Journal of the American Medical Association, CXCI (January 18, 1965), 113; and H. E. Stokinger, "Sanity in Research and Evaluation of Environmental Health," Science, CLXXIV (November 12, 1971), 662-665.

pesticide use.[12] The act provided that "economic poisons" in interstate commerce were to be registered, at that time, with the Department of Agriculture. Registration was subject to withdrawal if products were found to be adulterated, misbranded, or improperly labelled. Injury to man or other non-target species from use in accordance with label instructions or commonly-recognized practice is defined by the act as an indication of misbranding.

DDT was thus regulated almost from the beginning of civilian use. It may be argued, however, that registration served a legitimizing function more than a regulatory one; though the act provided criminal sanctions for violation, it is reported that no case was ever referred to the Justice Department for prosecution.[13] Though a case can be made for more or less continuous assessment under FIFRA, first-order effects seem to have been valued over second-order consequences. This probably resulted from a protective or promotional attitude on the part of the Department of Agriculture rather than a regulatory one.

The other major statute relevant for DDT is the Food, Drug and Cosmetic Act of 1938. As amended, this act requires the Secretary of Health, Education, and Welfare to establish maximum allowable levels (tolerances) for residues of economic poisons in food products. The Food and Drug Administration (FDA) can seize goods in interstate

---

[12] 7 U. S. C. 135.

[13] William H. Rodgers, Jr., "The Persistent Problem of the Persistent Pesticides: A Lesson in Environmental Law," in Environmental Law (Greenvale, N.Y.: Research and Development Corporation, 1970), pp. 70-114, especially pp. 73-75. See also James B. Macdonald and John E. Conway, Environmental Litigation (Madison: Department of Law, University of Wisconsin Extension, 1972), pp. 135-141.

commerce which violate such tolerances. The Delaney Amendment to the act, added in 1958, requires a "zero tolerance" for materials which produce cancer in test animals.[14] Like the provisions of FIFRA, the assessment required by this statute constituted no significant obstacle to DDT use for a number of years.

Other assessors argued for the overriding importance of DDT's indirect effects during this period. The major event in the emergence of DDT as an issue did not occur, however, until 1962. The publication of Rachel Carson's The Silent Spring in that year seems unanimously credited with the effective dissemination of the thesis that widespread pesticide use was undesirable because of the unintended effects. Damage to birds and wildlife, possible human health risks, and disruption of complex environmental relationships possibly endangering all forms of life were cited. Carson called for more cautious use of pesticides and was especially critical of persistent compounds, including DDT. Silent Spring was a successful book, partly because of the skill of its author, a biologist whose previous works had been well received.[15]

Carson's work, in effect a private assessment of the polemic type, was quickly followed by both supportive and hostile actions from

---

[14] 21 U. S. C. 346; Rodgers. "Persistent Problem," p. 70; and Macdonald and Conway, Environmental Litigation, p. 252.

[15] On Carson and the writing of the book, see Frank Graham, Jr., Since Silent Spring (Boston: Houghton Mifflin, 1970). Graham, pp. 15-17, cites some earlier warnings. The popularity of the book is indicated by advance sales of 40,000, eleven hard-cover and twenty paperback printings, and total sales of two million copies by 1972. See Graham, Since Silent Spring, pp. 52-53; and Melvin J. Grayson and Thomas R. Shepard, Jr., The Disaster Lobby: Prophets of Ecological Doom and Other Absurdities (Chicago: Follett Publishing Company, 1973), p. 29.

interest groups. The National Wildlife Federation and the National Audubon Society honored Miss Carson with awards for her contribution to conservation efforts. Alternative assessments of pesticide technology, exculpatory in nature, were publicized in speeches and printed material by individual business firms and organizations such as the Nutrition Foundation, the Manufacturing Chemists Association, and the National Agricultural Chemical Association. Counter-attacks emphasized the importance of pesticides for food production and accused Carson of exaggerating hazardous effects.[16]

It should be noted at this point that DDT was not the only pesticide discussed in the emerging debate. Carson, the conservationist groups, and the chemical industry all attacked and defended chemical pesticides in general. DDT in particular seems to have become a symbol of other chemicals early in the debate. Its familiarity, variety of uses, and environmental persistence were factors in the symbolic importance attributed to DDT. It was an important pesticide, but it took on even greater importance as a representative of other similar agents.

In addition to the interest group activity generated by Silent Spring, some direct consequences in the policy process seem to have resulted from the book. President Kennedy mentioned it in a press conference; on the following day initiation of a pesticide study by the

---

16 New York Times, September 4, 1962, p. 37; ibid., September 22, 1962, pp. 28-29; ibid., March 2, 1963, p. 7; ibid., April 25, 1963, p. 35; ibid., December 5, 1963, p. 49; ibid., January 25, 1964, p. 25. See also Graham, Since Silent Spring, pp. 39, 48-49, 56-60, and 86-88; Ruth Mulvey Harmer, Unfit for Human Consumption (Englewood Cliffs, N.J.: Prentice-Hall, 1971), p. 135; and "Congress Weighs Stronger Controls on Pesticides," Congressional Quarterly Almanac, XX (1964), 139-142.

President's Science Advisory Committee was announced. The report of this group, released in 1963, recommended reduction in the use of persistent pesticides.[17] Other policy actions perhaps attributable to Silent Spring include a Senate investigation which resulted in recommendations for continued study and encouraging development of safer pesticides. Congress also amended the act governing the regulation of pesticides to prevent marketing of untested products. President Johnson expressed gratitude to Carson as he signed the legislation.[18] In addition, the Departments of Agriculture and Interior limited their direct use of DDT. A different type of reaction was exhibited by the House appropriations sub-committee on agriculture, chaired by Jamie Whitten of Mississippi. This body released a report charging Carson with creating an unnecessary air of panic.[19]

During the same period, state governmental action included creation of a study commission in California, a request by the governor

---

17 Graham, Since Silent Spring, p. 51, suggests that Kennedy read the portions of the book which appeared in The New Yorker and was perhaps motivated to take action. Grayson and Shepard, Disaster Lobby, pp. 29-30, credit the presidential action to public pressure resulting from the book. A rather general causal relation is cited in a number of accounts, including Helen B. Shafer, "Pesticide Control," Editorial Research Reports, May 20, 1964, pp. 361-380.

18 New York Times, July 22, 1966, p. 12; ibid., May 13, 1964, p. 49. Graham, Since Silent Spring, pp. 361-380, cites Senator Ribicoff, who chaired the Senate investigation, as stating that he had read Silent Spring and concluded that Congressional action was needed.

19 New York Times, May 23, 1963, p. 39; ibid., September 6, 1964, p. 28; ibid., April 20, 1965, p. 28. Whitten later published That We May Live (Princeton: D. Van Nostrand Company, 1966), based on the subcommittee's report.

of New Hampshire that state agencies cease using DDT, and the pesticide's elimination from New Jersey gypsy moth control programs. The Audubon Society was apparently instrumental in the last action. Hearings on the use of DDT in mosquito control programs were held in Suffolk County, New York, in response to public pressure.[20]

At this stage in the controversy, some reduction of use occurred on the part of government agencies. The dominant theme at the national level was for limited action, such as studies which recommend gradual change and adjusting the pesticide regulation statute. Beginning in 1967, a marked change in policy actors and actions becomes evident.

A major new group emerged in 1966-1967, with its origins in a suit against DDT use for mosquito control in Suffolk County, New York, initiated by Victor Yannacone, an attorney, and his wife Carol. The court action was unsuccessful, though DDT use was halted anyway. As an event symbolically important for all DDT use, the suit was widely publicized by the Audubon Society, which also followed Yannacone's suggestion and voted to endorse the formation of an "environmental defense fund." The Environmental Defense Fund was incorporated in 1967. Though the EDF relied on second-order assessment information quite similar to that presented by Carson and others, it proved an innovation in environmental politics in its combination of legal and scientific

---

[20] New York Times, April 4, 1964, p. 20; ibid., April 18, 1964, p. 57; ibid., May 7, 1964, p. 55; ibid., May 26, 1964, p. 41; and ibid., June 4, 1964, p. 34.

expertise and its focus on judicial and administrative, or quasi-judicial, remedies.[21]

The EDF took the initiative in one of the most significant events at the state level during this period. As a result of extended administrative hearings, DDT was declared a pollutant under Wisconsin law. These proceedings, lasting from late 1968 through the first half of 1969, were widely recognized as having great symbolic importance for both opponents and defenders of DDT. The EDF's marshalling of expertise was met on the opposing side by the National Agricultural Chemical Association.[22] The organization, however, was unsuccessful in federal court during this period. In addition to the national publicity given the Wisconsin hearings, group activity of a more conventional type continued, including "educational" campaigns by the National Wildlife Federation and the National Audubon Society, which disclosed that the national bird, the bald eagle, was threatened with extinction, at least partially as a result of pesticide effects.[23]

---

[21] New York Times, September 11, 1966, p. 129; ibid., October 2, 1967, p. 49; ibid., December 2, 1967, p. 79; and Harmer, Unfit for Human Consumption, pp. 245-246. On these tactics as innovative, see Luther J. Carter, "Environmental Law (I): Maturing Field for Lawyers and Scientists," Science, CLXXIX (March 23, 1973), 1205-1209; and Joseph L. Sax, Defending the Environment: A Strategy for Citizen Action (New York: Alfred A. Knofp, 1971).

[22] New York Times, December 1, 1968, sec. IV, p. 10; ibid., December 3, 1968, p. 31; ibid., January 14, 1969, p. 11; ibid., January 15, 1969, p. 48; Harmer, Unfit for Human Consumption, pp. 43-44, 60-61, 121, 250-251; Graham, Since Silent Spring, pp. 257-258; and Victor John Yannacone, Jr., "Environmental Law/Environmental Systems Science: Interaction at the Interface in Litigation and Legislation," in Environmental Systems Science, Vol. II of the Proceedings, National Institute on Environmental Litigation, April, 1973, ed. by Victor John Yannacone, Jr. (N. p.: American Bar Association, 1974), 191-236.

[23] New York Times, February 28, 1968, p. 35; ibid., April 28, 1969, p. 43; ibid., May 20, 1969, p. 53; and ibid., June 27, 1969, p. 15.

Actions in other states against DDT included restrictions on its use in California and Arizona. In Michigan DDT sales were banned administratively after an FDA seizure of contaminated coho salmon.[24] Federal government actions proceeded but followed the same gradual course as in the earlier phase. The FDA strengthened tolerances for DDT residues in food products, while the Department of Agriculture suspended use of DDT and other pesticides in certain departmental programs. Robert Finch, Secretary of Health, Education, and Welfare, announced the appointment of the Mrak Commission to study pesticides in their relationship to environmental health.[25]

The period 1966-1969 was particularly marked by the emergence of litigation as the strategy of anti-DDT groups. The focus on administrative and judicial remedies continued with the announcement on October 31, 1969, that the National Audubon Society, the Environmental Defense Fund, the Sierra Club, and the Western Michigan Environmental Action Council had petitioned Secretary of Agriculture Clifford Hardin to ban the use of DDT under FIFRA because of excessive danger to humans and wildlife.

---

24 Ibid., March 27, 1969, p. 50; ibid., April 17, 1969, pp. 1, 15; ibid., April 18, 1969, p. 41; and ibid., October 29, 1969, p. 25. Chemical industry representatives were active in appealing the Michigan and Wisconsin rulings; see ibid., May 4, 1969, p. 41; and ibid., September 14, 1969, p. 72.

25 Ibid., March 15, 1967, p. 35; ibid., February 8, 1968, p. 45; ibid., April 23, 1969, p. 47; ibid., August 16, 1969, p. 27; and Facts on File, XXIX (August 28-September 3, 1969), 559. Harmer, Unfit for Human Consumption, pp. 99-100, links Finch's action to a National Cancer Institute Study which found DDT to be carcinogenic in test animals. Rodgers, "Persistent Problem," p. 70, credits public opinion and the salmon seizure.

The EDF also petitioned HEW to prohibit the sale of foodstuffs with DDT residues.[26] Within the next two months several actions were taken by federal agencies. HEW Secretary Finch announced that the government intended to prohibit DDT use in residential areas soon and to phase out all but "essential" uses over a two-year period. These actions were identified as the result of a joint HEW-Agriculture-Interior agreement to implement the recommendations of the Mrak Commission. Secretary Hardin announced the further action of suspending some DDT uses, including tobacco, shade tree, and home and garden applications. The Department of Agriculture also published in the Federal Register a proposal to cancel all other uses of the pesticide.[27]

On December 29, 1969, however, the petitioning organizations filed suit in the District of Columbia Court of Appeals claiming exhaustion of administrative remedies and asking review of Hardin's decisions, under the provisions of FIFRA, especially his failure to suspend registrations as a part of cancellation proceedings. Without suspension, marketing could continue throughout extended cancellation procedures, the length of which was guaranteed by chemical company appeals. In March, 1970, Hardin was ordered by the court to suspend registrations or give cause for failing to do so. Three months later Hardin replied that

---

[26] New York Times, November 1, 1969, p. 30. See pp. 97-99, above, on the relevant statutes.

[27] New York Times, November 13, 1969, p. 1; ibid., November 21, 1969, pp. 1, 16; ibid., June 1, 1970, p. 20; ibid., January 8, 1971, pp. 1, 15; and Rodgers, "Persistent Problem," pp. 70, 84-85. The complete citation of the Mrak Report is: U.S., Department of Health, Education, and Welfare, Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health (Washington, D.C.: Government Printing Office, 1969).

the available evidence did not indicate "imminent hazard" to human health and that suspension was not warranted. Cancellation notices for fifty additional uses were issued later, again without suspension.[28] The situation remained stalemated until pesticide regulation responsibilities were transferred to the newly-created Environment Protection Agency in December, 1970.

During the same period, other actions included initiation of "zero tolerances" by HEW after a court order to Finch. Seizures of contaminated food, primarily fish, continued. State restrictions increased, including bans in Vermont, Washington, New York, and Wisconsin, where a statute supplemented the earlier administrative ruling.[29] Interest group activity on behalf of the pesticide continued, including an American Forest Institute announcement of increased gypsy moth damage, warnings from agricultural groups that substitutes would be necessary to maintain food and cotton production, and an attempt by the "Operation Good News" committee of the Drug, Chemical and Allied Trades Association to enlist Vice President Agnew in its pro-pesticide campaign.[30]

---

28 New York Times, December 30, 1969, p. 14; ibid., January 8, 1970, p. 14; ibid., May 29, 1970, p. 8; ibid., June 30, 1970, p. 33; and ibid., August 29, 1970, pp. 1, 5. See also Macdonald and Conway, Environmental Litigation, pp. 133, 141-142, 158, 187-188, and 235-236.

29 New York Times, December 7, 1969, p. 67; ibid., December 30, 1969, p. 14; ibid., January 4, 1970, p. 29; ibid., January 9, 1970, p. 16; ibid., April 6, 1970, p. 31; ibid., April 15, 1970, p. 6; and ibid., June 1. 1970, p. 20.

30 Ibid., November 15, 1969, p. 16; ibid., December 30, 1969, pp. 37, 51; ibid., February 8, 1970, p. 52; ibid., November 12, 1970, p. 40; ibid., February 20, 1971, p. 27; and ibid., March 10, 1971, p. 38.

On December 2, 1970, the Environmental Protection Agency came into existence and assumed the function, among others, of pesticide regulation. William D. Ruckelshaus, EPA Administrator, was promptly ordered by the Court of Appeals to cancel registrations for all uses of DDT and to make an immediate determination of "imminent hazard," which Hardin had failed to do to the satisfaction of the court. Cancellation notices were issued by Ruckelshaus, who announced that he had decided against suspensions, citing dangers associated with substitute pesticides.[31] Pursuant to FIFRA, challenges led to the appointment of a "scientific panel" by the EPA, which recommended phasing DDT out but cited only indirect threats to human welfare. A second appeal resulted in appointment of a federal hearing examiner, who reported in April, 1972, that DDT should be allowed to continue in limited agricultural use. Nevertheless, cancellation procedures completed, Ruckelshaus announced on June 14, 1972, that registrations for all uses of DDT were cancelled, except for use on green peppers, onions, and sweet potatoes, and for public emergencies, effective December 31, 1972.[32]

The decision to ban DDT was apparently effective, though there are reports of illegal sales under state and federal prohibitions and of

---

[31] Ibid., January 8, 1971, pp. 1, 15; ibid., January 16, 1971, p. 59; ibid., March 19, 1971, pp. 1, 78. See also Richard A. Carpenter, "Federal Policy and Environmental Chemistry," in Environmental Management: Science and Politics, ed. by Morton Gorden and Marsha Gorden (Boston: Allyn and Bacon, Inc., 1971), pp. 519-529; Stahrl Edmunds and John Letey; Environmental Administration (New York: McGraw-Hill, 1973), p. 82; and William M. Upholt, "Pesticide Highlights--The Seventies: New Legislation," in Deichmann, Pesticides and the Environment, pp. 19-20.

[32] New York Times, August 6, 1971, p. 37; ibid., September 22, 1971, p. 15; ibid., April 26, 1972, p. 9; and ibid., June 15, 1972, pp. 1, 20. EDF Letter, May, 1973, reports the cancellation of the last agricultural uses as well.

government employees ignoring bans on agency use. Certain legal exceptions have been granted, particularly in the northwestern states for use against tussock moths, with side effects of game and livestock contamination. All such requests have not been granted, however, and a 1973 proposal by the House Agriculture Committee to restore authority for approving emergency exceptions to the Secretary of Agriculture failed.[33]

There has been some consideration of the impact of this action on the criteria used in evaluations of DDT. The EPA reported in 1975 that DDT resudues in humans had declined since the prohibition and that the economic impact has been "minimal." Though the cost of using other pesticides ranged from one to six dollars per acre for cotton, the EPA estimated that this meant only a 2.2¢ increase per year for the average consumer. Various species of birds and marine life have been reported to be on the increase since DDT was banned. The U. S. Public Health Service reports only a slight increase in malaria in 1974; the incidence in reported cases per 100,000 population is lower since the ban, that is, in 1973 and 1974, than during the years in which DDT was used for mosquito control.[34]

---

33 On illegal use, see New York Times, June 18, 1970, p. 35; ibid., April 7, 1962, p. 15; ibid., May 12, 1972, p. 15; Facts on File, XXX (July 23-29, 1970), 537; and Harmer, Unfit for Human Consumption, pp. 257-260. On exceptions, see New York Times, April 21, 1973, p. 8; ibid., November 13, 1973, p. 22; ibid., June 29, 1974, p. 14; ibid., October 16, 1974, p. 21; and ibid., November 25, 1975, p. 59.

34 New York Times, August 13, 1975, p. 19; EDF Letter, March, 1976; and U. A. Department of Health, Education and Welfare, Public Health Service, Morbidity and Mortality, XXIII (June 15, 1975), 2, 3, 44. Environmental Quality, Sixth Annual Report of the Council on Environmental Quality (December, 1975), pp. 368-376, summarizes many consequences of the ban.

Assessments In The Process

Consideration of the role of assessment activities is presented below in two sections. The first identifies and discusses the more significant of these activities in the context of the typology of assessments formulated in Chapter II. A second section follows the analysis of policy-making and evaluates the role actually played by assessments in the process.

As an initial step, the variables which were considered in various assessments can be identified. When assembled into a single list these variables provide a comprehensive framework for assessing DDT pesticide technology. Such a "model" assessment is presented in Figure 3. It should be noted that most actual evaluations considered only some of these factors. In the model assessment no attempt has been made to supply quantitative values for costs and benefits. This is primarily a result of the difficulties associated with valuing non-economic factors, such as those dealing with health and aesthetic satisfactions. Actual assessments display a wide disagreement on such variables. The fact that no comprehensive assessment of the type discussed in Chapter II occurred is due in substantial part to the barriers which unavoidably confront comparative valuation of non-economic variables.[35]

The actual assessments related to DDT may be considered in several categories. Several of the more significant ones are identified

---

[35] J. C. Headley and J. N. Lewis, The Pesticide Problem: An Economic Approach to Public Policy (Washington, D.C.: Resources for the Future, Inc., 1967) is particularly helpful in considering the cost/benefit equation related to DDT and other pesticides, including the difficulties associated with valuation.

Benefits	Costs
Agricultural effects of less damage to crops and greater yields; societal benefits of greater amount and variety of food and lower cost. Similar effects in connection with forestry.	Direct costs of manufacturing and applying DDT.
	Agricultural effects of damage to beneficial insects; societal costs in food availability and cost.
Public health effects of fewer disease vector insects; societal benefits should include lower incidence of illnesses such as malaria and encephalitis, measurable in terms of intangible values of less illness and death and economic values of greater productivity and lower health care costs.	Ecological effects of damage to non-target organisms, both birds and fish. Societal costs in loss of aesthetic satisfactions associated with presence of wildlife; economic and non-economic costs from deprivation of recreational opportunities; economic costs in commercial fishing.
Occupational health effects of avoiding poisoning from replacement pesticides such as the more directly toxic parathion.	Human health effects of direct poisoning (minor) and DDT residues in general population. Societal costs in non-economic and economic factors related to possible carcinogenesis, teratogenesis, and mutagenesis.
Aesthetic benefits of avoiding unpleasant insect sound, sight, and touch.	Macro-ecological effects of possible environmental disruption; cost probabilistic but infinitely valued by some assessors.

Policy Alternatives

Continue existing situation, with concomitant costs and benefits.

Discontinue DDT use without replacement; avoidance of costs and loss of benefits.

Discontinue DDT use and replace with non-chemical pest controls; cost avoidance but net benefits probably less.

Discontinue DDT use and replace with other pesticides. Probably less benefits, new costs incurred, including direct pesticide poisoning and greater cost for material used.

Combine above courses of action, such as partial ban on DDT and replacement with variety of other pest control means. Calculation of costs and benefits depends on particular configuration employed.

Figure 3: Model Assessment of DDT Pesticide Technology.

below, while their role in the debate is considered in more detail in a later section. First-order assessments are to be credited with the diffusion of the technology in the first place and, as noted above, were apparently resulting in a decline in DDT use by the time the controversy started. This did not play an important part in the policy decisions. It appears neither to have mitigated opponents' attacks nor to have rendered DDT's defenders less resolute.

Comprehensive assessments occurred in several forms. Private polemic assessments included Carson's book and similar literature produced by individual actors as well as the vast amount of material issued by interest groups opposed to DDT use. Exculpatory assessments were publicized by other groups, particularly the National Agricultural Chemical Association. Private scholarly assessments, in the form of expert testimony and publications in professional journals, were utilized by all private actors but were either selectively chosen or differentially valued.[36]

Many governmental comprehensive assessments are also identifiable. In the early phases the President's Science Advisory Committee and the Ribicoff subcommittee produced evaluations emphasizing costs to a degree, while Whitten's subcommittee found benefits to be the overriding consideration. The Wisconsin hearings and other state actions resulting in restrictions on DDT also fall into the category of governmental comprehensive assessments. Finally, evaluations were issued by

---

[36] See, for example, Harmer, Unfit for Human Consumption, pp. 41-42, on residue-retention research such as that presented by Quinby, et. al., "DDT Storage," Data on wildlife effects, such as Wurster, "DDT Residues," tended to be highly valued by environmentalist groups and discounted by pesticide manufacturers. See Rodgers, "Persistent Problem," p. 89.

the Mrak Commission, by the judiciary in EDF v. Hardin (1970) and EDF v. Ruckelshaus (1971), and by the scientific panel and the hearing examiner appointed by the EPA under the provisions of FIFRA. Though similar information was reviewed in each of these, recommendations varied. The Court of Appeals found immediate suspension desirable. More gradual elimination was advocated by the others, with the exception of EPA's hearing examiner, who recommended that DDT be allowed to continue in limited agricultural use. Explanation of the policy actions on DDT must clearly go beyond consideration of institutionalized assessments.

Analysis: Who Banned DDT And Why

In this section the potential explanation of the policy process discussed in Chapter III are applied to the case of the DDT controversy. The procedure followed below consists of examining the evidence relevant to hypothetical explanations suggested by research on public policy in general.

The Institutional Model. As a first consideration, it cannot be denied that the existing structure of regulations and governmental roles is significant for describing the policy process in this case. The question of "who banned DDT?" can be answered in terms of institutionally-defined actors. Individuals whose decisions were significant included Secretary of Agriculture Clifford Hardin, Secretary of HEW Robert Finch, Chief Judge David Bazelon of the D. C. Court of Appeals, and William Ruckelshaus, EPA Administrator, to name a few. Statutory requirements under FIFRA and other laws designated these actors as jurisdictionally responsible. Such identification does not, of course, constitute anything approaching a complete analysis of the policy process in this case. Though the ultimate decisions were made by these

actors, the nature of decision-making and the role played by non-institutional actors must be considered. The first of these may be examined in terms of the "policy science" approach and the incremental model.

The Rational Model. According to the literature's prescription for policy-making, the process described above should have been one of orderly consideration of alternative policies weighted according to their relative net values for society. As noted in the discussion of assessments, policy options accompanied by their respective costs and benefits were not usually delineated in assessments of DDT. Though the form of rational policy-making is approached by the use of expert panels to study the question, the limitations of this procedure are indicated by the variance in recommendations of such bodies. One apparently significant set of events, that involving the judiciary, did not feature such a process but rather relied on the adversary assessments offered by opposing parties. The situation can be explained in terms of several factors, some of which have already been noted. Incomplete "scientific" information, the probabilistic or indeterminate nature of DDT's effects, lack of a clearly defined goal, and the complex set of actors involved all contributed to the nature of the phenomenon. Also, shifting focus on pesticides in general and DDT as a particular, and symbolically representative, application does not indicate that policy-making followed the prescriptions of "policy science."

Incrementalism. The hypothesis that policy decisions tend to represent marginal changes in existing policy can be profitably applied to DDT policy, though in a non-quantitative manner. Consideration of the series of decisions from 1963 to 1972 indicates that the national

government followed an incremental pattern of policy changes. Study of the situation, amending FIFRA, and restricting agency use of DDT represented the first gradual changes. More actions of this kind were followed by actual restrictions on sales of DDT for private use but even this strong regulatory decision took the form of a series of marginal changes. Successively, uses of DDT were banned in at least three stages, each being further tempered by the refusal to suspend registrations which allowed continued use until lengthy cancellation procedures were completed. Indeterminancy of policy outcomes, incomplete information, and perhaps political expediency may all be considered as factors predisposing policy on DDT to follow the incremental pattern. It must be noted, however, that definite change in policy is discernible over time, even though each change was marginal. Thus it is still of importance to identify the significant motive factors which were involved in decision-making.

The Many or the Few? A key question in the analysis of DDT policy is whether the significant influences on the decision to ban the pesticide are best characterized as those of an elite, a single consensual class of individuals in society, or as proceeding from the interaction of rival centers of power in a pluralistic system. The study of policy has not proceeded to a level of achievement sufficient to provide any sort of political litmus test for elitism and pluralism. Based on the data relating to this case, however, it is argued below that the group model of politics has the most explanatory value for policy-making on DDT.

The individual decision-makers identified above could certainly be classified as members of an American elite. Yet the manner in which

DDT emerged as a subject of policy offers mixed evidence about the all-inclusive role of an elite group in the process. To be sure, the role played by Kennedy and Ribicoff early in the controversy supports an elitist interpretation. One could even include Miss Carson in the elite because of her erudition, publishing success, and education. Such an application of the approach is self-defeating, however, because of circularity. Everyone with influence is labelled an elite member and elite members are defined as those with influence. This reasoning has no explanatory value.

Further evidence supporting an elitist interpretation of DDT policy include opinion poll data which indicate that the American people came to rate environmental concerns as a serious problem only after significant actions had been taken by government. For example, Gallup's "most serious problem" poll did not display a significant concern with the environment until 1971, after passage of the National Environmental Policy Act. A sample from the International Who's Who displayed concern earlier and a Harris poll of 1970 specifically asking about DDT indicated that more highly educated individuals were more likely to favor a ban on the pesticide.[37] These data indicate a lack of a grass-roots movement against DDT. "Public opinion" was led by someone; whether it was a single consensual elite or not is another matter.

One interpretation of the controversy is that the governing elite co-opted the fledgling environmental concern during the Nixon

---

[37] George H. Gallup, The Gallup Poll: Public Opinion, 1935-1971 (3 vols.; New York: Random House, 1972), III, 2304, 2371, 2324, and 2338; and The Harris Survey Yearbook of Public Opinion, 1970: A Compendium of Current American Attitudes (New York: Louis Harris and Associates, Inc., 1971), pp. 55-56.

administration for the purpose of diverting activist attention from the war in Vietnam. Such an interpretation, while intriguing and consistent with the feature of elite theory which holds that the masses are manipulated through apparently important but actually meaningless exercises such as elections, is probably impossible to prove.[38] The traditional orientation of the Republican Party toward business would lead one to expect a less vigorous pursuit of environmental concerns.

Another explanation for the emergence of the environment as a larger issue encompassing DDT as a pesticide and a symbol of chemical pollutants is that leadership was provided by the news media. Content analysis of media coverage and other measures indicate that the environment became much more newsworthy in 1969, again preceding public opinion. One paper, for example, increased environmental coverage from 89 column-inches in 1968 to 380 in 1969.[39] This may, of course, be regarded as a manifestation of elite leadership or manipulation, depending on how broadly the governing elite is defined.

There are several features of the DDT controversy which are not amenable to explanation in terms of the elite model. The supposed change in elite attitudes, either as co-optation or genuine value

---

[38] See Richard Neuhaus, In Defense of People: Ecology and the Seduction of Radicalism (New York: The Macmillan Company, 1971); James Ridgeway, The Politics of Ecology (New York: E. P. Dutton & Co., 1970); and Jon Margolis, "Land of Ecology," in The Ecological Conscience: Values for Survival, ed. by Robert Disch (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1970), p. 149.

[39] U. S., Department of Health, Education, and Welfare, Office of Education, Educational Resources Information Center, The Environmental Information Explosion: The Press Discovers the Environment, by David Peter Sachs, and David Mark Rubin, Vol. II of Mass Media and the Environment (Washington, D.C.: Government Printing Office, 1971), pp. 26-28.

re-orientation, does not explain the significant levels of conflict over DDT which existed after the first phase of study and recommendations but before the commissioning of the Mrak Commission. During this period, great symbolic value was placed on such highly publicized events as the Suffolk County suit and the Wisconsin hearings. The latter especially seems to be an obvious case of group conflict adjudicated by government officials. Group activity must be assigned a central role in maintaining DDT as a policy issue during the period 1966-1968.

Another point which is difficult to reconcile with the elite model centers on the model's postulate that elite members share a high degree of value consensus. To be sure, it is argued that perfect elite agreement is an overly stringent requirement for the empirical referents of the model.[40] Yet one of the central values identified as a part of the basic consensus is that of capitalistic economics, at least in principle. It may be argued that the ecology movement challenged this value to some degree by questioning the value of economic growth and affluence and by demanding a sizable increment in the degree of effective control exercised over business and industry by government. A disagreement on this point would seem to indicate a cleavage within the elite beyond the tolerance of the elite model's requirements.

On the DDT issue it can be demonstrated that the "free enterprise" issue was very real for some protagonists in the debate. The Drug, Chemical and Allied Trades Association's "Operation Good News" had the purpose of correcting a supposed anti-industry bias in the news

---

[40] See Dye's criticism of Robert Dahl's "Critique of the Ruling Elite Model," American Political Science Review, LII (June, 1958), 463-469, in Politics in States and Communities, p. 366. On the economic values held to be part of the consensus, see Dye and Zeigler, Irony of Democracy, p. 6.

media. Louis McLean, secretary and general counsel of Velsicol Chemical Corporation and later the industry task force representative at the Wisconsin hearings, wrote to Houghton Mifflin in 1962 suggesting reconsideration of the publication of Silent Spring. He cited the aid rendered by "natural food faddists and Audubon groups" to "sinister influences" which had the dual purposes of undermining the respectibility of business and reducing the food supply of the Western nations to the level of the Communist bloc.[41] The evocation of the value of anti-Communism is to be noted.

It seems unlikely, therefore, that an elitist interpretation of policy-making on DDT will suffice. A central role must be assigned to the organized interest groups active in the process. It may be argued, to be sure, that such groups were themselves made up of the American elite. This is applicable in the sense that the members of organizations such as the Sierra Club and the Environmental Defense Fund tend to have more education, higher income, and higher occupational status than the average citizen. This generalization about the individuals in such groups appears to be quite accurate.[42] Thus, a "plural elite" label is perhaps warranted in this case. For analytical purposes the significant distinction is between a monolithic structure of influential individuals

---

[41] Letter from George H. Cadgene, past president of the Drug, Chemical and Allied Trades Association, to New York Times, March 18, 1971, p. 38; Graham, Since Silent Spring, p. 49. See also similar statements by Grayson and Shepard, Disaster Lobby, p. 3.

[42] Environmental Information Explosion, pp. 49-50; Daniel H. Henning, Environmental Policy and Administration (New York: American Elsevier Publishing Company, 1974), pp. 6-7; J. Clarence Davies III, The Politics of Pollution (New York: Pegasus, 1970), p. 80; and Margolis, "Land of Ecology," p. 145.

and a pluralistic one. This feature remains unaffected by the "representative" or "democratic" nature of the multiple power centers involved.

The irreducible role which must be assigned to groups in this case is that of raising and maintaining DDT as a policy issue. It may still be argued that elite members "really" made the decision; this is accurate in the sense that a few individuals with high status by virtue of government position actually made the decisions banning DDT. There seems to be a serious flaw in the available conceptual frameworks here. The situation of "groups proposing and elites disposing" appears conceptually indistinguishable from the postulate of pluralist theory that government officials referee group conflict and allocate the values sought on the basis of the relative strength of opposing groups or coalitions.[43]

In order to demonstrate that the group model offers the superior explanatory value in the case of DDT policy it is necessary to find some plausible empirical referents for the relative strengths of the opposing factions. The length of the controversy and the gradual accomplishment of objectives by the anti-DDT forces suggests that a dynamic relationship is to be expected. Earl Latham states:

> What may be called public policy is actually the equilibrium reached in the group struggle at any given moment, and it represents a balance which the contending factions of groups constantly strive to weight in their favor.[44]

---

[43] One formulation of the role of government in a pluralist model is that it "referees the group struggle, ratifies the victories of the successful coalitions, and records the terms of the surrenders, compromises, and conquests . . . ." This is taken from Latham, "Group Basis," p. 390. He refers in this passage to the legislature in particular but on p. 392 includes the bureaucracy and judiciary as performing similar functions.

[44] _Ibid._, p. 390.

Thus, the process of anti-DDT policy may be viewed as a record of the relative strengths of the opposing coalitions at successive points in time. This is, of course, a potential alternative to the applicability of the incremental model, though the factor of political feasibility in that formulation could incorporate the notion of shifts in the pluralistic balance of power.

Unfortunately, measurement of the relative strengths of groups and coalitions is, at the present state of the discipline, far from exact. Several potential indices may be suggested which neither alone nor in the aggregate are completely satisfactory. These include the number of groups involved, the membership of these groups as a reflection of apparent political power and of manpower, funds as another measure of resources, and expert information as a source of power in group conflict.

The number of organized groups making up the opposing coalitions provides some empirical reference for the hypothesis that the pluralist model best explains policy-making on DDT. In the anti-pesticide coalition the major actors remained largely the same throughout the controversy. The National Audubon Society and the National Wildlife Federation, for example, were involved from beginning to end. A major addition is evident in the formation of the Environmental Defense Fund in 1967. That this development may have been decisive is argued at greater length below. Also to be noted is the increase in other ecologically-oriented groups during the period of the controversy, a factor which affected the DDT issue as a component of the larger and more inclusive concern with environmental quality.[45]

---

[45] Margolis, "Land of Ecology," pp. 144-145; Henning, Environmental Policy and Administration, p. 24.

The pro-pesticide coalition displays even less change throughout the controversy. The National Agricultural Chemicals Association was the major protagonist. There was a decline in manufacturers of DDT during this period but this does not seem to represent a serious decline in the strength of the coalition. The symbolic importance attached to DDT probably maintained the resolution of the groups involved on this side. In addition, appeals filed against the ban on DDT indicate that companies which did not manufacture DDT themselves but used it in pesticide products they formulated also felt an interest in protecting the pesticide.[46] In certain phases, such as the litigation initiated by the EDF and others, the Department of Agriculture must be considered to have been a part of the pro-DDT coalition.

To be noted in this case is the relatively low visibility of agricultural interest groups. Though some statements were issued by farm groups, such organizations as the Farm Bureau Federation apparently took little action on behalf of DDT. Perhaps a partial explanation for this lies in the mixed composition of such groups. Farmers primarily involved in row crop production, especially cotton, definitely had an interest in retaining DDT as a legitimate pesticide. For some crops, however, DDT was relatively unimportant. Dairy farmers were directly threatened by retention of the pesticide because of the danger of FDA seizure of milk with DDT residues in excess of allowed levels.

In short, the coalitions were composed on one side of chemical companies and their representative trade associations and on the other of

---

[46] Selected Pesticides, p. 14; New York Times, January 8, 1970, p. 14.

conservationist-environmentalist groups. Using the index of the number of organizations involved, it seems likely that the pro-DDT forces remained constant while anti-DDT groups increased to some degree. It would be absurd, of course, to argue that all organized interest groups are equal in resources for the exercise of influence. An attempt must therefore be made to identify other referents for the application of the pluralist model.

A second index to be considered is that of membership. The nature of the organizations involved renders comparability difficult. Groups such as the National Agricultural Chemical Association and the Drug, Chemical and Allied Trades Association do not enlist members from the public as do the conservationist and environmentalist groups. Thus, on the basis of the number of individuals affiliated with the groups involved, the anti-DDT coalition would clearly seem to be the stronger. Though no comparison is possible, it can be shown that the opponents of the pesticide were in the ascendancy according to this index. For example, the Environmental Defense Fund, organized in 1967, had 11,000 contributors in 1970. By 1972 this had risen to 36,000 and increased further to 40,000 in 1973. Thus it seems likely that the index of membership also indicates an increase in resources for the anti-DDT groups, while the opposing coalition remained relatively constant.

Resources in the form of funds available for publicizing the group's point of view and for obtaining counsel and witnesses for administrative or judicial proceedings are a third possible index of group

---

[47] Carter, "Environmental Law," 1205-1209; and EDF Letter, May, 1973. The writer is indebted to Dr. Charles F. Wurster, Jr., of the EDF for his assistance in providing material on that organization.

strength. It appears impossible to render a complete accounting of expenditures made by the opposing coalitions in the DDT controversy. The Audubon Society, for example, reports that DDT campaign spending cannot be separated from spending for publications generally, because much anti-DDT material was presented in magazines regularly published by the Society. The EDF, which was involved in matters other than DDT, displays an increasing budget during the period under consideration. In 1969 the group had funds of $43,000, while by 1972 the budget had risen to $938,000.[48] Again the lack of data renders comparisons impossible but it seems likely that the anti-DDT forces enjoyed an increase in resources during the controversy according to this index. Worthy of note is the success of non-business groups over business interests. The reverse is frequently cited as a generalization about environmental policy and policy in general.[49]

A final resource to be considered is that of expert information. In the case of policy on DDT this seems to have been of central importance, though establishing any sort of a quantifiable referent is difficult. The campaigns for and against DDT, the administrative hearings, and the litigation involved in the controversy all involved this factor.

---

48 Letter to the writer from Robert C. Broadman, Director, Public Information, National Audubon Society, dated April 30, 1976; Carter, "Environmental Law," pp. 1205-1209; and Washington Post, December 31, 1971, p. A 4. The National Agricultural Chemical Association did not reply to a request for information on this and other subjects.

49 Davies, Politics of Pollution, p. 94; Elizabeth H. Haskell and Victoria S. Price, State Environmental Management: Case Studies of Nine States (New York: Praeger, 1973), pp. 38 and 244; Henning, Environmental Policy and Administration, p. 26; and Dye and Zeigler, Irony of Democracy, pp. 217-218.

Neither side can be said to have been unarmed in this respect, yet the anti-pesticide coalition apparently emerged as superior. Two types of expertise can be identified.

The first and perhaps the more conventional sense in which expertise must be considered is the technological. From beginning to end, a large number of individuals with appropriate academic credentials in various areas of the physical and biological sciences issued statements and testified about the effects of DDT use. Though both coalitions were able to summon resources of this kind, it seems likely that over time the anti-pesticide forces gained the upper hand. Not only were many assessments of the "private scholarly" variety issued during the years of the controversy but the growing amount of material available was effectively presented by expert witnesses, including academicians who had published repeatedly on DDT and its effects. Some idea of the resources available from this quarter can be gained from considering the EDF's scientific advisory committee, made up of experts willing to serve as witnesses in judicial and administrative proceedings. Early in 1969, this group numbered about one hundred; it doubled by the end of that year and was reported to have grown to seven hundred members by 1973.[50]

A second type of expertise involves what has been labelled "technique" for the purposes of this study. It must be recognized that technological or scientific expertise was not the only resource of

---

[50] Figures on the advisory panel are cited by Luther J. Carter, "DDT: The Critics Attempt to Ban Its Use In Wisconsin," Science, CLXIII (February 7, 1969), 548-550; "History of EDF," material provided by Dr. Charles F. Wurster, Jr.; and Carter, "Environmental Law," pp. 1205-1209. On EDF's use of its evidence, see Yannacone, Environmental Systems Science.

knowledge employed by the anti-DDT coalition. To be noted first is that the effective presentation of the available data supporting the case against the pesticide required organizational skills without which the scientific data might well not have been effective. Legal skills, also a "technique," were also of great importance. Selection of judicial and quasi-judicial arenas for waging the battle against DDT, as well as the management of the case during proceedings, indicates superior tactics on the part of the ecology coalition. Though it may be argued that DDT would have been banned anyway it seems quite likely that the pressure of court orders obtained by the EDF and its allies were instrumental in securing the prohibition of the pesticide.[51] It cannot be denied that the most effective anti-DDT actions occurred after the adoption of this strategy as a supplement to or a replacement for the more conventional "educational" campaigns which had been conducted against DDT for several years by various organizations.

Given the success of the strategy of relying on litigation and expert testimony to achieve group goals it can be speculated that the DDT case suggests a "new pluralism" model of policy-making. Though the emergence of groups on this issue and their multiplicity is probably characteristic of pluralism in its familiar form, it may be argued that the reliance on expertise as a resource is a phenomenon indicating a change in the factors which are to be regarded as crucial in group conflict. The case of DDT can be cast into a scenario of emerging technocracy, with industry as the rear guard of the older society yielding to the forces of the future. This is partly invalidated, however, by

---

[51] See pp. 102-103 above on the innovativeness of the approach.

the presence of managerial and technological experts on the pro-DDT side, including both industry representatives and the substantial resources commanded by the Department of Agriculture in its defense in EDF v. Hardin (1970).

DDT Policy in the States. Analysis of policy-making on DDT at the state level supports the conclusions reached regarding national policy-making. Nine states enacted stringent restrictions on DDT sales and use during 1969 and 1970, before the national ban on the pesticide. A tenth, Florida, took limited action which must be regarded as primarily of symbolic importance. According to one classification of interest group activity in the states, six of these had strong "pressure systems" while the other four were classified as having moderate systems. None exhibited weak group activity and influence.[52]

To be noted further is that policy in the states seems to reflect a sort of "post-industrial politics." As indicated by Table I, the states banning DDT tended to be high in per capita income, urbanization, and percentage of the labor force composed of managerial and professional personnel. Though some had significant agricultural sales during this period, there is less apparent relationship in connection with this variable. However, when the first three variables are combined according to rank order with a similar ordering of agricultural sales it becomes obvious that the typical state banning DDT had enough agricultural activity to warrant attention to the issue but appears to have had its policy shaped by influences attributable to its socio-economic

---

52 Harmon Zeigler, "Interest Groups in the American States," in Politics in the American States, ed. by Herbert Jacobs and Kenneth Vines (2d ed.; Boston: Little, Brown and Company, 1965), p. 114.

TABLE I

RANK ORDER OF STATES BANNING DDT, ACCORDING TO SELECTED VARIABLES
(Figures represent position of these states in rank ordering of all states on variables listed)

State[a]	Income[b]	% Urban[c]	Mgr./Prof.[d]	Farm Sales[e]	Comb. Index[f]	Mod./Strong Groups[g]
California	8	1	5	1	1	1
New York	2	4	14	16	2	2
Illinois	7	7	32	4	3	3
Maryland	10	15	3	36	7	4
Washington	13	18	11	22	7	4
Florida	9	28	13	16	14	11
Arizona	33	29	28	28	17	14
Michigan	12	15	36	21	19	16
Wisconsin	21	28	37	8	23	20
Vermont	31	50	13	44	40	33

[a] New York Times, January 4, 1970, p. 29; ibid., February 14, 1970, p. 27; ibid., April 6, 1970, p. 31; ibid., December 29, 1969, p. 14; ibid., November 16, 1969, p. 29; ibid., October 29, 1969, p. 25; ibid., July 6, 1969, pp. 6-7, 34-39; ibid., April 18, 1969, p. 86; ibid., October 4, 1970, p. 31; and Facts on File, XXX (March 26-April 1, 1970), 216.

[b] Per capita personal income, 1970 (U. S., Department of Commerce, Statistical Abstract of the United States, 1971, p. 314).

[c] Percentage of population living in urban areas, 1970 (Statistical Abstract, 1972, p. 18).

[d] Professional and managerial workers as a percentage of the civilian labor force, 1970 (U. S., Department of Commerce, City-County Data Book, 1972, p. 18).

[e] Value of farm products sold by farms with sales of $2,500 or more, 1969 (ibid., p. 27).

[f] Computed by adding rank order positions of all states for the four variables presented and constructing a combined ranking.

[g] Computed by removing states rated as having weak pressure systems from the rank order presented in the preceding column.

composition. Elimination of states with weak "pressure systems" from the ranking further emphasizes the nature of the phenomenon. It can be argued, therefore, that state DDT policy exhibits the characteristics of pluralism or multiple elitism in a societal setting likely to be influenced by technologically-related factors.

In summary, the analysis of policy-making on DDT indicates that the group model has substantial explanatory value, though there are phenomena which can be interpreted as reflections of elitism. The nature of the groups involved and the analysis of state-level policy suggest that the "multiple elite" perspective of pluralism is of value for this case and that DDT policy may reflect the characteristics of "technological society" politics. It may be suggested that the complexities of policy-making in the contemporary political system of the United States are such that a certain ambiguity in the application of currently-available explanatory models is to be expected. Based on the conclusions discussed to this point, it is possible to further examine the role played by assessment activities in the DDT controversy.

Assessment: An Evaluation

It was posited in Chapter III that, in policy-making resembling the group model, assessment would serve as a weapon or resource of opposing groups or coalitions. This was the role played by assessment activities in the case at hand. In a variety of political settings, from "educational" campaigns to court actions, opposing groups presented alternative assessments. Though it is not argued that either falsified scientific data, each coalition seems to have selectively chosen and differentially valued available information in a manner consistent with

the achievement of group goals. This phenomenon may be explained in part, perhaps, by limitations of the accuracy of the best knowledge available on the effects of DDT use and the accompanying social costs and benefits. For this reason, as well as the effects of group interest, technology assessment cannot be said to have operated according to the design offered by proponents of an institutionalized assessment capability.

Some features of the controversy resemble the rational model of policy-making, including technology assessment as a component of the process. According to this perspective, which is also consistent with elitist theory, the decision-maker, in this case Finch, sought out information from experts, the Mrak Commission, and followed the guidance of that group's recommendations. It is entirely accurate to say that the Mrak Commission Report recommended banning DDT within two years and that this goal was adopted by the major agencies involved. There are other factors, however, which rule out the case of DDT as an example of rational policy-making.

A first factor is that no assessment body, including the Mrak Commission, provided the policy-maker or makers with a set of clearly-identified policy options weighted according to the net cost or benefit associated with each. This was primarily a function of the limitations on relevant knowledge at the time. Nevertheless, the framework for rational decision-making must be characterized as incomplete.

Second, a rationalist or elitist scenario for the ban on DDT faces the question of whether or not the Mrak Commission would have been named at all if organized group pressure had not been evident for some time previously. It is not possible to answer this with certainty;

however, the change in group tactics around 1967 offers a potential explanation for renewed interest in banning DDT after the first round of limited actions against the pesticide under the Kennedy and Johnson administrations had apparently lost its momentum. Similarly unanswerable is the question of the real effects of the assessments made by the D.C. Circuit Court in its orders to Finch, Hardin, and Ruckelshaus. Perhaps DDT would have been banned anyway; it is not possible to estimate this probability. It is noteworthy that the two-year timetable was exceed in any event, even under environmentalist pressure. Without such pressure, it may be speculated, the schedule for banning DDT would have been further exceeded.

The rationalist or elitist interpretation of the role of assessment faces a further barrier in consideration of the number of official assessments available during the process. Though the Mrak Commission was apparently influential, the relevant decision-makers had a variety of assessments from which to choose. One, that of the hearing examiner appointed under FIFRA, actually recommended allowing continued use of DDT. Thus it may be suggested that the choice was made on other than "rationalistic" grounds. At no point did official assessments, all based on substantial scientific data, present a consensual recommendation for policy action or a clear set of policy options with identification of associated costs and benefits.

In summary, it cannot be said that policy-making in the case of DDT was made in the absence of expert information or contrary to all available expertise. The most effective use of assessment information was, however, in an adversary role and there is sufficient reason to conclude that technological expertise was greatly enhanced in

effectiveness by expertise in technique. The value of scientific and technological knowledge per se cannot be regarded as the only crucial factor, Rather than a comprehensive set of options accompanied by effects associated with each, policy-making proceeded characteristically on the basis of adversary assessments presented by opposing coalitions. Not surprisingly, these alternative assessments presented a polarized view of the technology in question. The phenomena of differential valuation of the same or similar data and valuation at the absolute level of some factors seem to represent a serious barrier to the effective functioning of assessment in this case.

CHAPTER V

THE FEDERAL DATA BANK: ELITES AND INCREMENTALISM

In this chapter the policy to be analyzed is that involving the establishment of a computerized data bank by the national government as a means of facilitating statistical operations by governmental and private researchers. The data bank as a policy issue may be dated from 1960, when the project was proposed by the Social Science Research Council, to 1968, when this particular project was discontinued, though the general subject of federal data collection continues to be of interest.

The data bank issue differs in several respects from that concerning DDT. It represents a departure from the focus on the physical environment which characterizes many technologically-related issues. Nevertheless, the electronic computer is an important manifestation of technology and as much a symbol of technology in its own way as DDT. The effects in question here are different. The emphasis is on intangibles such as rights and freedoms rather than physical consequences. Another difference between the cases is the type of political actor most prominently involved. The data bank issue displays less organized group activity than the DDT controversy; it is argued below that the interaction between elite members of various types was the central element in this case. As such, it provides a prototypic example of policy-making along the lines of the new pluralist and technocratic models.

The process to be followed here is similar to that employed in the preceding study. First, the technological system involved is described, including the effects which have given rise to controversy. A second step is a brief narrative description of the policy process in this case, followed by identification of assessment activities. Analysis of policy-making is the next topic and, finally, assessment activities in the data bank case are evaluated.

The Data Bank As A Technological System

Description of the technology involved here is not as simple as in the case of DDT. Stated simply, the concept of the data bank involves the use of electronic data processing to provide government records in a usable form to social science experts, both governmental and non-governmental. The term "data bank" has no precise meaning in technological jargon but connotes certain characteristics as it is commonly used. First, a data bank contains information about individuals drawn from formerly separate files and, second, the data are organized in a central file or interconnected system. A third connotation is that the information is to be shared by several users. Data banks may be manual but the advantages of computerization, discussed below, increase the feasibility of such operations.[1]

The computer is not, therefore, the only element of importance, though it is the technological application involved in this issue. It must be kept in mind that other significant factors were present which

---

[1] Alan F. Westin and Michael A. Baker, Databanks in a Free Society: Computers, Record-Keeping and Privacy, Report of the Project on Computer Databanks of the Computer Science and Engineering Board, National Academy of Sciences (New York: Quadrangle Books, 1972), pp. 229-230.

may be classified as "techniques" in accordance with the definitions established in Chapter I. These are, first, bureaucratic record-keeping and decision-making, and, second, social science methods. Each of these is discussed below.

Computer technology is best regarded as a combination of physical devices and the knowledge of their use in order to extend the mental capacities of man. The electronic computer does this both by its capacity for retaining, or "remembering," information and its ability to recall and manipulate such information with a speed far exceeding the capacities of the human mind. It does not do this independently, of course, but stores and processes data as directed by its human operators.

The electronic digital computer is the composite result of many technological applications. Basically, it consists of equipment which can store information in a binary code, process it, and transfer it to an output device. The apparatus includes some means of input, such as punched cards or magnetic tape, from which the machine can transfer data to a storage device, in early forms by means of open or closed switches, in later ones by electrical polarization of magnetic cores. The processing phase of operations consists of recalling information and manipulating it in accordance with instructions, or programming, also fed into the machine. Data may be processed arithmetically or transferred from storage to an output device. The last of these may be in the form of a printer or other means directly readable by the user.[2]

---

[2] The treatment of computer technology here relies on the following: D. S. Halacy, Jr., Computers--The Machines We Think With (Rev. ed.; New York: Harper & Row, 1969); Rein Turn, Computers in the 1980's (New York: Columbia University Press, 1974); and Westin and Bakers, Databanks, pp. 7-14.

Though the antecedents of the computer are at least a century old, the most significant developments in the initial phases of the present technology occurred during the 1940's. The commercial production of computers began in the 1950's, with vacuum tube construction the major characteristic. The second generation, appearing in the late fifties, relied on transistors as the primary component and the third, beginning around 1967, utilizes solid-state integrated circuits. Each generation has displayed significant increases in computer capacity. Speed, memory capacity, and operation cost have all been improved. From 1955 to 1965 the number of additions per second increased from 25,000 to 5,000,000, memory capacity was expanded by more than two thousand per cent, and the cost of operation decreased. The last, measured in the cost of one million additions, fell from ten dollars to three and one-half cents.[3]

Other significant developments include the capacity to have input and output operations removed in space from the central processing unit so that information may be transmitted to remote users by telephone lines or radio waves. By the time of the case under discussion computers also had the capacity for "on-line" operation, that is, handling individual transactions on demand rather than in a pre-ordered sequence ("batch processing").

The utility of the first-order consequences of computer technology for government operations is obvious. Record-keeping and information processing are activities characteristic of bureaucratic organizations and have been since long before the advent of the

---

[3] Turn, Computers, pp. 58-59; Alan F. Westin, Privacy and Freedom (New York: Atheneum, 1967), p. 166.

electronic digital computer. Decisions made in a bureaucratic organization are ideally made on rational grounds, that is, on the basis of information rather than chance or premonition, for example. The common expectation is also that they should be made in as expeditious and efficient a manner as possible, promoting the basic rationale of the bureaucratic technique, that is, optimal management of complex aggregations of individuals or other items related to the organization's purpose. The advantages of rapid retrieval and manipulation of information for operations of this kind are self-evident.[4]

It is therefore not surprising that the United States government has been an early and major adopter of computer technology. Table 2 summarizes this phenomenon. It should also be noted that organizational and governmental technique apparently stimulated a trend in information use to which the computer is a latecomer. As Table II indicates, the amount of information processed by government was already increasing sharply when the technological capacities of electronic data processing became available.

Though it seems likely that informational trends preceded computer development, the advantages of the latter are substantial. This can be illustrated by a few examples. The 1960 census, with improvements in technological capacity, took only half as long to process as the preceding one. A search of statutes reported by Halacy took ten days work by four individuals but was accomplished in ten minutes by computer. As a

---

[4] There is not a great deal of literature on pre-computer record-keeping as an organizational activity; see, generally, Stanton Wheeler, ed., On Record: Files and Dossiers in American Life (New York: Russell Sage Foundation, 1969).

TABLE 2

TRENDS IN INFORMATION USE BY
THE UNITED STATES GOVERNMENT, 1940-1970

Year	Federal Computer Inventory[a]	Income Tax Returns[b]	Items Added to Census[c]
1940	NA[d]	14,598,074	17
1950	2	53,060,098	1
1960	403	61,499,420	16
1970	5,277	74,279,831	NA[e]

[a] Westin and Baker, Databanks, p. 29.

[b] U. S. Department of Commerce, Historical Statistics of the United States: Colonial Times to 1970 (2 parts; 1975), Part 2, p. 1110.

[c] Joseph Steinberg, "Government Records: The Census Bureau and the Social Security Administration," in Wheeler, On Record, pp. 230-231.

[d] Not applicable.

[e] Not available.

last example, it is reported that, for one dollar, a computerized system can search 7,200,000 records. A comparable hand search would cost $3,600.[5]

---

[5] Halacy, Computers, pp. 149, 152; statement of Caxton Foster, in U.S., Congress, Senate, Committee on the Judiciary, Federal Data Banks, Computers and the Bill of Rights, hearings before the Subcommittee on Constitutional Rights of the Committee on the Judiciary, U. S. Senate, 92nd Congress, 1st Sess., February 23, 24, 25, March 2, 3, 4, 9, 10, 11, 15, and 17, 1971, Part I, p. 707.

The records kept by governmental agencies by the second half of the twentieth century extended to a large number of subjects, covering almost every sector of society. Included are statistical programs *per se*, such as the decennial census, information generated by regulatory activities, and records associated with operational responsibilities, such as those of the Internal Revenue Service and the Social Security Administration. One inventory of data in 1964 identified information as varied in scope as the census of population and a one-time survey of 520 small woodland owners in Ohio in 1963.[6] Such information is of course the basis for the endeavors of the social sciences, including economics. The rationale of social science knowledge is discussed in Chapter II. It consists basically of gathering data through observations, identifying similarities in situations, events, and relationships, and generalizing from the phenomena in question on the basis of such similarities. Because of factors of cost and legitimacy, government records provide the most feasible source of many types of information about society. Such data serve not only scholarly interests but are involved in administrative management techniques such as program budgeting, systems analysis, and operations research.[7]

---

[6] Report of the Committee on the Preservation and Use of Economic Data to the Social Science Research Council, April 1965 (the Ruggles Report), Appendix 1 of U.S., Congress, House, Committee on Government Operations, The Computer and Invasion of Privacy, hearings before a subcommittee of the Committee on Government Operations, U.S. House of Representatives, 89th Congress, 2nd sess., July 26, 27, and 28, 1966, pp. 214-253.

[7] See Alan F. Westin, "Introduction," in Information Technology in a Democracy, ed. by Alan F. Westin (Cambridge, Massachusetts: Harvard University Press, 1971), pp. 15-29.

The data bank concept as embodied in the proposal discussed in this study can be seen as a technological system combining all of these elements. Using the speed and memory capacities of the computer, information gathered by government, if stored in the proper form, can be retrieved in ways which have great utility for social science research. This is essentially the first-order consequence sought from the system. Possible indirect effects were, however, the primary factor in the development of a controversy over the proposal.

The major second-order consequence at issue in the data bank debate, like other indirect effects, follows from the nature of the system. Information gathered for the purpose of providing statistical summaries for the use of the social sciences can also be retrieved and used for other purposes. As discussed below, one of the key points in this controversy was identification of individual subjects in such a collection of data. Unquestionably, the utility of the system depends on having each individual subject, whether a person or a business firm, identified in some way. Thus, information from various agencies can be collected in such a way that particular configurations of characteristics can be observed. It is not enough to know, for example, that a certain percentage of the population is made up of home-owners and another proportion is receiving Social Security benefits. To be of optimum value, an information system would have to be able to combine the two sets of data and yield, to continue the example, statistics on the number of Social Security recipients who own homes. Association of data in this manner requires storage of information not only in the aggregate but according to the individual reporting unit. This feature also provides the means for data use for other than statistical purposes. There

is disagreement about the technological capacity of the system to prevent individual files from being retrieved for purposes other than providing the bits of information needed to make up a statistical summary of a given class of individual subjects.[8]

The danger of the use of such a system in a way unintended by its proponents lies in its impact on individual rights, particularly the right to privacy, not expressly guaranteed by the Constitution but held to exist by the judiciary. While earlier formulations of a right to privacy were based on common law principles, Justice Douglas, speaking for the Court in Griswold v. Connecticut (1965), held that such a guarantee was implied in specific provisions of the Bill of Rights. The rationale of this protection is that individuals have a legitimate interest in not having their affairs known to others, both for the sake of privacy itself and because of the impact that information can have on one's relations with others, both in a legal and an extralegal context.[9]

The sources of undesirable effects fall into two categories. First is access to and use of information by individuals who are not authorized to obtain personal data, including employers and credit concerns, and extending to extortionists. A second consideration is misuse

---

8 U.S., Executive Office of the President, Bureau of the Budget, Statistical Evaluation Report No. 6--Review of Proposal for a National Data Center, a report prepared by Edgar S. Dunn, Jr., Consultant to the Office of Statistical Standards, Bureau of the Budget (the Dunn Report), Appendix 2 of The Computer and Invasion of Privacy, pp. 259-261.

9 See C. Herman Pritchett, The American Constitution (2nd ed.; New York: McGraw-Hill, 1968), p. 686; Westin, Privacy and Freedom, Chapter 13; Jerry M. Rosenberg, The Death of Privacy (New York: Random House, 1969), Chapter 1; and Abraham S. Goldstein, "Legal Control of the Dossier," in Wheeler, On Record, pp. 415-443.

of information by individuals authorized to have access, such as use of tax records to discredit a political candidate. Means of preventing abuse of a data bank system may be considered under two headings.[10]

The first of these is technological, that is, construction of the system in such a way as to prevent unauthorized access and perhaps unauthorized use. Physical security, such as locks, guards, and so forth, is one means of accomplishing the former. System security can also be implemented by constructing the system to require some identification, such as a physical key, a password, or even voice- and fingerprint identification in order to obtain access to data. A final type of safeguard lies in further programming the computer system to release information only in statistical summaries covering groups of a specified size. Thus information about a single individual or a small group would be unobtainable. This approach could also be used to instruct the computer not to "dump" information, that is, print out its entire memory and to record the user and the data requested for each inquiry. Illegitimate use by ostensibly legitimate users could be prevented or at least policed in this way. Whether the means of protection discussed here would be adequate to prevent undesirable second-order effects of the proposed data bank was a matter of dispute during policy-making on the proposal. Experts have stated categorically, however, that any present computer

---

[10] On the possibilities of abuse, as well as the security measures discussed below, see H. John Denault III, Don Parris, Michael E. Alpert, Stephen M. Burgin, Frank E. Merideth, Thomas A. Robinson, and James F. Stiven, "The Computerization of Government Files: What Impact On The Individual?" UCLA Law Review, XV (September, 1968), 1371-1498.

system was inherently subject to subversion by other individuals with the requisite expertise.[11]

The second means of protection lies in the realm of technique. That is, unauthorized access or use could be made punishable by law in order to discourage potential abusers of the data system. Though it is pointed out that older manual systems of record-keeping have operated satisfactorily under this kind of control, there seem to have been significant doubts about its adequacy for the proposed system.[12] This is possibly due to emphasis on the technological aspects of the project rather than factors related to the techniques involved. That is, computerization may have attracted more attention than the elements which the new system would have shared with older, less technologically-advanced forms of record-keeping.

Within the context of these considerations of technology, technique, first-order effects, and possible second-order consequences it is instructive first to consider the evolution of the data bank issue, its course, and its apparent resolution. This is followed by

---

[11] See the statement of Emanuel Piore of IBM in U.S., Congress, Senate, Committee on the Judiciary, Computer Privacy, hearings before the Subcommittee on Administrative Practice and Procedure of the Committee on the Judiciary, U.S. Senate, 90th Congress, 1st sess., March 14 and 15, 1967, pp. 117-122; and the statements of Paul Baran and Burton Squires, in Computer and Invasion of Privacy, especially p. 120.

[12] Karl E. Bakke, General Counsel of the Department of Commerce, states that no abuse of census data by a Department employee has ever been detected, in U.S., Congress, House, Committee on Government Operations, Federal Information Systems and Plans--Federal Use and Development of Advanced Information Technology, Part 2, hearings before a subcommittee of the Committee on Government Operations, U.S. House of Representatives, 93rd Congress, 1st sess., April 10 and 17, 1973, p. 406.

identification of assessment activities, analysis of policy-making, and evaluation of the role of assessment.

The Data Bank As An Issue

This debate occurred within the context of a larger public discussion concerning technology and privacy. Also involved were such matters as listening devices, psychological testing, and the polygraph, as well as private data bank activities, such as those used by banks and credit organizations. Private polemic assessments of the relevant technologies and techniques were not uncommon during the period covered by this study and may have contributed to the occurrence and intensity of concern about a federal data bank for statistical purposes. Noteworthy among these were Vance Packard's The Naked Society and Alan Westin's Privacy and Freedom.[13] Though important, assessments of this type cannot be said to have had the significance of, for example, Silent Spring in connection with the DDT issue.

The specific data bank proposal under examination here may be traced to the concern of a professional interest group about the availability of usable data. In 1959 the American Economic Association recommended that attention be given to this matter by the Social Science Research Council, a private non-profit organization. The basic problem perceived was that, while the federal government had been collecting more information useful to economics and other social sciences, the statistical system was not equipped to satisfy the high level of demand

---

[13] (New York: Pocket Books, 1965; originally published in 1964); (New York: Atheneum, 1967). Westin in particular may be consulted for a comprehensive treatment of technological threats to privacy in a variety of manifestations.

for existing data. Thus, an important source of "microdata" on individual citizens was not available for analysis, though its value for scholarly inquiry was considerable. In response to the Association's recommendation, the Council created a committee to study problems associated with preserving and providing economic data, chaired by Richard Ruggles, an economist.[14]

The Ruggles Report, as it is called, was issued in 1964. It identified the central problem as the decentralization of the federal statistical system. Useful information was collected by a number of agencies, including regulatory commissions. Though the Bureau of the Census and the Bureau of the Budget's Office of Statistical Standards performed some of the functions of a central statistical agency, there was no means of coordination. Among the results identified by the report were difficulties in the preservation of useful information and in data access by potential users. The improvements made possible by computer technology were noted, including lower cost, faster processing and retrieval, improved data quality, new types of analysis, and greater storage capacity. It was recommended that the Bureau of the Budget take steps to establish a Federal Data Center with authority for interagency data collection and responsibility for a computerized service facility to provide information to agencies and individuals. This was recognized

---

[14] Useful summaries of the history of the proposal include U.S., Congress, Senate, Committee on the Judiciary, Federal Data Banks and Constitutional Rights: A Study of Data Systems on Individuals Maintained by Agencies of the United States Government, summary and conclusions prepared by the staff of the Subcommittee on Constitutional Rights of the Committee on the Judiciary, U.S. Senate, 1974, pp. 7-10; and U.S., Congress, Library of Congress, Congressional Research Service, "The Federal Data Center: Proposals and Reactions," by Robert L. Chartrand and Louise Giovane Becker, Report No. TK 6565 C, June 14, 1968.

to be an innovation of sufficient magnitude to require new legislation. The problem of privacy, or "disclosure," was noted but was not held to be serious.

On receiving the Ruggles Report the Bureau of the Budget hired a consultant, Edgar S. Dunn of Resources for the Future, Inc., to evaluate it and consider means of implementation. The Dunn Report, issued in December, 1965, concurred with its predecessor on the faults of the current system and also found the collection of machine-readable data to be the most strategic factor in effecting improvements. Dunn recommended establishment of a "National Data Service Center," and estimated that three to five years and three million dollars would suffice for its development. Like the Ruggles Report, this analysis noted the possible second-order effect on privacy but did not consider the problem sufficiently important to warrant losing the potential improvement in statistical services for governmental and scholarly users.

The feeling of confidence that privacy was not significantly endangered did not extend to the next set of actors to become involved. In June, 1966, the Senate Subcommittee on Administrative Practice and Procedure of the Committee on the Judiciary held hearings on the invasion of privacy. Chairman Edward V. Long of Missouri and other members were not reassured by Dunn's statement that the proposed center would not contain "sensitive information," and that the benefits from improved policy-making capacities would far outweigh any threat to privacy. Dunn and Ruggles were similarly unsuccessful in persuading the Special Subcommittee on Invasion of Privacy of the House Committee on Government

Operations in July of the same year.[15] This set of hearings is particularly instructive regarding the attitudes of the actors involved.

The Congressmen present all exhibited concern over the privacy issue, indicating that dangers outweighed the benefits expected from the data center. Chairman Cornelius Gallagher of New Jersey labelled the prospect of data centralization "appalling." Congressman Benjamin Rosenthal of New York expressed a personal feeling of "intense apprehension." The minority party member of the subcommittee, Frank Horton of New York, stated: "We could be destroyed." Similar feelings are evident in the statements of Vance Packard, already noted as a publicist on the subject, Charles A. Reich of Yale Law School, and a representative of the American Civil Liberties Union.[16]

Representatives of the social sciences and the bureaucracy were much more optimistic regarding the risks involved. Ruggles and Dunn were joined in this attitude by Raymond T. Bowman and Paul Krueger of the Office of Statistical Standards of the Bureau of the Budget. It was generally admitted that an operation such as was proposed would require some identification of individual subjects for purposes of collating data from different sources. However, the sufficiency of statutory safeguards was asserted. Dunn devoted substantial attention to differentiating between "intelligence" and "statistical" systems and

---

[15] U.S., Congress, Senate, Committee on the Judiciary, Invasions of Privacy, hearings before the Subcommittee on Administrative Practice and Procedure of the Committee on the Judiciary, U.S. Senate, 89th Congress, 2nd sess., March 23-30, June 7-16, 1966; The Computer and the Invasion of Privacy.

[16] Ibid., pp. 3-7, 29, 183.

cited a full range of security measures, including programming controls.[17]

The last major category of participants in the hearings consisted of experts in computer technology. Paul Baran of the Rand Corporation and Burton Squires of the University of Illinois discussed possible safequards but were not optimistic regarding their effectiveness for protecting privacy. Baran referred to the possibility of a "1984" nation resulting from continuation of present trends in centralization of data systems, an analogy also cited by Packard in his testimony. He also denied that Dunn's distinction between intelligence and statistical systems was meaningful. Squires stated: "We are here dealing with a technology that is as potentially dangerous and powerful as a nuclear explosive device."[18]

Several generalizations can be drawn about the interaction of these individuals. Obviously, the experts in technique and in technology, as well as the Congressional participants, differed in their assessment of the risks involved in establishing a federal data center. It was agreed that individual identification of subjects was necessary; the disagreement centered on the significance of the risk to be associated with this feature of the system. Though there was substantial emphasis on computer technology as the central element to be considered, attention was also given to the technique of bureaucratic organization. This was indicated in Gallagher's question to Bowman, answered in the negative by the Budget official: "You are not going to go ahead and do this without

---

[17] Ibid., pp. 51-53, 65, 92-93, 97.

[18] Ibid., pp. 121, 128, 135.

congressional approval are you?" Packard, using the Orwellian analogy, predicted that "Big Brother" in this country might turn out to be "a relentless bureaucrat obsessed with efficiency."[19]

Because of the decidedly skeptical attitude of the Congressional committees, the Bureau of the Budget initiated a third study of the proposal, conducted by a committee chaired by Dr. Carl Kaysen of Harvard. The Kaysen Report, issued in October, 1966, supported the concept of a national data center. The privacy issue, however, received more attention than in the earlier studies and statutory safeguards against unauthorized disclosure were emphasized. Kaysen testified before the Long subcommittee in March, 1967, but continuing fears of potential privacy violations were not allayed.[20]

The concept of a national data center received some Congressional support later in 1967 in the form of an endorsement by the Joint Economic Committee. Nevertheless, the aggregate assessment by other committees continued to see the risk to privacy as outweighing the benefits of improved statistical services. A summation of this feeling was issued by the House Government Operations Committee in 1968. It recommended that no national data center be established until the system could be guaranteed capable of protecting the privacy of individual citizens. The proposal has not since been seriously considered by

---

[19] Ibid., pp. 13, 76. See also statements similar to Packard's by Horton, Reich, Baran, and Squires, pp. 6, 32, 121-122, and 137.

[20] U.S., Executive Office of the President, Bureau of the Budget, Report of the Task Force on the Storage of and Access to Government Statistics, October, 1966, in Computer Privacy, pp. 25-37.

Congress, though, to be sure, other manifestations of the technology-privacy relationship have received Congressional attention.[21]

Some of the later investigations into the phenomenon of government information systems, including computerization, provide a means of considering the outcome of the policy decision not to allow the establishment of a national data center. The hostile reaction of the Congressional committees involved was, of course, successful in precluding a single data bank as proposed. However, the efficacy of this action in preventing the second-order effects threatened by that proposal may be questioned in terms of other developments.

A 1974 survey of 54 federal agencies found that, instead of one centralized data bank, at least 858 existed, including more than one billion records on individuals. Of these, 741, or 86 per cent, were computerized. Examination of statutory authority for these operations indicates that most were the result of initiatives within the bureaucracy. Analysis of 498 data banks, excluding some Department of Defense information collections and others about which no information was available, reveals that 87, or 16 per cent, had express statutory authority. Those designated as having "derivatory" or "implied" authority comprised 66 per cent and operations with no authorization at all made up 17 per cent. The intermediate categories were defined respectively as "essential" or "useful" to programs with specific authorization. Of the 498 data banks, only 10, or 2 per cent, had automated access to other agencies but 60 per cent had access of some kind. It

---

[21] See New York Times, March 28, 1968, p. 34; and the statement of Dr. Ruth M. Davis of the Department of Commerce, in Federal Information Systems and Plans, Part 2, p. 418.

may be argued, therefore, that the concept of a central data bank was effectuated or at least made possible by interagency communication in a majority of the data operations surveyed.[22]

The operation of incremental growth on the basis of first-order assessment according to the rationale of the bureaucratic technique seems to be present in this development. Thus it may be suggested that, while the actors concerned with privacy as the primary factor were effective in blocking the specific data bank proposal discussed above, those who found efficiency in data processing to be the superior value were successful in progressing toward data centralization and automation. The interaction is considered at greater length below, following identification of assessments which are in evidence in policy-making on the proposed national data center.

Assessments in the Process

The most significant assessments involved in the national data center proposal are of the governmental type, according to the typology established in Chapter II. Some private assessment is evident in polemic works such as Packard's The Naked Society and in statements of interest group representatives before Congressional committees but these seem to have had less direct importance than official evaluations. These are both "operational," such as the Dunn and Kaysen Reports, and "investigatory," including the committee hearings involved. The latter are less explicit and structured than the former yet still comprise

---

22 Federal Data Banks and Constitutional Rights, summary and conclusions, pp. 35, 43-49. The percentages presented here have been rounded off to the nearest whole number.

comprehensive assessments by virtue of the range of effects considered. The Ruggles Report is hard to classify. In origin it was private and academic but the response of the Bureau of the Budget indicates that it achieved at least a degree of official status.

None of these assessments can be said to have been rigorously comprehensive. Policy options emerged only by presentation of opposing views rather than as a part of the assessment process. The major characteristic seems to be a result of the costs and benefits involved. Figure 4 summarizes the major factors relative to assessment of the program. Most assessments recognized the existence or possibility of all of these, at least, but the nature of the phenomenon precluded rigorous comparison. Both benefits and costs, aside from operation expenditures, are not amenable to calculation in monetary or other comparable terms. Efficiency of government operations, knowledge in the social sciences, and the values associated with privacy are the primary considerations--yet all defy quantitative measurement. Of necessity, the assessors of the proposal estimated qualitative values; however, the same factors were valued quite differently. For those favoring the data bank, the benefits outweighed the costs, while the opposite conclusion was reached by the proposal's opponents.

Also to be noted is the lack of distinction between the component technologies/techniques comprising the proposed operation. This occurred to some degree but not in any systematic fashion. A final and related phenomenon perhaps results from the difficulties associated with quantification but also may be credited to non-rationalistic tendencies in human thought and communication. The symbol of a totalitarian society was frequently evoked, usually by reference to George Orwell's novel,

Benefits	Costs
Effects of improved preservation of and access to "microdata" on individuals and other units of analysis.	Monetary costs of establishing and maintaining system, affected by expenditures made for security measures.
Societal benefits: Direct advantages from improved administrative and policy capacities in program planning, implementation, and evaluation; indirect advantages of facilitating understanding of society by economics and other social sciences. Probability of such developments eventually contributing to direct benefits noted above.	Effects of incurred risk to individual privacy because of possibility of unauthorized access or unauthorized use by authorized users.
	Societal costs in terms of intangible values of privacy on individual basis and for the nature of society.
	Possible effect of reliance on available data rather than most relevant information; direct and indirect societal costs in quality of policy decisions and research.

Policy Options

Establish system without further development of security measures; benefits probabilistic, costs in operational expenditures and intangibles incurred.

Do not establish system; benefits lost, costs for this particular operation avoided.

Establish system with emphasis on development of security measures; benefits probably delayed for a time, increased monetary cost but probability of intangible costs reduced; cost-benefit equation depends on particular configuration adopted.

Figure 4: Model Assessment of the Proposed National Data Center

1984. Because of general knowledge of this book, such references probably were quite effective in connoting the risks involved, in an extreme way. While communication was undoubtedly enhanced, evaluation of the specific program in question was perhaps colored by this strong, emotionally-appealing symbol in an arational manner.

The role played by assessments identified above can be better evaluated in the context of the significant actors and processes involved in policy-making on the data bank proposal. Evaluation of this role follows consideration of the phenomenon with reference to the policy models discussed in Chapter III.

Analysis

Following the procedure used in the preceding chapter, the models dealing with the nature of decision-making are examined first below, followed by those which posit significant sets of actors in the process.

The Rational Model. As in the case of DDT, the policy process on the national data center follows the prescriptions of this model to a point. The policy issue emerged, information was gathered, and the decision was made. However, as noted in the discussion of assessment, no set of alternatives with the associated costs and benefits was available. The official source of information, that is, the federal agency with primary statistical responsibility, acted in an adversary role, as did the committee members who made the decision. The rather diffuse method of decision is significant. The proposal seems to gradually lose momentum and die off rather than being evaluated and decided upon in a rational manner. The focus on computer technology, though not exclusive, reflects a degree of misdirection, since the techniques involved were at least as important as, if not more significant than, the hardware portion of the proposed system. The emotional connotations of 1984 symbolism, while not irrelevant to the second-order effects in question, probably had a similar effect. Many of these barriers to "policy science" decision-making can be traced to the nature

of the values involved, in particular the difficulty of establishing criteria of comparison.

The Incremental Model. One factor in this case which may be traced to incrementalism is the initial problem noted by Ruggles and other assessors. The decentralization of the federal statistical system was not a designed feature of the governmental framework but rather resulted from gradual accretions of statistical operations and responsibilities. In one sense, the data center proposal was a rationalistic corrective to this pattern; its rejection perhaps reflects the cost avoidance feature of incrementalism. However, the outcome of policy on the question, that is, the proliferation of interconnected data banks, also displays incrementalism in action, perhaps with the effect of subverting the intent of Congressional decision-makers.

The Institutional Model. As in the case of DDT, the apparently significant actors can be identified by institutionally-defined roles. Gallagher, Long, and other legislators blocked the data center proposal. The rather diffuse way in which the decision was made is noteworthy, however. Congress as a legislative body did not consider and pass judgment on the proposal, except by default. It may be argued, of course, that committee action in this case followed the pattern of Congressional decision-making legitimized by practice and tradition and thus reflects no departure from the institutional model. Certain features of the case are, however, difficult to place in an institutional framework based on formal grants of responsibility and authority. This is especially applicable to the incremental growth of data banks on the initiative of executive agencies rather than by express legislative

authorization. Again, the institutional model cannot be said to constitute a complete analysis of policy-making.

Pluralism or Elitism? The policy process on the national data center does not fall neatly into either the pluralist or elitist model. For reasons discussed in detail below, however, the elitist perspective seems the most accurate, with certain qualifications.

There is some interest group activity evident in this case, notably the ACLU participation in Congressional hearings. The role of the American Economic Association may also be considered as a manifestation of this phenomenon. Yet the primary factors in sustaining efforts to implement the proposal and in blocking its implementation were not interest group representatives. Rather, executive agencies and legislators dominated the conflict. There is an absence of group "educational" campaigns and the like. Adjudication is not to be expected, since the proposal did not approach reality. Though there was a real conflict involved it seems to have been resolved in a rather subdued manner. This type of conflict management seems much more characteristic of elitism than of group competition and interaction.

Another index of elite dominance is a lack of public concern in contrast to elite involvement. Opinion poll data of a later period, 1970-1971, indicates that no grass-roots movement was likely on the matter. A Harris poll of 1970 found that only 34 per cent of the population felt that privacy invasion was a serious threat to them, while polls of college students and of participants in a Transportation Institute conference in 1971 exhibited higher levels of concern, respectively, of 61 and 83 per cent. This is consistent with an elitist interpretation, of course, and conforms closely to the generalization of

elite theorists that civil liberties are monitored and protected by elite members in the face of mass disinterest or hostility.[23]

There was certainly conflict over the data center proposal but, as noted in the preceding chapter, complete consensus is not held by elite theorists to be a necessary condition for the applicability of their model. As mentioned above, the conflict involved here was managed in a rather subdued manner. This feature, the absence of a high level of group activity, the lack of widespread public concern over privacy, and the consistency of emphasis on civil liberties in the elite literature all support the characterization of this policy decision as an elitist one. Why, then, was there any conflict whatsoever? The answer argued below is that this case exhibits incipient elite succession along the lines of the technocratic model discussed in Chapter III.

The thesis that technological change has altered the strategic factors in society from land and capital to expert knowledge, of either or both techniques and technology, has been noted. This case seems to display a technocratic elite, perhaps an emergent one, in conflict with a more traditional elite. Privacy as a personal freedom characterizes the traditional value system, while it may be suggested that efficiency and rationalism are characteristic of the newer elite elements.

That these values dominated the thinking of the proposal's advocates is demonstrated by a statement by Dr. Carl Kaysen, chairman of the third committee to recommend establishing the data center. Kaysen states:

---

[23] Polls cited by Westin and Baker, Databanks, pp. 466-469. On this feature of elite theory, see Dye and Zeigler, Irony of Democracy, Chapter 5.

> It is neither intemperate nor inappropriate to observe that the merits of the proposed data center have hardly been discussed in the tones that ordinarily mark consideration of a small change in government organization in behalf of greater effectiveness and efficiency.[24]

It is apparent that Kaysen felt that the desired change was a routine one and was perhaps shocked at the opposition of the Congressional committees involved. The same emphasis on efficiency and effective information storage and use is evident on the part of other social scientists and representatives of the bureaucracy involved in the debate. In the hearings discussed at length above, it is significant that experts in technique predominated over those in technology in the expression of this attitude. This suggests that the "managerial society" scenario for technologically-advanced society is more applicable than that of a "technocracy" of engineers and scientists.

The interpretation of this case as an example of elite change can also accommodate the role of the American Economic Association in the development of the proposal. The professional interests of statisticians and users of quantitative data provided more commonality between governmental and extra-governmental actors than differences based on a distinction between private and public categories. That professional and managerial elites were in conflict with more traditional elite members does not prove that change is taking place with regard to such phenomena. It may be suggested, however, that the great increases in record-keeping activities and the increased capacities to manipulate data referred to above serve as an indication that this type of activity

---

[24] "Data Banks and Dossiers," in The World of the Computer, ed. by John Diebold (New York: Random House, 1973), p. 385, emphasis added.

is in the ascendancy. As the segment of government and society engaged in this activity becomes larger and more significant, it is plausible to predict that the newer elites and their characteristic values will become increasingly dominant. The continued development of interconnected data storage after the rejection of the data center proposal also may be taken as a reflection of this development.

If, then, policy-making in this case may be best characterized as elite decision-making, the role played by assessment activities should conform to the hypotheses regarding this relationship formulated in Chapter III. The final section of this chapter evaluates assessment in this context.

Assessment: An Evaluation

True to the dictates of elite theory, assessors in this case had a subordinate role in policy-making. Each side in the debate marshalled its own assessments but the traditional elites freely dismissed the expert assessments offered by the Bureau of the Budget in the form of the Ruggles, Dunn, and Kaysen Reports. To be sure, this action was probably facilitated by the assessment information elicited from experts in computer technology. It seems probable that a similar reaction would have been possible on the basis of information presented by the proposal's advocates alone, especially the admission that individual identification of data would be essential to the operation of the data center. Thus, expertise must be considered as ineffective in the direct confrontation between traditional and emergent elites.

To the degree that bureaucratic and social science values prevailed in the developments after rejection of this specific proposal,

assessment can be said to have been quite effective. This is consistent with the expectation that technocratic or managerial systems of power provide the most fertile environment for the efficacy of technology assessment. It should be noted that the apparently efficacious assessments were of the operational variety and therefore display the characteristic of limited comprehensiveness regarding the range of effects considered.

It may be argued that assessments in this case, as with policy-making on DDT, served as weapons in conflict between opposing interests. This is true to a degree but seems to differ from the case discussed in the preceding chapter in that opponents of the data center did not exhibit a compulsion to counter favorable assessments with different interpretations of the same "scientific" data. The efficiency of computerized informational systems was not questioned, for example, nor the premise that increased information leads to increased knowledge about society and hence to improved administrative and policy capacities.

In conclusion, the role of assessment activities in this case must be regarded as less than optimal in comparison with the assumptions of the assessment movement discussed in Chapter II. The problem of intangible values, in this case, privacy, is central. In policy-making of this kind the inability to deal in a satisfactory way with non-material costs and benefits further complicated by the necessity of accommodating probabilistic factors seems to constitute a significant barrier to the development of truly comprehensive assessment. These problems are essentially the result of the nature of the phenomena in question. Also present implicitly is the highly significant question of the proper role of expertise in a democratic political system, in

this case involving elite maintenance of civil liberties values essential to the democratic nature of government. Neither the assessment literature nor the example of policy examined in this chapter offer a satisfactory means of dealing with this seemingly inherent conflict.

CHAPTER VI

MEDICAL TECHNOLOGY AND THE DEFINITION OF DEATH: PROFESSIONAL SELF-REGULATION

In this chapter the policy to be examined is related to recent accomplishments of medical technology as they have impacted upon legal criteria for the determination of death. During the 1960's technological developments called into question the sufficiency of the existing definition of death as the cessation of circulation and respiration. It had become possible to measure a third criterion, that of brain activity, previously discernible only through more visible functions. Innovations in life-support technology made possible the maintenance of circulatory and respiratory activities in the absence of brain function. Finally, the development of heart transplant technology, requiring removal of that vital organ from donors as quickly as possible after death, forced the issue of defining death in terms of cessation of brain function. The "brain death" proposal is the central factor in this case. Though the medical profession has enjoyed a high degree of control over the conditions of its work, public policy has impinged on the medical sphere sufficiently, through such matters as malpractice and patient consent regulation, to render the definition of death a question susceptible to governmental action.

The policy process in this case differs significantly from the two examples analyzed in preceding chapters. Medical technology has not

received as much public attention as environmental matters and data collection and use, except for short periods of intense interest such as that aroused by the Quinlan case in 1975. A second departure from the other cases occurs in the governmental institutions involved. While the others have had a primary focus at the national level, the present case is concerned with state governments only. Also, adjudication has had more significance with regard to the definition of death than in the other cases. The court actions of the DDT case, though important, were perhaps not as significant ultimately as administrative policy-making. Finally, as argued at length below, this case differs in that it displays a high level of professional group involvement, resulting in successful maintenance of self-regulation. This phenomenon resembles the "new feudalism" model of the policy process discussed in Chapter III. This model suggests a high probability of assessment effectiveness, though evaluation is likely to be accomplished from the perspective of the profession rather than that of government.

The procedure followed in the analysis of this case, as in the preceding ones, begins with description of the technological factors involved, including the effects contributing to emergence of death criteria as a subject of policy. This is followed by a description of the policy process, consideration of assessment activities, analysis of policy, and evaluation of the role of assessments in process.

Three Medical Technologies

As indicated in the introduction, three areas of change in medical technology have given rise to the question of redefining the criteria of death. Discussed on the following pages are technological developments in brain monitoring, life support, and cardiac transplantation.

Electroencephalography. As noted above, for much of medical history the existence of brain activity was evident only through the continuation of other body functions. The monitoring of electrical signals from brain activity, or electroencephalography, however, allows measurement of this phenomenon, including cessation. Physiologically-produced electrical activity has been noted experimentally since the nineteenth century and instrumentation for its measurement was increasingly improved throughout the first half of the twentieth. Clinical use of the electroencephalograph may be dated from the 1930's and 1940's. Users of the EEG seem agreed that the technology has faults in exact determination of the cessation of life. It has substantial potential for distortion of signals from external sources.[1] A second difficulty is that cases involving hypothermia (extremely low body temperature) and nervous system depressant poisoning (barbiturates) produce isoelectric, or flat, EEG readings which do not in fact indicate irreversible brain damage. Finally, there appear to be cases in which individuals with isoelectric EEG readings have later recovered.[2] These problems seem responsible for the inclusion of other clinical tests of brain function in most formulations of "brain death," as discussed below.

Life-Maintenance Technologies. This area is of significance because the devices involved allow the continuation of circulatory and

---

[1] L. A. Geddes and L. E. Baker, Principles of Applied Biomedical instrumentation (New York: John Wiley & Sons, Inc., 1968), pp. 262-263, 306, 309-310; and H. S. Wolff, Biomedical Engineering (New York: McGraw Hill Book Company, 1970), pp. 37, 42-47.

[2] See Warren Shibles, Death: An Interdisciplinary Analysis (Whitewater, Wisconsin: The Language Press, 1974), p. 291; John Langone, Vital Signs: The Way We Die in America (Boston: Little, Brown and Company, 1974), p. 146; and "What Is Life? When Is Death?" Time, LXXVII (May 27, 1966), 78.

respiratory activity in the absence of brain function. Spontaneous heartbeat may be replaced with both short- and long-term substitutes. The first, consisting of an external pump, is more a surgical aid than an extended maintenance device and is properly considered in the context of transplant surgery, of which the heart-lung machine is an indispensable element. Long-term augmentation is possible in the form of electrical stimulation of heartbeat by a "pacemaker," a radio receiver which stimulates the heart regularly on power from an internal or external source. This technology, in use since 1959, presents few problems in the present context. Its users are usually ambulatory and the applicability of death criteria is not in question.[3]

The maintenance of the respiratory function is more directly involved in sustaining life in the anomalous zone where life and death are perceived as merging. The technology of interest here replaces muscular action in the absence of brain stimulation, in contrast to the simulation of nervous function performed by pacemakers. The earliest form of long-term artificial respiration was the "iron lung," a device encasing the patient and simulating muscular action by alternately raising and lowering its internal pressure, thus causing expansion and contraction of the lungs. The improved form of respiration replacement consists of a pump which forces air into the patient's lungs through a tube inserted in an incision in the trachea, or windpipe. Exhalation is achieved either by negative pressure from the respirator or by allowing the elasticity of the chest to expel air. This device can thus

---

[3]Harold M. Schmeck, Jr., The Semi-Artificial Man: A Dawning Revolution in Medicine (New York: Walker and Company, 1965), pp. 82-92; and, generally, Wolff, Biomedical Engineering.

sustain an individual who has lost brain function which normally stimulates breathing.[4]

The use of maintenance devices over the past two decades has sustained many individuals who otherwise would have soon satisfied both traditional criteria of death. Cases have been reported of individuals being maintained for periods of several years in a state of continued respiration and heartbeat without conscious brain activity.[5] This situation of itself raises the question of redefining death criteria but the primary impetus toward adoption of "brain death" seems to have resulted from the technological and physiological dictates of heart transplantation surgery.

Transplant Technology. The same physiological phenomena which lie at the base of new concepts of death criteria are also the factors in organ transplantation which have made this technological application salient in the "brain death" question. Death, it seems agreed, is a process more than an event. Organs and tissues of the human body become permanently nonfunctional, that is, they die, at differential rates. Brain tissue is the most sensitive to oxygen deprivation, or anoxia, while heart and kidney tissue, for example, continue to be viable for longer periods. It is this phenomenon which makes transplantation possible. A donor whose brain has irreversible damage or deterioration

---

[4] Ibid., pp. 186-187.

[5] There have been, unfortunately, no quantitative studies of the use of such aids, according to Alexander Morgan Capron and Leon R. Kass, "A Statutory Definition of the Standards for Determining Human Death: An Appraisal and a Proposal," University of Pennsylvania Law Review, CXXI (November, 1972), 87n. A case of five-year survival in a vegetative state is reported in "A Life in the Balance," Time, CVI (November 3, 1975), 61.

may still provide cardiac or renal tissue which will be functional when placed in the recipient's body. The time span of tissue survival is not unlimited; thus, it is useful for transplant purposes if a donor remains on a respirator or other aids until the transplant is possible, even though there has been irreparable brain damage or deterioration.[6]

Transplantation involves an extremely complicated technological system, including the organization and coordination of many medical specialties and devices. Only a brief treatment of the subject is possible here but it serves to demonstrate how and when this technology became sufficiently important to stimulate discussion of the relationship between transplants and death criteria. In general, successful organ transplantation required the development of several components, including surgical technique, tissue-typing to minimize the rejection phenomenon, and immuno-suppressive treatments to control rejection. The last two are in a developmental stage but were sufficiently advanced to permit human applications by the early 1950's for kidney transplants and the late 1960's for heart replacement.[7]

Transplantation of the kidney does not strictly require the death of the donor, since it is a paired organ; however, the majority of kidneys transplanted are from cadaver donors and the proportion of donated organs from this source is increasing. This application

---

[6] See Robert S. Morison, "Death: Process or Event?" Science, CLXXIII (August 20, 1971), 694-698; and Carl E. Wasmuth, Jr., "The Concept of Death," Ohio State Law Journal, XXX (Winter, 1969), 34-37.

[7] For a comprehensive technical treatment of transplants, see John S. Najarian and Richard L. Simmons, eds., Transplantation (Philadelphia: Lea & Febiger, 1972). The complexity of the field is described in a less technical manner in Christiaan Barnard and Curtis Bill Pepper, Christiaan Barnard: One Life (Toronto: The Macmillan Company, 1969).

represents the most advanced form of transplant surgery. Table 3 shows its adoption rate. At present, this treatment is regarded as relatively routine. Its status as a regular clinical practice and the tendency toward cadaver donors indicate a constant and substantial number of cases in which kidney transplantation may involve death criteria.[8]

Cardiac transplants are distinctive in that they require the death of the donor. There is, therefore, an intimate connection with death criteria. The development of heart transplant technology has differed markedly from that of renal transplantation. Its later human application may be traced in part to more difficulties in surgical technique, notably the necessity for by-passing cardiac function for a time without killing the patient. This was met by development of the heart-lung machine, which externally circulates and oxygenates the patient's blood during the operation. Beginning with an initial success in 1967 heart transplant surgery increased rapidly during the next year but its use has since declined. The "moratorium" apparently resulted from the judgment that the limited survival time of patients indicated that the technique was still relatively experimental. It was felt, therefore, that further development was necessary, especially in non-surgical areas, such as rejection.[9] Table 3 illustrates this trend in applications of cardiac transplant technology.

---

[8] See Advisory Committee to the Renal Transplant Registry, "The 12th Report of the Human Renal Transplant Registry," Journal of the American Medical Association, CCXXXIII (August 18, 1975), 788; and Renée C. Fox and Judith P. Swazey, The Courage to Fail: A Social View of Organ Transplants and Dialysis (Chicago: University of Chicago Press, 1974), Chapter 3.

[9] For accounts of the operation see Denton A. Cooley, Robert Bloodwell, Grady L. Hallman, and James J. Nora, "Transplantation of the Human Heart: Report of Four Cases," Journal of the American Medical Association, CCV (August 12, 1968), 479-486; and Barnard and Pepper, One Life, pp. 252-323. On the decline in applications of the technological system see Fox and Swazey, Courage to Fail, Chapter 6.

TABLE 3

KIDNEY AND HEART TRANSPLANTS, BY YEAR
1962-1975

Year	Kidney[a]	Heart
1962	67	-
1963	157	-
1964	359	-
1965	453	-
1966	561	-
1967	832	2
1968	1,245	101
1969	1,539	47
1970	1,992	17
1971	2,917	18
1972	3,501	18
1973	3,845	33
1974	3,706	29
1975	3,373	32

[a] Total for 1953-1961: 123.

Source: "World Totals and Chronology of Organ Transplantation," table provided by American College of Surgeons/National Institutes of Health Organ Transplant Registry in a letter of June 22, 1976 to the writer from Pauline Olsen, Information Coordinator, Organ Transplant Registry.

Second-Order Consequences. Though the level of application of heart transplants is insignificant compared to renal transplantation, the cardiac application seems to have been more important with regard to second-order effects and the emergence of "brain death" as a potential subject of policy. This phenomenon may be traced to the requirement for donor death in the heart operation and, perhaps, to the symbolic role accorded the heart in Western culture.

As is characteristic of such phenomena, the second-order effects in question follow from the nature of the technological system and its application. Noted above is the desirability of donors remaining on life-maintenance equipment until the transplant operation is possible. In the absence of legitimacy for "brain death," however, removing vital organs or "pulling the plug" of a respirator amounts to causing the death of the donor. This, of course, may be quite properly regarded as an infringement on the rights of the donor and as such is potentially the subject of criminal and civil adjudication.

There are several parties affected by this situation. First, the donor may be adjudged to have a right to life, possibly infringed upon by transplantation. Interests in life prolongation are also evident on behalf of the family and associates of the donor, a second set of parties to be considered. For both of these, it should be noted, continuation of circulatory and respiratory functions in the presence of irreversible brain damage may be either a valued situation or the opposite, either a blessing or a curse. In such a condition the donor cannot, of course, be said to be an active participant, so that effects as perceived by others become of primary importance insofar as legal action or other measures are concerned. The issues of a "right to die" and of euthanasia are both involved in such matters; however, this analysis will focus on the relationship of death criteria to transplantation.

A third set of affected parties consists of individual physicians and the medical profession generally. Because of statutory and ethical considerations, second-order effects include possible mental

anguish as well as civil and criminal legal sanctions.[10] In addition to these potential consequences for physicians participating in transplants, the medical profession as a whole may be considered to be affected by the presence or absence of increased governmental regulation of the profession's work and by the effect of the situation on the prestige of medicine.

Finally, the circumstances under which an individual is pronounced dead are of interest to government, as the set of institutions and roles responsible for society as a whole. The rights of citizens are certainly a matter in which the state has an interest and there are other legal considerations, such as inheritance, contingent on the process of certifying death. Society generally may be considered as a part of this fourth set of affected parties. The nature of a society is affected by the definition of life, the value accorded life, and the worth of an individual's right thereto, all of which are potentially affected by the second-order consequences of the medical technologies discussed above.

It is evident in the discussion of policy-making below that all of these manifestations of indirect effects were involved in the process, though they were not specified clearly in most of the interactions which occurred. Identification of assessment activities follows the narrative description of the issue and its course.

---

[10] See Mark Kusanovich, "Medical Malpractice Liability and the Organ Transplant," University of San Francisco Law Review, V (April, 1971), 223-282; and Walter C. Ward, "Human Organ Transplantation: Some Medico-Legal Pitfalls for Transplant Surgeons," University of Florida Law Review, XXIII (1970), 136-137.

"Brain Death" As An Issue

Policy on the subject of medical practice is, of course, no innovation. Since the emergence of medicine as a combination of techniques and technologies for the purpose of maintaining and restoring health it has been the subject of some governmental attention. Policy has included both action and non-action, with a predominant pattern of granting monopoly status to medical practitioners with particular types of training and methods, including autonomy in regulating entry into the profession.[11] Exceptions to this autonomy include malpractice laws and the law of patient consent, intended to protect the citizen as patient against undesirable applications of the healing technique.

The legal system in the United States incorporates substantial deference to medical expertise. Malpractice litigation, for example, requires expert testimony to prove negligence. Of more present interest, the judgment of the physician has commonly been deferred to in determination of the cessation of life. This determination and that of the cause of death are of obvious importance for such matters as inheritance and control of the proscribed behaviors of murder and manslaughter.

Though until recently the same determination of death could be made by a layman in most cases, the usual pattern in the states of the United States has been to require a physician's certification of death. The states have not usually specified criteria. Such statute law as existed stated in effect that an individual was dead when a physician pronounced him to be. When empirical referents were needed, those of

---

[11] An extensive treatment of this phenomenon may be found in Friedson, Profession of Medicine.

Black's Law Dictionary were usually relied upon. This work defines "death" as:

> The cessation of life; the ceasing to exist; defined by physicians as a total stoppage of the circulation of the blood, and a cessation of the animal and vital functions consequent thereon, such as respiration, pulsation, etc.[12]

This is what is referred to as the traditional definition of death, of course. The few applications arising in contested legal cases in the pre-transplant era were concerned with fixing a moment of death for inheritance or insurance purposes.

Judicial decisions in cases involving such an application consistently rejected the brain death concept. For example, in Thomas v. Anderson (1950) a California court ruled that a woman died when her circulation stopped, not seventeen days earlier when she suffered irreversible brain damage in the accident which killed her husband outright.[13] The beginning of the "transplant era" did not mean the end of cases of this kind or of the application of the traditional criteria. A different emphasis is evident after new medical developments, however. Judicial and legislative interest expanded to different kinds of cases and different treatment of the older criteria.

---

12 Black's Law Dictionary (4th ed., 1951), p. 488. See also Todd D. Christofferson, "Defining Death," Popular Government, XXXIX (November, 1972), 10-11; and Kusanovich, "Medical Malpractice Liability," pp. 241-243.

13 215 P.2d 478 (S.F. Ct. App. 1950). See also Smith v. Smith, 317 S.W.2d 275 (S.C. Ark, 1958); Richard G. Roth, "Legislation: The Need for a Current and Effective Statutory Definition of Death," Oklahoma Law Review, XXVII (1974), 729-730; and M. Martin Halley and William F. Harvey, "Medical vs Legal Definitions of Death," Journal of the American Medical Association, CCIV (May 6, 1968), 424.

The new era in medical technology may be dated from December, 1967, when Dr. Christiaan Barnard performed the first transplantation of a human heart from Denise Darvall, an accident victim, to Louis Washkansky in Cape Town, South Africa. A few days later a transplant was attempted in New York and during the following year more than one hundred such operations were performed worldwide.[14] "The year of the transplant," 1968, was followed by a decline in the application of the technology. This development does not seem to have detracted from the impact of heart transplantation.

The earlier and more successful application of kidney transplant technology has been noted, as well as the probability that the attention paid to heart transplants may be credited to the high symbolic value apparently placed on cardiac replacement. The literary, religious, and popular usages of the heart as representing the essence of human life are well known and are evident in accounts of the early operations. The attention paid in the press to the race, religion, and sex of the donors and recipients attest to this value, as do some remarks by transplant surgeons themselves.[15] It seems likely that the image of the physician replacing the seat of life itself is largely responsible for the high visibility of cardiac transplantation in public opinion and medical and legal attention, perhaps more than the complex technological achievements

---

14 New York Times, December 4, 1967, pp. 1, 56; and "The Heart: Miracle in Cape Town," Newsweek, LXX (December 18, 1967), 86-90.

15 See Barnard and Pepper, One Life; Philip Blaiberg, Looking At My Heart (New York: Stein and Day, 1968); and Fox and Swazey, Courage to Fail, pp. 114-115. The phenomenon in general is discussed by Paul Ramsey, "On Updating Death," in Updating Life and Death: Essays in Ethics and Medicine, ed. by Donald R. Cutler (Boston: Beacon Press, 1968), pp. 32-34.

involved. As already noted, some of the issues related to brain death definition had been present previously yet did not attract the same intense attention accorded the drama of cardiac replacement.

Expressions of interest in the brain death concept can be classified according to three categories. A first group of phenomena consists of professional reconsideration of the criteria for determining death. This is a matter internal to the medical profession for the most part, though some popular writing exists on the subject. Second, there are cases of judicial policy-making, of interest both for particular cases and as precedents for later similar situations. The third class of phenomena consists of legislative action on the question. It is argued below that this kind of policy was shaped by professional initiatives which were in turn reactions to litigation in the area. Each of these is discussed below, not in strict chronological order because analysis is facilitated by classification by the decisional locus and the actors involved.

Professional proposals for change were not entirely lacking before December, 1967. Brain death criteria had been proposed by Dr. Robert Schwab in 1966 and were the subject of inquiry by a special committee of the American Electroencephalographic Society appointed in 1967. Such reconsideration became more prominent during the "year of the transplant."[16]

---

[16] "What Is Life?" p. 78; and Daniel Silverman, Michael G. Saunders, Robert S. Schwab, and Richard L. Masland, "Cerebral Death and the Electroencephalogram: Report of the Ad Hoc Committee of the American Electroencephalographic Society on EEG Criteria for Determination of Cerebral Death," Journal of the American Medical Association, CCIX (September 8, 1969,) 1505.

In June, 1968, the Councils of the Organizations of Medical Science, meeting in Geneva, adopted a set of criteria for determining irreversible loss of cerebral function. An American Medical Association symposium considered the matter in July and in August the Journal of the A.M.A. published a set of criteria which seems the most widely accepted of all those proposed. These standards, contained in the Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death, will be examined at length below. Also in August, the World Medical Assembly, meeting in Australia, adopted the "Declaration of Sydney," on safeguards to protect donors. In the same month leading transplant surgeons met in Cape Town to discuss their specialty, including criteria for donor death. In September, the deliberations of the Second International Congress of the Transplantation Society were added to the body of medical and scientific opinion. Further actions in the following year included the meeting of the First International Symposium on Organ Transplants and the publication of the American Electroencephalographic Society's committee recommendations.[17]

The Harvard Committee's report, entitled "A Definition of Irreversible Coma," is both widely recognized as the most authoritative formulation of criteria and reasonably representative of proposals in the area. It cites as reasons for redefinition the improvement in life

---

[17] David Hendin, Death as a Fact of Life (New York: W. W. Norton & Company, 1973), pp. 35-36; "When Do You Pull The Plug?" Journal of the American Medical Association, CCV (July 1, 1968), 29; "A Definition of Irreversible Coma: Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death," Journal of the American Medical Association, CCV (August 5, 1968), 337-340; New York Times, August 10, 1968, p. 25; ibid., September 9, 1968, p. 23; ibid., July 20, 1969, p. 58; and Silverman, et. al., "Cerebral Death," 1505-1510.

maintenance technologies and the possibility of outmoded criteria causing controversy in organ procurement for transplantation. Characteristics of a permanently nonfunctioning brain, the Committee proposed, are: (1) Total unawareness to external stimuli and internal need; (2) No movement or spontaneous breathing; (3) No reflexes and fixed, dilated pupils; and (4) A flat EEG reading, preferably over a period of twenty minutes. Repetition of these tests at least twenty-four hours later is recommended.[18]

The report proposes that an individual who meets these criteria is in a condition of irreversible coma and that such a person may be declared dead, after which supportive measures such as artificial respiration may be terminated on the responsibility of the physician in charge. Apparently, the declaration of death before "pulling the plug" is a feature intended to avoid the interpretation that the patient was alive prior to the removal of maintenance aids. The report also notes that determination of death in the United States is treated as a question of fact to be addressed in each case. There was apparently no feeling among the committee members that statute law was needed to legitimize the criteria proposed. Rather, the report seems intended at securing legitimacy within the profession. As noted above, the expert judgment of practitioners of medicine has usually been relied upon in determination of death.[19]

There were suggestions of legal recognition of brain death during this period of intense professional interest in the question.

---

[18] "Irreversible Coma," pp. 337-340.

[19] _Ibid._, pp. 337-340.

Joseph Kelner, a specialist in medical law, indicated in 1968 that such approval was desirable. In the same year a New York state commission was created by the legislature to consider a "precise definition" of death for organ donors. Little came of these proposals. Rather the emergence of the question in the judicial system seems to have come first.[20]

Three types of legal cases may be distinguished for the purposes of this study. First, there are those which involve transplantation in some way but lead to neither innovative legal precedents nor proposals for legislative action. A second category comprises those cases in which judicial dicta incorporate the use of brain death criteria as legitimate applications of the physician's expertise within the existing legal framework. The third group includes cases which, for whatever reason, seem to contribute to demands for legislative recognition of irreversible brain damage as criterion for death.

The earliest cases in this area are of the first type. They typically involve the use of a victim of violent attack as a heart donor and include the use of life support equipment to maintain respiration and circulation until the time of the transplant operation. Efforts have been made by individuals accused of the original assault to use as a defense the argument that death was in fact caused by the termination of maintenance aids or removal of the vital organ rather than by the violent act of which they are accused. Courts in Texas, California, and Oregon have implicitly accepted the concept of brain death in these

---

[20] New York Times, August 11, 1968, sec. IV, p. 2; ibid., November 28, 1968, p. 48.

cases by directing or allowing juries to consider the criminal act charged as the cause of death.[21]

Of more importance for legal precedent are those cases in which judicial notice has been directly taken of brain death criteria. The first case in which this occurred was Tucker v. Lower (Virginia, 1972). in which transplant surgeons were sued for causing the death of a donor, the brother of the plaintiff.[22] Physicians testified that the donor had suffered irreversible brain damage in a fall and was therefore considered dead, though he might have continued to show vital signs if maintained with mechanical aids. The judge, in a reversal of an earlier statement, allowed the jury to apply the criteria of brain death, resulting in a finding of no liability on the part of the surgeons. A 1975 case in New York resulted in a direct judicial statement that brain death is the legal end of life. This declaratory judgment supported the position of the Health and Hospitals Corporation of New York City in conflict with that city's medical examiner and the state attorney general over the necessity of autopsies in all violent deaths, a requirement which meant that organs of such victims were useless for transplants.[23]

---

21 Ibid., May 8, 1968, p. 23; ibid., May 15, 1968, p. 18; ibid., January 28, 1969, p. 20; ibid., May 20, 1974, p. 23; ibid., May 24, 1974, p. 20.

22 No. 2831 (Richmond, Va., L. & Eq. Ct., May 23, 1972). See also New York Times, May 24, 1972, p. 6; ibid., May 27, 1972, p. 15; Ward, "Human Organ Transplants," p. 137; and Capron and Kass, "Statutory Definition," p. 98.

23 New York Times, March 8, 1975, p. 29; ibid., April 26, 1975, p. 12.

Two cases serve as representatives of the third class of litigation. It is of interest that the case which has aroused the most intense attention is not concerned with the protection of the patient against irresponsible declaration of death in the process of transplantation. Rather, it is of the type which may be termed the "right to die" case and in that sense is a digression from the purpose of this chapter. It is instructive, however, of the legal and physiological factors involved with redefinition of death.

In September, 1975, the parents of Karen Anne Quinlan filed suit in a New Jersey court requesting that Miss Quinlan's father be appointed her guardian for purposes of terminating medical treatment. Miss Quinlan, an adult, had been maintained in a state of coma by a respirator since the previous April, apparently as a result of respiratory failure which followed ingestion of tranquilizers and alcohol. Though early attention, including proposals for legislative definition of death in New Jersey, focused on brain death criteria, subsequent expert testimony indicated that the patient was not "brain dead" because of discernible reflex action, EEG readings, and, eventually, some capacity for spontaneous breathing.[24]

The suit was eventually successful for the Quinlans on appeal, though the patient proved capable of spontaneous breathing. It apparently arose because Miss Quinlan's physicians feared legal liability

---

[24] The references to this case in the news media have been quite numerous, of course. Of particular interest on the points indicated are: New York Times, September 14, 1975, p. 44 (first notice of case); ibid., September 22, 1975, p. 71 (proposal for legislation); ibid., November 11, 1975, pp. 1, 62 (original court decision); and ibid., July 30, 1976, sec. II, p. 2 (appellate decision and Miss Quinlan's survival without respirator discussed).

for granting her family's request for life support termination, a request which had in the past been routinely granted elsewhere, according to some sources. The case's innovation seems to lie in the question of whether or not a right to refuse treatment, accorded in several cases to competent adults, can be granted to guardians of an incompetent individual. A case involving an individual meeting the "irreversible coma" criteria has yet to be decided, apparently, though a case in Missouri was underway when the patient involved died without termination of maintenance aids.[25]

One further point illustrated by the Quinlan case is relevant to the difficulty of applying legal criteria to complex physiological states. Miss Quinlan was held by experts to be in a "chronic vegetative state," caused by damage to the brain, probably from anoxia. The parts of the brain controlling conscious activity were damaged but deterioration did not extend to the brain stem region where involuntary action is regulated. The essence of life seems missing, yet the boundaries are still difficult to discern even in the presence of the brain death concept.

The second case to be discussed in this category received no widespread attention. It did, however, result in legislative definition of death criteria. The process leading to the enactment of the first statute defining death is described in a letter to the Journal of the American Medical Association. A physician from the University of Kansas

---

[25] On previous practice, see "A Life in the Balance," p. 57; and New York Times, November 2, 1975, sec. IV, p. 9. On a right to refuse treatment, see ibid., July 3, 1971, p. 21; and ibid., June 8, 1973, p. 84. The Missouri case is reported in ibid., November 2, 1975, p. 55; and ibid., November 10, 1975, p. 36.

Medical Center explains how a legal case which recognized the traditional criteria of death led transplant surgeons in Kansas to fear liability because this recognition constituted the only state law on the subject. In reaction, members of the Medical Center staff, relying in part on the Harvard Committee's report, drew up a law which would protect surgeons from liability in the death of a donor. The proposed legislation was presented to the state legislature, which, apparently to the doctors' surprise, enacted it into law.[26]

The Kansas law and a similar one passed in Maryland in 1972 allow two alternative sets of criteria for the physiological state of death. An individual is to be considered legally and medically dead if spontaneous respiration and cardiac function have ceased irreversibly _or_ if spontaneous brain function is absent. In either case, the criteria must be met "in the opinion of a physician, based on ordinary standards of medical practice . . . ." The Kansas statute follows the Harvard Committee recommendations specifically in providing that death is to be pronounced before artificial means of support are terminated.[27]

The primary criticism lodged against this statute is that its purpose is facilitation of transplants, meaning, if accurate, that it deals only with protection of the medical profession and no other second-order effects. According to Dr. Taylor, one of the drafters, the

---

[26] Loren F. Taylor, "A Statutory Definition of Death in Kansas," _Journal of the American Medical Association_, CCXV (January 11, 1971), 296.

[27] Taylor, "Statutory Definition," p. 296; Roth, "Legislation," p. 733; and Capron and Kass, "Statutory Definition," pp. 108-109.

"legislation was drawn without regard to the hazards in other areas of the law, particularly wills." Taylor and at least one commentator hold the statute to be adequate as a general purpose regulation of indirect effects in the area.[28]

Legislative action of this type is apparently limited, though the doctors involved in the Kansas statute were quite successful in securing the desired protection. It seems likely that the role played by the American Medical Association with regard to definition of death legislation is a central factor. The professional group, through its legislative body, the House of Delegates, has consistently opposed legislative definition. Beginning in 1968 the A.M.A. has held that pronouncement of death is a matter for the professional judgment of the physician and in 1973 began to recommend that its constituent state societies urge their state legislatures to postpone defining death by statute. The reason cited is fear of malpractice action by survivors of patients declared dead, on the ground that specific criteria were violated.[29] This is somewhat surprising because of the quite different reaction to the same fear which resulted in the Kansas statute. While it is not possible to establish with certainty the importance of A.M.A. opposition, the example of the Uniform Anatomical Gift Act suggests that the group's stand on legislation of this kind may be quite significant.

---

28 Taylor, "Statutory Definition," p. 296. The law is defended by Don Harper Mills, "The Kansas Death Statute: Bold and Innovative," New England Journal of Medicine, CCLXXXV (October 21, 1971), 968-969; and criticized in Capron and Kass, "Statutory Definition," p. 109.

29 New York Times, December 5, 1973, p. 27; ibid., December 4, 1974, p. 26.

Both the A.M.A. and the American Bar Association endorsed this provision allowing individuals to "bequeath" organs for transplantation and its rate of adoption by state legislatures was quite rapid.[30]

Policy-making on the question of redefining death in terms of brain function thus has taken a number of forms. Though tactics of individual physicians and professional organization have varied, there is a pattern which can be identified in internal reconsideration, judicial action, and legislative redefinition. The traditional self-regulation of the medical profession has remained undisturbed for the most part throughout the process. Policy decisions such as the Harvard Committee's recommendations are, of course, based on the assumption that this question is a matter properly handled within the profession, a view supported by the American Medical Association. It is noteworthy that such a perspective is legitimized by governmental actors in the process. Judicial deference to medical opinion is evident in Tucker v. Lower and other cases.

Even the legislative actions which have occurred have not removed certification of death from the realm of the physician's professional judgment. The Kansas statute does not specify criteria such as the length of time an individual must display an isoelectric EEG in order to be pronounced dead; rather, it allows the physician involved to apply such a criterion if he so chooses and leaves specific measurements to medical judgment "based on ordinary standards of medical practice."

---

30 See Francis D. Jones, "Uniform State Laws," The Book of the States, 1970-1971, pp. 101, 108; and Catherine Lyons, Organ Transplants: The Moral Issues (Philadelphia: Westminster Press, 1970), pp. 119-125.

Thus, the making of public policy in this case clearly followed the development of expertise in the technologies and techniques which make up the medical profession's work activities. Even though the relevant decisions were made within the profession, they are binding on society, of course, and must be considered public policy in that sense. The role of government has been one of legitimation, through court decisions, legislative actions, and failures to disapprove what has been done by the medical profession.

Assessments in the Process

As in the cases discussed in the preceding chapters, there is a lack of truly comprehensive assessment with regard to medical technology and the redefinition of death criteria. It is possible, of course, to formulate a list of factors involved in such an evaluation; a "model" for assessing this aspect of medical technology appears in Figure 5. However, no actual assessment which approaches rigorous consideration of the relevant elements can be identified in the policy process.

Undeniably, an attempt at comprehensive assessment similar to that envisaged by the assessment proponents discussed in Chapter II would be unproductive, largely because of the seemingly inherent problem of comparative valuation and valuation of intangible factors. Both costs of redefining death to facilitate transplants, such as infringement on rights of patients and their survivors, and the benefits, including prolonged life at a probably reduced capacity for recipients of transplants, deal in values which defy quantification. Some effects, such as the survival of brain-damaged individuals, are differentially valued by the relatives and friends of patients involved. In such situations some value a "right to life," others a "right to die."

Benefits	Costs
Effects of facilitating cardiac and renal transplants through organ availability and legal security of surgeons involved.	Effects of removing life-support aids from individuals otherwise capable of being maintained in a state of continued respiration and circulation though incapable of brain function.
Benefits of life prolongation for more organ recipients; unquantifiable in terms of subjective valuation by recipient and associates, measurement in economic terms possible but offset by probability of continued health impairment.	Economic costs of additional transplant operations.
Possible indirect benefits for some brain-damaged patients in value of "right to die."	Costs in intangibles of right of individual and associates to patient's life in unconscious state; probabilistic cost of erroneous diagnosis of irreversible brain damage.
Direct and indirect benefits to individual physicians and medical profession in protection against legal liability in transplant and other cases and continued autonomy.	
Diffuse societal benefits in improvments in medical knowledge, insofar as transplants are experimental in nature.	

Policy Options

Redefine death criteria strictly, by statute; probability of some cost avoidance and loss of some benefits, cost to medical profession in loss of a degree of autonomy, societal costs or benefits of which cannot be estimated.

Redefine death criteria to allow inclusion of brain death in factors considered by physicians or allow professional redefinition in an internal manner; benefits secured, costs incurred, both unquantifiable and largely immeasurable.

Do not allow use of brain death criteria in death definition; costs avoided, benefits lost.

Figure 5: Model Assessment of Brain Death Criteria Adoption As An Element in the Technological System of Transplantation

A search for actual assessments in this case reveals a substantial departure from the cases already analyzed. While there is some writing of a publicist nature about the question, it does not seem to have been significant for policy decisions in this case.[31] Governmental actions, including non-actions, judicial decisions, and legislative enactments, constitute assessments of a sort, primarily of the operational variety; there is a distinct absence of investigatory assessments and of consideration of a wide range of societal effects. The assessments which predominate in this case are those of the medical profession, in a variety of forms. As noted, many medical organizations performed assessments, the Harvard Committee being the most prominent. In the case of the Kansas statute a work group of physicians constituted the significant assessment body. A concern with patients' well-being and rights is not absent from such considerations. However, the benefits of redefinition seem to have dominated most assessments evident in this area.

These assessments are rather difficult to classify in terms of the categories established in Chapter II. According to that scheme, they are private in nature. Neither polemic nor exculpatory, the evaluations involved must be considered scholarly within the framework of Chapter II. This is not entirely satisfactory, largely because of the somewhat ambiguous position of professional groups in the usual model of society which clearly separate private and public actors. In this case the important assessors were private, yet acting with the authority of government, with a legitimacy conferred by specific action

---

[31] For an example, see Langone, Vital Signs.

or by continuation of past practices of deference to expert judgment with regard to the phenomenon in question. If, indeed, the "new feudalism" model of policy-making is accurate, some reconsideration is necessary to account meaningfully for the operations of "private government," as manifestations of this kind are sometimes called.

In the section which follows, the policy-making process in this case is examined in depth with regard to the models discussed in Chapter III. This is followed by an evaluation of the role played by assessment in the case of transplant technology and the redefinition of death.

Analysis

As noted above, this case clearly resembles the "new feudalism" model, with the "plural elite" model also deserving consideration. Application of other models, however, is of use in analyzing the type of process in evidence and in identifying some of the difficulties encountered in applying a traditional model of dichotomized "public" and "private" actors.

The Rational Model. In this case, as in the preceding ones, policy-making bears little resemblance to the rational model. The deference paid to policy decisions made outside of government and the decidedly reactive role of governmental actors in the policy process can scarcely be considered as examples of optimal procedure. Information was gathered on the question of redefining death, to be sure, but this was primarily an extra-governmental activity. It cannot be said to have constituted a comprehensive attempt at collecting relevant data for all societal effects and formulating alternative courses of action with their correlative costs and benefits.

Demand/Information Patterns. It may be noted briefly that the hypotheses of Salisbury and Heinz regarding the type of policy resulting from particular configurations of demands and decision costs are valid for this case. It is posited that a unified demand pattern coupled with high decision costs, including information costs, will be associated with policy of a self-regulatory nature.[32] The primary impetus for action or non-action in this case was from a single source, the medical profession. It may be assumed that information costs for the technology and its effects would have been high for governmental actors because of the technical expertise and intangible factors involved. Finally, as noted above, the outcome of the policy process was indeed a policy allowing and legitimizing self-regulation of the phenomenon in question.

Incrementalism. The tendency to effect only limited change in policy decisions is evident with regard to the redefinition of death. Developments in medical technology raising new questions of protecting the citizen as patient were answered by a modification of the existing arrangement; death certification continued to be a matter of professional medical judgment with the additional feature of authorizing such judgment to incorporate the relevant innovations in medical technology. Past patterns continued in the absence of a federal role in the policy process and the continued reliance on state regulation of the medical profession and of the definition of death criteria. Avoidance of political costs and information costs seems to be significant here. The limited nature of innovation, whether considered a virtue or not, in this case is characteristic of incremental decision-making.

---

[32] Salisbury and Heinz, "Theory of Policy Analysis," pp. 41, 48-49.

The Institutional Model. It may be argued that the medical profession qualifies as a social institution in a functional sense; however, the institutional model is usually applied in terms of formal governmental arrangements. In the latter sense the model is almost entirely insufficient in this case. The significant decisions about death criteria generally were not made by legislative bodies and promulgated by law but were instead a function of a professional group. To be sure, the role of the medical profession was legitimized by governmental actors but this reactive role is hardly typical of an institutionally-oriented description of the policy process. A more realistic institutional model which includes functional institutions as well as legal ones seems called for in matters featuring a high degree of self-regulation by professional groups.

Pluralism and Elitism. The salient role of a single profession in this case indicates that the elite model is of limited value for the present analysis. If the usual interpretation of elitism is relied upon, the only role which can be assigned to a small homogeneous group of the better members of society is that of acquiescence in the demands of the medical profession. The emphasis on rights typical of such a group in the United States seems to be absent, in that facilitation of transplants and maintenance of professional autonomy were the primary considerations, though concern for donors was not completely lacking.

Similarly, the usual model of pluralism does not have much utility for this case. The medical profession may be considered as an organized interest group, to be sure, acting in the approved fashion of seeking to influence policy in directions favorable to its members. Yet on this issue the central factor of a multiplicity of power centers in

society is not in evidence. For this issue, the professional group seems to have been the only significant center of power. For this reason, the interpretation of policy as an equilibrium point in group struggles is of little use for analyzing the decision to redefine death criteria.

The difficulties of analyzing the process are not alleviated to any great degree by application of the "plural elite" model. Certainly, the A.M.A. illustrates the phenomenon of plural elites, as distinguished from a democratic interpretation of pluralism, quite clearly. The position of the House of Delegates on statutory definition may perhaps be traced to this feature of the organization. That the A.M.A. displays oligarchical characteristics in its internal government seems agreed upon by students of the professions.[33] Besides an inherent conservatism which may be expected from such a configuration of power, the leadership represents the average practitioner more than the pioneer in new techniques. Despite the role of scientific expertise as a referent for professional legitimacy, it is reported that most physicians relate primarily to personal clinical experience.[34] For the bulk of the profession, facilitation of transplants may be less significant than

---

33 See Friedson, Profession of Medicine, pp. 27-28; Gilb, Hidden Hierarchies, pp. 117-132; Lipset, "The Law and Trade Union Democracy," p. 90; and David R. Hyde and Payson Wolff, "The American Medical Association: Power, Purpose, And Politics in Organized Medicine," in Lakoff, Private Government, pp. 162-170. On the profession's position and objectives generally, see the works by Friedson and Gilb cited above and Jeffrey Lionel Berlant, Profession and Monopoly: A Study of Medicine in the United States and Great Britain (Berkeley: University of California Press, 1975).

34 See Friedson, Profession of Medicine, pp. 162-171, 339-344.

maintaining a high degree of autonomy in the vast number of routine deaths which do not involve transplantation. It may be argued that the Association's actions were intended to serve the average physician, not the scientist-innovator. This occurred within the general professional objective of maintaining a position of autonomy with regard to society and government.

Defining the medical profession as an example of plural elitism is accurate, yet does not suffice to explain the policy process in this case. The central feature is the absence of competing centers of power, whether elitist or democratic in nature. Essentially, the phenomenon which must be the focus of analysis with regard to the redefinition of death criteria is a segment of society which, by virtue of legitimacy secured on the basis of expert knowledge, is capable of autonomous control of itself internally and of a certain sector of activities which affect all members of society. Its functions do not overlap and compete with other sectors but rather co-exist in a segmented manner. This phenomenon is essentially that labelled "new feudalism" in Chapter III.

There is nothing new about the position of the medical profession in this regard, of course. It has maintained its "fief" in the United States for decades. However, some innovation in the analysis of politics and society is required to take proper account of this and similar professional groups and their activities. The phenomenon has not been unnoticed, to be sure, but much conceptualization of the policy process fails to take it into account. The "new feudalism" perspective takes on additional importance when the traditional professions of medicine and law are considered as precursors of newer occupations seeking the same status, a phenomenon which is in evidence in present-day

American society. The increasing technological orientation of society may be assumed to result in a greater value for expertise, which is the essence of justifications for autonomous professional operation.[35]

Assessment: An Evaluation

It is suggested in Chapter III that assessment is most likely to be effective when expertise is a strategic factor in political power. This may occur in several forms, of course, including "new feudalism," as well as technocratic and managerial elitism. Among these manifestations the basic distinction is the composition of the ruling group or groups and their scope of control. The basis of control remains expertise. In such an environment it seems likely that a rationalistic activity such as technology assessment will receive its most favorable reception. This is not to say, of course, that it will be entirely successful, because of limitations in the physical and social world. Rather, the rationale and legitimacy of the enterprise are more congruent with prevailing norms than in other political and social environments.

This expectation regarding the role of assessment seems to be borne out in the case of redefining death. The policy decision which prevailed through judicial recognition, legislative authorization, or governmental non-action was apparently that dictated by a professional consensus resulting from consideration of the facts involved and the relevant costs and benefits. The assessments of redefinition in accordance with the dictates of technological innovation and professional

---

[35] Glib, in Hidden Hierarchies, considers several professions in various stages of development.

autonomy were followed in the policy decision. It is to be noted that the range of effects considered is probably limited in assessments of this kind. Though intangible factors relating to general societal consequences were not ignored, the emphasis was placed on elements relating directly to the profession. Maintenance of professional autonomy, the security of the profession's members in the legal context, and the facilitation of employing the profession's technological means were the primary factors involved in the assessments and therefore in the policy decisions.

While cases such as this may seem encouraging for the success of assessment, certain points should be noted. First, assessment of this kind may not promote truly comprehensive assessment if particularistic criteria are emphasized at the expense of societal ones. Deference to an organized profession in cases such as this involves accepting not only the authoritative expertise in technology and technique on which the profession is based but also granting to the practitioners of that expertise the authority to make decisions on political and social matters which extend beyond the realm of their specialty.[36]

A second factor is that prevalence of autonomous professional organizations in a society which increasingly relies on specialization of knowledge raises significant questions for democratic political ideology. Third, compartmentalization of societal functions may call into question the very ability to govern society as a whole, thus

---

[36] See Friedson, Profession of Medicine, Chapter 15; Lyons, Organ Transplants, pp. 11-23; and Earl R. Babbie, Science and Morality in Medicine: A Survey of Medical Educators (Berkeley: University of California, 1970), p. 179.

requiring a readjustment of the role of government. In the final analysis, such a situation would make doubtful the accomplishment of the goal of assessment, that is, the establishment of societal control over its internal processes which involve technology. These considerations are among the questions addressed in the concluding chapter of this study.

CHAPTER VII

CONCLUSIONS: AN EVALUATION OF ASSESSMENT

The purpose of this study is to examine the ways in which policy is made on societal concerns related to technology, with particular reference to the concept of technology assessment as a device for rendering technologically-motivated change manageable. In Chapter II a process for accomplishing this control is described, together with the difficulties which must be faced in doing so. In the remainder of the study, the political environment of assessment is analyzed conceptually and empirically. This chapter comprises an attempt to generalize about technology assessment in that environment and thus to reach conclusions about the possibility of establishing conscious, purposeful societal control over the phenomenon of technologically-related change.

The task is undertaken by first considering the limitations on the efficacy of assessment activities which are evident in the case studies above. These include both limitations on knowledge and on the use of knowledge about technology and its effects on society. A second consideration is that of the outlook for assessment in the political system and society of the contemporary United States, a future which, it is argued, may be characterized as a dilemma of the current age since both the success and the failure of assessment have significant implications for man as citizen and as member of society. Finally, the options available, their implications, and their requirements are discussed.

Limitations On Assessment

It is argued in the concluding section of the chapter on technology assessment that the implementation of that concept faces significant problems. This generalization has been borne out by the evidence adduced in the three case studies of technologically-related policy-making. The limitations may be considered under two headings, those which involve the state of knowledge itself and those which are encountered by virtue of the political environment in which implementation of knowledge must be attempted.

Limitations on Knowledge. It is to be noted that, despite significant advances in understanding, there are serious limits on comprehension of both the physical and social worlds. Though the physical sciences have certainly developed means of explanation far beyond their counterparts in the social sphere, it is evident that their application in certain policy-related areas falls short of complete understanding. This is true of both the identification of causal relationships and the description of technological impacts. In particular, the case of DDT illustrates this phenomenon, with its disagreements between equally qualified individuals on the existence and degree of some of the consequences claimed for the pesticide. It is also evident to a degree in the lack of consensus regarding computer security capacities.

The most serious limits on knowledge must be associated with the social sciences. Understandably, given the variety of human behavior and the vast complexity of variables in a given social situation, the difficulties of identifying cause-effect relationships are magnified in the social sphere in comparison to the physical. Of great significance

for policy decisions but effectively unanswerable in the cases described above were such questions as the ultimate social impact of DDT prohibition or retention, the benefit-risk equation for centralizing and computerizing federal data, and the net benefit or cost for society of allowing brain death criteria to be adopted by the medical profession. Not only was there disagreement on the outcome or impact of technological consequences but also on the occurrence of such consequences. Included are such matters as the existence of deprivation of rights by doctors or data bank users and the degree of health costs and aesthetic benefits involved in banning DDT.

The reasons for such failures are many. Social indeterminacies encountered in the three examples of policy-making occur not only in relation to cause-effect chains. Also of significance is the lack of consensus on goals for policy programs and actions. Without standards of human life quality, including aesthetic appreciation of nature, the value of privacy, and the essence of life itself, it is difficult if not impossible to evaluate available policy alternatives. The absence of a means to value effects in a comparative way is also an important obstacle in social knowledge. This involves quantitative but non-monetary factors, such as increased life span and health and statistical processing efficiency. Perhaps more importantly, this difficulty is encountered with regard to values which are intangible but are no less real for individuals and society. Rights and freedoms, as well as the value placed on life and health, must be considered in evaluation of policy alternatives. This is no idealistic prescription; such factors are valued by members of society and therefore must be considered in governmental actions or non-actions which authoritatively allocate

values for society. Failure to appreciate significant social realities such as these may have significant effects on the legitimacy and thus the existence of a political system. Inability to compare factors of this kind constitutes a serious limitation on knowledge generated by the social sciences and therefore on the effective application of technology assessment.

It cannot be argued, of course, that the knowledge of the physical or the social sciences is inconsiderable and of no value for assessing technology. Limitations do exist, nonetheless, and must be taken into account in evaluating technology assessment. There are also noteworthy problems associated with applying available knowledge, whether by a specifically-identified office of Technology Assessment or, as in the case studies, through a variety of means for assessment activities generically identical with the proposed innovation. These difficulties are considered in the section below.

Limits on the Use of Knowledge. In this discussion reference is made to assessment both in the specific sense and the generic. Characterizations are in most cases applicable to both, because of the similarities between technology assessment as advocated by the assessment movement and the practices implicitly employed to perform the same function.

A first consideration deals specifically with explicit assessment. As discussed in Chapter II, the assessment movement emphasizes the importance of providing expert information on technological effects to Congress only. The analyses of cases undertaken in this study clearly indicate the departure from political reality which such an emphasis represents. The assessment prescription seems to assume a

rather simplistic model of policy-making in the United States, that is, that Congress makes policy through enacting statutes and the roles of the other branches are implementation and interpretation. It is noteworthy that none of the examples analyzed featured such a role for the national legislature.

There was, to be sure, Congressional action on pesticides but the decision to ban DDT was primarily administrative, probably under the stimulus of judicial orders. An organ of Congress was involved in the data bank decision but committee initiative and reaction was more important than the complete utilization of the legislative process. In addition, the actions of the executive branch, in particular certain elements of the bureaucracy, had great import for the policy outcome in that case study. The question of redefining death criteria was raised and resolved in professional organizations, state courts, and state legislatures. Though a formal assessment mechanism might have stimulated more overt Congressional activity on these issues, there remains the fact that evaluations made at other points provided the central elements in the relevant policy decisions. Not to be overlooked is the importance of state and even local governments in the DDT and brain issues. In the former, state policies were precursors of national action; in the latter state action or non-action was the major component of governmental policy-making.

A second consideration deals with the effectiveness of institutionalization as a means of insuring access of expert information to the policy process. The examples of specialized bodies for provision of such information in the case studies suggest limited potential for the Office of Technology Assessment. Several institutionalized sources of

expert knowledge were, for example, used in the DDT policy process, from the President's Science Advisory Committee to the ad hoc Mrak Commission. The decision on a national data center involved a number of studies and hearings. In both cases, access itself was assured; however, the multiplicity of actors of this kind and their disagreement on the available options calls into question the effectiveness of such access.

More optimistic predictions for the Office of Technology Assessment must rest on the assumption that this situation will change because of the OTA's creation. Particularly because of the assessment movement's focus on Congress, it seems likely that other governmental actors will continue to rely on other sources of expertise in the future. Disagreement between experts seems probable, because of the limitations on the reliability of knowledge discussed above. It is of course possible that a new kind of knowledge, that is, a sophisticated comprehensive technology assessment capability, will result in greater effective access. This development faces significant obstacles, however, as discussed in Chapter II. The political considerations discussed below also contribute to the likelihood of limited effective access in the future.

Before proceeding to limitations imposed by the political environment of assessment, a third factor relating to the effectiveness of expertise should be examined. From the case studies, it seems likely that, even in the presence of expert information about a technologically-related policy issue, policy considerations will include elements not strictly related to that issue. There is a definite influence of factors which appeal to emotion and valuational thought in each of the policy decisions analyzed above.

The DDT issue, as noted in Chapter III, was not a function of the level of the pesticide's use. Rather, its emergence is related to changing attitudes about the phenomenon. It seems to be agreed that Rachel Carson's Silent Spring provided the catalyst in this case and that its success was due in large part to the skill of the writer in presenting a warning which had already been issued by others. Once the issue developed, it is noteworthy that the focus of debate fluctuated between DDT in particular and pesticides in general, with actions taken on the former being influenced by its symbolic representation of synthetic pesticides and chemical pollutants generally.

In the policy process on the national data center proposal it is noted above that discussion and decision-making considerations were not confined to the technical capabilities for system security. The numerous references to the totalitarian world portrayed by George Orwell in 1984 suggest that the images evoked by that work were important components in policy-making. This novel is certainly not irrelevant to the question of data use but using it as a standard to judge the specific proposal under discussion is not encouraging for the effective use of expert analysis of particular programs involving technological applications.

Redefining death as a policy issue was also affected by this phenomenon. While the development of renal transplantation technology preceded that of the cardiac application and was numerically the superior of the two, the emergence of death criteria as a subject of policy-making by both public and professional actors was stimulated by the more dramatic connotations of replacing the human heart. Not only do the popular and literary symbolic usages of the heart seem to be important here but it is also to be noted that cardiac transplants had declined

drastically in number by the time any governmental action was taken on the question of redefining death criteria. It seems likely that the Quinlan case provoked more discussion of the question than earlier cases such as Tucker v. Lower, even though the facts involved did not require consideration of death criteria so much as a complication of the "right to die" issue. In summary, in this case as in the other two, policy considerations were not confined to technical factors and their explicitly identified consequences. The occurrence and impact of other images and attitudes is not random but it takes place in a rather unpredictable manner.

A fourth category of limitations facing technology assessment may be identified as specifically political in nature. The ideal of assessment in the policy process is the achievement of a rational operation which provides highly reliable information evaluated according to the net social cost or benefit of a given technological application or technologically-related program. This is based on the premise of maximization of societal or public good. It is not productive for present purposes to review the arguments for or against the possibility of identifying and pursuing such an optimum course of action for the entire society, beyond pointing out that many of the phenomena involved are discussed above in terms of causality, goal consensus, and comparative valuation. Whether achievement of the ideal is possible or not, it remains significant that, in the cases analyzed, expert information was used with particularistic, not general, ends in mind. In each case, expert information was employed to further group interests, whether environmentalist goals, efficiency criteria, or the dual motives of transplant facilitation and maintenance of professional autonomy. This

occurred within the framework of pluralistic conflict, possible elite succession, and "new feudal" self-regulation.

In these instances, those involved would undoubtedly argue that the particular interest was also the public interest. This may or may not be the case, of course, and the limitations on knowledge in the social sciences preclude definitive judgment on the question in each policy decision analyzed. The factor of emphasis on first-order consequences in the policy process indicates, however, that in certain situations there was a lack of comprehensive consideration which seemingly is necessary for pursuit of the public interest. Examples include the Department of Agriculture's attitude toward pesticides before and during the DDT controversy, the limited consideration of intangible effects of data bank development by bureaucratic actors, the incremental growth of interrelated data collections in the same case, and emphasis on transplant facilitation and practitioner protection rather than the rights of patients in the medical technology case.

The tendency to seek particular rather than general ends is doubtless unavoidable to a high degree. The scope of societal and governmental processes and phenomena, the indeterminacy of effects and impacts, and human perceptual and cognitive capacities all contribute to a narrow focus in participants' views of the policy process. Both use of knowledge for particularistic ends and emphasis on first-order consequences may seemingly be traced to these factors.

The limitations which assessment faces because of its political environment raises the question of redesigning assessment so as to take account of political realities in a more effective manner. There are similarities in the cases analyzed in the political problems encountered,

as discussed immediately above. It is to be noted, however, that a different model of the policy process proved to have the most explanatory value in each example of technologically-related policy-making. That different kinds of interaction may take place in various situations renders redesign to achieve effectiveness difficult.

For example, it could be assumed from DDT policy-making that advocacy assessment should be encouraged, that a "marketplace of assessments" should be created to test options and select the best alternative. There are obstacles, however, beyond those imposed by possible distortion or selective use of information for group purposes. With regard to the redefinition of death criteria, there was no adversary to effectively present a counter-argument to the position of the medical profession. The absence of organized group activity at a significant level in the data bank case as well as the effectiveness of operational assessments in incremental change also indicates that the adversary process cannot be relied upon. Thus, there either is too much variety in the political world to allow effective redesign or the indeterminacy of knowledge in political science precludes identification of the key variables at the present time. In either event, it is unlikely that assessment design can overcome the complexities of its political environment in the near future.

It may be argued that the cases analyzed above suggest that a trend in the characteristics of technologically-related policy-making is taking place. That a pluralism based on the power of expertise in both technology and technique may be emerging is discussed in the analysis of DDT policy. The emergence of a new elite of managerial and social science experts is noted as a possibility in the data bank case. In

policy on the redefinition of death criteria a neo-feudalism based on knowledge is considered with regard to the medical profession, both in the context of its traditional autonomy and as an indicator of things to come in an increasingly technology-oriented society. If this generalization is accurate, it may be assumed that assessment will become more effective because of the affinity of knowledge-based power for rationalistic processes and solutions. The limitations of particularistic use and the multiplicity of power configurations remain as limits on the achievement of the ideal of technology assessment as it is proposed by its advocates.

Before proceeding to discussion of assessment's alternative futures, the limitations noted above may be summarized. The development of an effective assessment capacity is first confronted with difficulties related to the achievement of highly reliable knowledge necessary for attaining its goals. Social knowledge is especially faced with barriers related to causal relationships, goal choice, and comparative valuation of effects. The use of knowledge is also confronted with significant obstacles. The necessity of taking a variety of governmental actors into account, the insufficiency of institutionalization as a means of guaranteeing effective access, and the tendency for emotionally-induced factors to intrude into the policy process are factors which must be considered. Political considerations, especially the use of information for particularistic purposes, are also significant inhibitions on the development of effective comprehensive assessment. Though political realities impose important limits, there is not currently available a sufficient understanding of politics to make redesigning assessment a likely short-term solution. An increase in the

"technological society" patterns of policy-making indicates greater potential for assessment, but with limitations imposed by the political configurations involved. With these items in mind, the alternative futures which are possible for assessment may be considered.

The Futures of Assessment

In the discussion below the implications of assessment's failure or success are considered in terms of their most complete manifestations, that is, as absolutely successful or an utter failure. This is done in order to identify the implications of the two alternative states in their most fully developed forms. In reality, of course, a mixture of the two situations may take place, with concomitant degrees of the respective effects occurring. For each, however, there would seem to be a level which, while less than absolute, will result in significant consequences of the types described.

The Failure of Assessment. In the introductory chapter assessment is described as based on a third perspective of the man-technology relationship, one which assumes that man is affected by technologically-related change but has the capacity for dealing with and controlling such change if the requisite information and implementation can be developed. A process for achieving such a capacity is discussed in Chapter II, consisting of assessment, forecasting, policy action, and evaluation. If, however, assessment is unsuccessful in either information or means of implementation, or both, the possibility of achieving control seems unlikely. This characterization applies to assessment in either explicit or implicit forms.

What are the consequences of failing to develop a significant level of purposeful management over technologically-related societal

developments? They may be summarized as the effects which follow from failure to adapt to changing environmental conditions. If government follows an incremental course of action, characterized by limited change from existing patterns of behavior, it faces just such a failure. A political system which reacts by degrees to a world in which technological change is so rapid as to constitute a change in quality rather than quantity will face serious societal dysfunctions.

Some biological analogies suggest that the price of failing to adapt is extinction and, indeed, prophecies of doom for life itself from nuclear weapons or environmental pollution cannot be categorically dismissed. Less dramatic but no less drastic possibilities include dissolution of social and political institutions and processes sufficient to render society ungovernable and unmanageable for man both individually and collectively. More limited dysfunctions may be entailed in the failure to assess and manage. Power failures, energy crises, erosion of rights to privacy and other prerogatives, disruption of ecological systems, and deprivation of aesthetic satisfactions are among the phenomena which may be included in this category. In short, the failure to control technologically-related change has the potential to radically alter the nature of society and the situation of man as individual, as citizen, and as member of society.

It is possible, of course, that uncontrolled change will result in beneficial alteration of society rather than in catastrophes and dysfunctions. Since there can be no direct knowledge of the future, this interpretation cannot be dismissed. The problems related to technology which are cited by assessment proponents and others suggest that this outcome is less likely than the one discussed above. Also, there

is the possibility that change, particularly in intangible factors, will be valued quite differently in the future than it is in the present. What is adjudged undesirable at this point in time may not be in some future society. While the potential for both of these developments must be admitted, it must also be recognized that each entails reliance on trends in society and history whose direction is at best indeterminate rather than attempting to exert conscious control over technologically-related change.

The Success of Assessment. Though the perspective described above is somewhat gloomy, it is not to be expected that the opposite is true of the alternative outcome. Change, to a great degree technologically-related change, is taking place and will continue to do so. Each possibility for assessment faces certain implications because of the nature of the change, of the societal situation, and of the assessment process.

If assessment is developed successfully, it appears likely that many of the risks discussed above will be avoided, though limitations on knowledge must still be taken into account. This achievement may itself result in political and social change, however. Basic to this potentiality is the major premise of assessment that expert knowledge is a central element in societal management. For assessment to work in an optimum manner, the knowledge of technological effects must be the primary consideration in policy-making. This means that other factors, such as the desires of citizens, may be placed in a secondary position if there is conflict between the two criteria. The consequences of such an occurrence for a democratic political system are obvious.

In more detail, two aspects of the problem are especially significant. One is the question of goal selection. Choosing an optimum policy alternative on the basis of expert knowledge requires a goal choice in order to provide a criterion for selection. In the absence of consensus on the goals of society and the political system, the application of assessment in an effective manner may require imposition of a goal. A second factor arises because of the long-term solutions necessary for many technologically-related problems. This requires that goal and policy selection must be binding over a considerable period of time, whereas the ideal of democratic government entails the necessity of public choice which may not accept continued adherence to a previous decision.

The imperatives of maximum control of society and its technological sector may therefore require a loss of democracy and personal freedom. To be sure, maximum control could create a society which is orderly and quite comfortable physically. Most utopias, however, seem rather dull and sterile, if not so tightly controlled as to be anti-utopian. The prospect of such a society seems uninviting, to say the least.

What Can Be Done? It is perhaps best to begin this final section with a statement of what cannot be done. The role of technology in modern society cannot be reversed or seriously arrested. Though some contemporary interest is evident in a simpler society of less specialization and more self-reliance, it is obvious that the vast majority is unwilling to do without the advantages of technology. It follows that technological effects must be dealt with in some way. Several alternatives may be identified.

Technological solutions have been suggested for some problems. Such devices as electronic direct democracy have been proposed but they do not answer the basic question of expertise versus popular choice. No panacea is likely to emerge from "technological fixes" of this kind.

There is always the choice of doing nothing. That is, technological effects can be acquiesced in, with acceptance of serious social dysfunctions a probable necessity. Life might be made palatable by hedonism, mysticism, or Stoic withdrawal into resignation and private virtue. None of these would promote societal adaptation and survival, however.

Another alternative is acceptance of a high degree of control in order to maximize technological benefits and minimize risks. This will require acceptance of the implications discussed above and could result in survival of a sort, though no more appealing than the former alternative.

The present situation of society in confrontation with its technological sector may be characterized, therefore, as a dilemma of the most serious proportions. Because neither alternative is satisfactory, a course between the two may be pursued. Such an intermediate prescription is difficult to draw up in detail. It must include development of assessment capabilities to some degree, whether under that explicit title or some other name. At the same time, however, the consequences of an extreme measure of control must be avoided to the greatest extent possible. This is a complex task because of the size and complexity of both society and government. It nevertheless seems worth undertaking.

The necessary means for achievement of this end are themselves quite difficult. What is required is understanding of the phenomena involved to the highest possible degree. All aspects require consideration, including society, politics and government, and science and technology. Education of the kind called for would have to have a depth and scope which cannot be achieved by a few seminars or public hearings on the subject of technology, society, and government. Ideally, it calls for explicit, overt attention to the complexities involved in the relationship of these three elements, in the existing disciplines, in interdisciplinary approaches, and perhaps in the development of a field of study devoted to the subject. All levels of the educational system would have to be involved, including some means of effective public education outside the framework of elementary, secondary, and post-secondary institutions. The rapidity of technological change itself requires a departure from the traditional view of education as a process ending early in life. The significant obstacles include the development of the necessary understanding of the phenomena involved, an achievement which is no small feat, as discussed at numerous points above. Also confronting this option are the prevailing trends of specialization in society and revolutionary increases in information about the perceptible world. Perhaps it is impossible to increase understanding of technology in society to a significant degree. The prospects of not attempting a middle course between technological determinism and rigid control, however, suggest that pursuit of that goal is worth the difficulties involved.

SELECTED BIBLIOGRAPHY

Books

Armytage, W. H. G. The Rise of the Technocrats: A Social History. London: Routledge and Kegan Paul, 1965.

Babbie, Earl R. Science and Morality in Medicine: A Survey of Medical Educators. Berkeley: University of California, 1970.

Barnard, Christiaan, and Pepper, Curtis Bill. Christian Barnard: One Life. Toronto: The Macmillan Company, 1969.

Bauer, Raymond, ed. Social Indicators. Cambridge, Mass.: The M.I.T. Press, 1966.

Bell, Daniel. The Coming of Post-Industrial Society: A Venture in Social Forecasting. New York: Basic Books, Inc., 1973.

Berlant, Jeffrey Lionel. Profession and Monopoly: A Study of Medicine in the United States and Great Britain. Berkeley: University of California Press, 1975.

Berle, Adolf A., Jr. Power Without Property: A New Development in American Political Economy. New York: Harcourt, Brace & World, Inc., 1959.

Bill, James A., and Hardgrave, Robert L., Jr. Comparative Politics: The Quest for Theory. Columbus, Ohio: Charles E. Merrill Publishing Company, 1973.

Black's Law Dictionary. 4th ed. 1951.

Blaiberg, Philip. Looking At My Heart. New York: Stein and Day, 1968.

Brzezinski, Zbigniew. Between Two Ages: America's Role in the Technetronic Era. New York: The Viking Press,

Burnham, James. The Managerial Revolution. Bloomington: Indiana University Press, 1960. Originally published, 1941.

Caldwell, Lynton Keith. Environment: A Challenge for Modern Society. Garden City, New York: Natural History Press, 1970.

Carpenter, Richard A. "Federal Policy and Environmental Chemistry." Environmental Management: Science and Politics. Edited by Morton Gorden and Marsha Gorden. Boston: Allyn and Bacon, Inc., 1971.

Carson, Rachel. The Silent Spring. Boston: Houghton Mifflin Company, 1962.

Cetron, Marvin J., and Bartocha, Bodo, eds. Technology Assessment in a Dynamic Environment. New York: Gordon and Breach Science Publishers, 1973.

Cleaning Our Environment: The Chemical Basis For Action. Report by the Subcommittee on Environmental Improvement, Committee on Chemistry and Public Affairs, American Chemical Society. Washington, D.C.: American Chemical Society, 1969.

Dahl. Robert A. Pluralist Democracy in the United States: Conflict and Consent. Chicago: Rand McNally and Company, 1967.

Davies, J. Clarence III. The Politics of Pollution. New York: Pegasus, 1970.

Deichmann, William B., ed. Pesticides and the Environment: A Continuing Controversy. New York: Intercontinental Medical Book Corporation, 1973.

Dror, Yehezkel. Public Policymaking Reexamined. San Francisco: Chandler Publishing Company, 1968.

_____. Ventures in Policy Sciences: Concepts and Applications. New York: American Elsevier Publishing Company, Inc., 1971.

Drucker, Peter F. The Age of Discontinuity: Guidelines to Our Changing Society. New York: Harper & Row, 1968.

Dye, Thomas R. Politics in States and Communities. 2nd ed. Englewood Cliffs, New Jersey: Prentice-Hall, 1973.

_____. Policy Analysis: What Governments Do, Why They Do It and What Difference It Makes. University, Alabama: The University of Alabama Press, 1976.

_____. Understanding Public Policy. Englewood Cliffs, New Jersey: Prentice-Hall, 1972.

_____, and Zeigler, L. Harmon. The Irony of Democracy: An Uncommon Introduction to American Politics. 2nd ed. Belmont, California: Wadsworth Publishing Company, Inc., 1972.

Easton, David. A Systems Analysis of Political Life. New York: John Wiley & Sons, 1965.

Edmunds, Stahrl, and Letey, John. Environmental Administration. New York: McGraw-Hill, 1973.

Elazar, Daniel J. American Federalism: A View From The States. New York: Thomas Y. Crowell Company, 1966.

Ellul, Jacques. The Technological Society. Translated by John Wilkinson. New York: Vintage Books, 1964.

Eulau, Heinz. The Behavioral Persuasion in Politics. New York: Random House, 1963.

Ferkiss, Victor C. Technological Man: The Myth and the Reality. New York: George Braziller, 1969.

Fox, Renée C., and Swazey, Judith P. The Courage to Fail: A Social View of Organ Transplants and Dialysis. Chicago: University of Chicago Press, 1974.

Friedson, Eliot. Profession of Medicine: A Study of the Sociology of Applied Knowledge. New York: Dodd, Mead and Company, 1970.

Galbraith, John Kenneth. The New Industrial State. New York: Signet Books, 1967.

Gallup, George H. The Gallup Poll: Public Opinion, 1935-1971. 3 vols. New York: Random House, 1972.

Geddes, L. A., and Baker, L. E. Principles of Applied Biomedical Instrumentation. New York: John Wiley & Sons, Inc., 1968.

Geiger, Theodore. The Fortunes of the West: The Future of the Atlantic Nations. Bloomington: Indiana University Press, 1973.

Gilb, Corinne Lathrop. Hidden Hierarchies: The Professions and Government. New York: Harper & Row, Publishers, 1966.

Gilbert, Claire W. "Community Power and Decision-Making: A Quantitative Examination of Previous Research," Community Structure and Decision-Making. Edited by Terry N. Clark. San Francisco: Chandler Publishing Company, 1968.

Graham, Frank, Jr. Since Silent Spring. Boston: Houghton Mifflin, 1970.

Grayson, Melvin J., and Shepard, Thomas R., Jr. The Disaster Lobby: Prophets of Ecological Doom and Other Absurdities. Chicago: Follett Publishing Company, 1973.

Halacy, D. S., Jr. Computers--The Machines We Think With. Rev. ed. New York: Harper & Row, 1969.

Harmer, Ruth Mulvey. Unfit For Human Consumption. Englewood Cliffs, New Jersey: Prentice-Hall, 1971.

The Harris Survey Yearbook of Public Opinion 1970: A Compendium of Current American Attitudes. New York: Louis Harris and Associates, Inc., 1971.

Haskell, Elizabeth H., and Price, Victoria S. State Environmental Management: Case Studies of Nine States. New York: Praeger, 1973.

Headley, J. C. and Lewis, J. N. The Pesticide Problem: An Economic Approach to Public Policy. Washington, D.C.: Resources for the Future, Inc., 1967.

Hendin, David. Death As A Fact of Life. New York: W. W. Norton and Company, 1973.

Henning, Daniel H. Environmental Policy and Administration. New York: American Elsevier Publishing Company, 1974.

Hume, David. A Treatise of Human Nature. The Philosophy of David Hume. Edited by V. C. Chappell. New York: The Modern Library, 1963.

Hunter, Floyd. Community Power Structure: A Study of Decision Makers. Garden City, New York: Anchor Books: 1953.

Huxley, Aldous. Brave New World. Garden City, New York: Doubleday, Doran & Company, Inc., 1932.

Irving, George W., Jr. "Agricultural Pest Control and the Environment." The Survival Equation: Man, Resources, and His Environment. Edited by Roger Revelle, Ashok Khosla, and Maris Vinovskis. Boston: Houghton Mifflin, 1971.

Jantsch, Erich. Technological Forecasting in Perspective. Paris: Organisation for Economic Co-operation and Development, 1967.

Kasper, Raphael G., ed. Technology Assessment: Understanding the Social Consequences of Technological Applications. New York: Praeger Publishers, 1972.

Kaysen, Carl. "Data Banks and Dossiers." The World of the Computer. Edited by John Diebold. New York: Random House, 1973.

Kranzberg, Melvin, and Pursell, Carroll W., eds. Technology in Western Civilization. 2 vols. New York: Oxford University Press, 1967.

Kuhn, Thomas S. The Structure of Scientific Revolutions. Vol. II, No. 2, International Encyclopedia of Unified Science. Chicago: University of Chicago Press, 1962.

Kuhns, William. Environmental Man. New York: Harper & Row, 1969.

_____. The Post-Industrial Prophets: Interpretations of Technology. New York: Weybright and Talley, 1971.

Lakoff, Sanford A., ed. Private Government: Introductory Readings. Glenview, Illinois: Scott, Foresman and Company, 1973.

Langone, John. Vital Signs: The Way We Die In America. Boston: Little, Brown and Company, 1974.

Lasswell, Harold D. A Pre-View of Policy Sciences. New York: American Elsevier Publishing Company, Inc., 1971.

Leary, James C., Fishbein, William I., and Salter, Lawrence C. DDT and the Insect Problem. New York: McGraw-Hill, 1946.

Lyons, Catherine. Organ Transplants: The Moral Issues. Philadelphia: Westminister Press, 1970.

Macdonald, James B., and Conway, John E. Environmental Litigation. Madison: Department of Law, University of Wisconsin Extension, 1972.

MacIver, Robert M. The Web of Government. Rev. ed. New York: The Free Press, 1965.

McLuhan, Marshall. Understanding Media: The Extensions of Man. New York: McGraw-Hill Book Company, 1964.

Marcuse, Herbert. One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society. Boston: Beacon Press, 1964.

Margolis, Jon. "Land of Ecology." The Ecological Conscience: Values for Survival. Edited by Robert Disch. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970.

Martino, Joseph P. Technological Forecasting for Decision-making. New York: American Elsevier Publishing Company, 1972.

Medford, Derek. Environmental Harassment or Technology Assessment? New York: Elsevier Scientific Publishing Company, 1973.

Meynaud, Jean. Technocracy. Translated by Paul Barnes. New York: The Free Press, 1964.

Michels, Robert. Political Parties: A Sociological Study of the Oligarchical Tendencies of Modern Democracy. Translated by Eden and Cedar Paul. Glencoe, Illinois: The Free Press, 1949. Originally published, 1915.

Mitchell, William C. "The Structural Characteristics of Policymaking." Policies, Decisions, and Organization. Edited by Fremont J. Lyden, George A. Shipman, and Morton Kroll. New York: Appleton-Century-Crofts, 1969.

Nader, Ralph. Unsafe At Any Speed: The Designed-In Dangers of the American Automobile. Rev. ed. New York: Grossman, 1972.

Najarian, John S., and Simmons, Richard L., eds. Transplantation. Philadelphia: Lea & Febiger, 1972.

Neuhaus, Richard. In Defense of People: Ecology and the Seduction of Radicalism. New York: Macmillan Company, 1971.

Orwell, George. 1984. New York: Harcourt, Brace, 1949.

Packard, Vance. The Naked Society. New York: Pocket Books, 1965. Originally published, 1964.

Pfiffner, John M., and Sherwood, Frank P. Administrative Organization. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1960.

Piccard, Paul J., ed. Science and Policy Issues: Lectures in Government and Science. Itasca, Illinois: F. E. Peacock Publishers, Inc., 1969.

Pritchett, C. Herman. The American Constitution. 2d ed. New York: McGraw-Hill, 1968.

Pyle, James L. Chemistry and the Technological Backlash. Englewood Cliffs, New Jersey: Prentice-Hall, 1974.

Ramsey, Paul. "On Updating Death." Updating Life and Death: Essays in Ethics and Medicine. Edited by Donald R. Cutler. Boston: Beacon Press, 1968.

Ranney, Austin, ed. Political Science and Public Policy. Chicago: Markham Publishing Company, 1968.

Reich, Charles A. The Greening of America. New York: Random House, 1970.

Ridgeway, James. The Politics of Ecology. New York: E. P. Dutton & Company, 1970.

Rodgers, William H., Jr. "The Persistent Problem of the Persistent Pesticides: A Lesson in Environmental Law." Environmental Law. Greenvale, New York: Research and Development Corporation, 1970.

Rogers, Everett M. Diffusion of Innovations. New York: The Free Press, 1962.

Rosenberg, Jerry M. The Death of Privacy. New York: Random House, 1969.

Sax, Joseph L. Defending the Environment: A Strategy for Citizen Action. New York: Alfred A. Knopf, 1971.

Schmeck, Harold M., Jr. The Semi-Artificial Man: A Dawning Revolution in Medicine. New York: Walker and Company, 1965.

Sharkansky, Ira, ed. Policy Analysis in Political Science. Chicago: Markham Publishing Company, 1970.

Shibles, Warren. Death: An Interdisciplinary Analysis. Whitewater, Wisconsin: The Language Press, 1974.

Sindler, Allan P., ed. American Political Institutions and Public Policy. Boston: Little, Brown and Company, 1969.

Stephenson, Carl. Medieval Feudalism. Ithaca, New York: Cornell University Press, 1942.

Teich, Albert H., ed. Technology and Man's Future. New York: St. Martin's Press, 1972.

Toffler, Alvin. Future Shock. New York: Random House, 1970.

Turn, Rein. Computers in the 1980's. New York: Columbia University Press, 1974.

Walton, John. "A Systematic Survey of Community Power Research." The Structure of Community Power. Edited by Michael Aiken and Paul E. Mott. New York: Random House, 1970.

Westin, Alan F., ed. Information Technology in a Democracy. Cambridge, Massachusetts: Harvard University Press, 1971.

_____. Privacy and Freedom. New York: Atheneum, 1967.

_____, and Baker, Michael A. Databanks in a Free Society: Computers, Record-Keeping and Privacy. Report of the Project on Computer Databanks of the Computer Science and Engineering Board, National Academy of Sciences. New York: Quadrangle Books, 1972.

Wheeler, Stanton, ed. On Record: Files and Dossiers in American Life. New York: Russell Sage Foundation, 1969.

Whitten, Jamie. That We May Live. Princeton: D. Van Nostrand Company, 1966.

Wilson, Billy Ray, ed. Environmental Problems. Philadelphia: J. B. Lippincott, 1968.

Wolff, H. S. Biomedical Engineering. New York: McGraw-Hill Book Company, 1970.

Yannacone, Victor John, Jr., ed. Environmental Systems Science. Vol. II of the Proceedings, National Institute on Environmental Litigation, April, 1973. N. p.: American Bar Association, 1975.

Zeigler, Harmon. "Interest Groups in the American States." Politics in the American States. 2d ed. Edited by Herbert Jacobs and Kenneth Vines. Boston: Little, Brown and Company, 1965.

Periodicals

Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death. "A Definition of Irreversible Coma: Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death." Journal of the American Medical Association, CCV (August 5, 1968), 337-340.

Advisory Committee to the Renal Transplant Registry. "The 12th Report of the Human Renal Transplant Registry." Journal of the American Medical Association, CCXXXIII (August 18, 1975), 787-796.

Bailey, John J., and O'Connor, Robert J. "Operationalizing Incrementalism: Measuring the Muddles." Public Administration Review, XXXV (January-February, 1975), 60-66.

Baskin, Darryl. "American Pluralism: Theory, Practice, and Ideology." Journal of Politics, XXXII (February, 1970), 71-95.

Boulding, Kenneth. "Reflections on Planning: The Value of Uncertainty." Technology Review, LXXVII (October-November, 1974), 8.

Capron, Alexander Morgan, and Kass, Leon R. "A Statutory Definition of the Standards for Determining Human Death: An Appraisal and a Proposal." University of Pennsylvania Law Review, CXXI (November, 1972), 87-118.

Carroll, James D. "Participatory Technology." Science, CLXXI (February 19, 1971), 647-653.

Carter, Luther J. "DDT: The Critics Attempt to Ban its Use in Wisconsin." Science, CLXIII (February 7, 1969), 548-550.

_____. "Environmental Law (I): Maturing Field for Lawyers and Scientists." Science, CLXXIX (March 23, 1973), 1205-1209.

Christofferson, Todd D. "Defining Death." Popular Government, XXXIX (November, 1972), 10-13, 21.

"Congress Weighs Stronger Controls on Pesticides." Congressional Quarterly Almanac, XX (1964), 139-142.

Cooley, Denton A.; Bloodwell, Robert D.; Hallman, Grady L.; and Nora, James J. "Transplantation of the Human Heart: Report of Four Cases." Journal of the American Medical Association, CCV (August 12, 1968), 479-486.

Daddario, Emilio Q. "Science Policy: Relationships Are The Key." Daedalus, CIII (Summer, 1974), 135-142.

Dahl, Robert. "Critique of the Ruling Elite Model." American Political Science Review, LII (June, 1958), 463-469.

Denault, H. John III; Parris, Don; Alpert, Michael E.; Burgin, Stephen; Merideth, Frank E.; Robinson, Thomas A.; and Stiven, James F. "The Computerization of Government Files: What Impact on the Individual?" UCLA Law Review, XV (September, 1968), 1371-1498.

Dye, Thomas R. "Inequality and Civil Rights Policy in the States." Journal of Politics, XXXI (November, 1969), 1080-1097.

EDF Letter, May, 1973.

EDF Letter, March, 1976.

Facts On File, 1962-1976.

Halley, M. Martin, and Harvey, William F. "Medical vs Legal Definitions of Death." Journal of the American Medical Association, CCIV (May 6, 1968), 423-425.

"The Heart: Miracle in Cape Town." Newsweek, LXX (December, 1967), 86-90.

Helmer, Olaf. "An Agenda for Futures Research." Futures, VII (February, 1975), 3-14.

Henriot, Peter J. "Political Questions About Social Indicators." Western Political Quarterly, XXIII (June, 1970), 235-255.

Jones, Francis D. "Uniform State Laws." Book of the States, 1970-1971, pp. 101-108.

Katz, Milton. "The Function of Tort Liability in Technology Assessment." University of Cincinnati Law Review, XXXVIII (1969), 587-663.

Kloman, Erasmus H., symposium ed. "Public Participation in Technology Assessment." Public Administration Review, XXXV (January-February, 1975), 67-81.

Kusanovich, Mark. "Medical Malpractice Liability and the Organ Transplant." University of San Francisco Law Review, V (April, 1971), 223-282.

LaPorte, Todd R. "The Context of Technology Assessment: A Changing Perspective for Public Organization." Public Administration Review, XXXI (January-February, 1971), 63-73.

Latham, Earl. "The Group Basis of Politics: Notes for a Theory." American Political Science Review, XLVI (June, 1952), 376-397.

"A Life in the Balance." Time, CVI (November 3, 1975), 52, 57-58, 61.

Lindblom, Charles E. "The Science of 'Muddling Through,'" Public Administration Review, XIX (Spring, 1959), 79-88.

Little, Dennis L. "Social Indicators and Public Policy: Some Unanswered Questions." Futures, VII (February, 1975), 41-49.

MacRae, Duncan, Jr. "Scientific Communication, Ethical Argument, and Public Policy." American Political Science Review, LXV (March, 1971), 38-50.

Mills, Don Harper. "The Kansas Death Statute: Bold and Innovative." New England Journal of Medicine, CCLXXXV (October 21, 1971), 968-969.

Morison, Robert S. "Death: Process or Event?" Science. CLXXIII (August 20, 1971), 694-698.

New York Times, 1962-1976.

Primack, Joel, and Von Hippel, Frank. "Scientists, Politics and SST: A Critical Review," Bulletin of the Atomic Scientists, XXVIII (April, 1972), 24-30.

Purcell, Arthur H. "Bringing Science to the Congress," Technology Review, LXXVII (March-April, 1975), 12, 68-69.

Quinby, Griffith E.; Hayes, Wayland J., Jr.; Armstrong, John F.; and Durham, William F. "DDT Storage in the U.S. Population." Journal of the American Medical Association, CXCI (January 18, 1965), 109-113.

Roth, Richard G. "Legislation: The Need for a Current and Effective Statutory Definition of Death." Oklahoma Law Review, XXVII (1974), 729-735.

Schneider, Mark. "The 'Quality of Life' and Social Indicators Research." Public Administration Review, XXXVI (May-June, 1976), 297-305.

"Science Policy for the White House." Technology Review, LXXVI (January, 1974), 8-19.

Shafer, Helen B. "Pesticide Control." Editorial Research Reports, May 20, 1964, pp. 361-380.

Silverman, Daniel; Saunders, Michael G.; Schwab, Robert S.; and Masland, Richard L. "Cerebral Death and the Electroencephalogram: Report of the Ad Hoc Committee of the American Electroencephalographic Society of EEG Criteria for Determination of Cerebral Death." Journal of the American Medical Association, CCIX (September 8, 1969), 1505-1510.

Sorin, Martin. "The Boundary Between Public and Private Policy-Making: A Reply to Mark V. Nadel." Journal of Politics, XXXVIII (February, 1976), 159-163.

Stokinger, H. E. "Sanity in Research and Evaluation of Environmental Health." Science, CLXXIV (November 12, 1971), 662-665.

Taylor, Loren F. "A Statutory Definition of Death in Kansas." Journal of the American Medical Association, CCXV (January 11, 1971), 296.

"Technology Office." Congressional Quarterly Almanac, XXVII (1972), 692-694.

Tribe, Laurence H. "Technology Assessment and the Fourth Discontinuity: The Limits of Instrumental Rationality." Southern California Law Review, XLVI (June, 1973), 617-660.

Ward, Walter C. "Human Organ Transplantation: Some Medico-Legal Pitfalls for Transplant Surgeons." University of Florida Law Review, XXIII (1970), 134-156.

Washington Post, December 31, 1971, p. A 4.

Wasmuth, Carl E., Jr. "The Concept of Death." Ohio State Law Journal, XXX (Winter, 1969), 32-60.

"What Is Life? When Is Death?" Time, LXXXVII (May 27, 1966), 78.

"When Do You Pull The Plug?" Journal of the American Medical Association, CCV (July 1, 1968), 29.

Wurster, Charles F., Jr. "DDT Residues and Declining Reproduction in the Bermuda Petrel." Science, CLIX (March 1, 1968), 979-981.

Government Documents

Federal Insecticide, Fungicide and Rodenticide Act. 7 U.S.C. 135 (1947).

Food, Drug and Cosmetic Act. 21 U.S.C. 346 (1938).

Smith v. Smith. 317 S.W.2d 275. S.C. Ark. 1958.

Thomas v. Anderson. 215 P.2d 478. S.F. Ct.App. 1950.

Tucker v. Lower. No. 2831. Richmond, Va., L. & Eq. Ct., May 23, 1972.

U.S. Congress. House. Committee on Government Operations. The Computer and Invasion of Privacy. Hearings before a subcommittee of the Committee on Government Operations, House of Representatives, 89th Cong., 2d sess., July 26, 27, and 28, 1966.

_____. Federal Information Systems and Plans--Federal Use and Development of Advanced Information Technology. 3 parts. Hearings before a subcommittee of the Committee on Government Operations, House of Representatives, 93d Cong., 1st sess., April 10 and 17, 1973.

U.S. Congress. House. Committee on Science and Astronautics. A Study of Technology Assessment. Report of the Committee of Engineering Policy, National Academy of Engineering, to the Committee on Science and Astronautics, House of Representatives, July 1, 1969.

_____. Technical Information for Congress. Report to the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, House of Representatives, 92d Cong., 1st sess., April 15, 1971. Revised ed.; originally released, 1969.

_____. Technology: Processes of Assessment and Choice. Report of the National Academy of Sciences to the Committee on Science and Astronautics, House of Representatives, 1969.

_____. Technology Assessment. Hearings before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, House of Representatives, 91st Cong., 1st sess., November 18, 24, December 2, 3, 4, 8, and 12, 1969.

_____. Technology Assessment. Statement of Emilio Q. Daddario, Chairman, Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, House of Representatives, 90th Cong., 1st sess., 1967.

_____. Technology Assessment--1970. 2 parts. Hearings before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, House of Representatives, 91st Cong., 2d sess., on H.R. 17046, March 13, 14, 16, 17, 28, 29, May 20, 21, 26, 27, June 2 and 3, 1970.

_____. A Technology Assessment System for the Executive Branch. Report of the National Academy of Public Administration of the National Academy of Public Administration to the Committee on Science and Astronautics, House of Representatives, July, 1970.

_____. Technology Assessment Seminar. Proceedings before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, House of Representatives, 90th Cong., 1st sess., September 21 and 22, 1967.

U.S. Congress. Library of Congress. Congressional Research Service. "The Federal Data Center: Proposals and Reactions," by Robert L. Chartrand and Louise Giovane Becker. Report No. TK 6565 C, June 14, 1968.

U.S. Congress. Office of Technology Assessment. The Financial Viability of Conrail. September, 1975.

_____. Oil Transportation by Tankers: An Analysis of Marine Pollution and Safety Measures. July, 1975.

_____. A Review of Alternative Approaches to Federal Funding of Rail Rehabilitation. August, 1975.

U.S. Congress. Senate. Committee on the Judiciary. Computer Privacy. Hearings before the Subcommittee on Administrative Practice and Procedures of the Committee on the Judiciary, Senate, 90th Cong., 1st sess., March 14 and 15, 1967.

_____. Federal Data Banks and Constitutional Rights: A Study of Data Systems on Individuals Maintained by Agencies of the United States Government. Summary and conclusions prepared by the staff of the Subcommittee on Constitutional Rights of the Committee on the Judiciary, Senate, 1974.

_____. Federal Data Banks, Computers and the Bill of Rights. Hearings before the Subcommittee on Constitutional Rights of the Committee on the Judiciary, Senate, 92d Cong., 1st sess., February 23, 24, 25, March 2, 3, 4, 9, 10, 15, and 17, 1971.

_____. Invasions of Privacy. Hearings before the Subcommittee on Administrative Practice and Procedure of the Committee on the Judiciary, Senate, 89th Cong., 2d sess., March 23-30, June 7-16, 1966.

U.S. Department of Commerce. City-County Data Book. 1972.

_____. Historical Statistics of the United States: Colonial Times to 1970. 2 parts. 1975

_____. Statistical Abstract of the United States. 1971.

_____. Statistical Abstract of the United States. 1972.

U. S. Department of Health, Education, and Welfare. Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health. Washington, D.C.: Government Printing Office, 1969.

_____. Office of Education. Educational Resources Information Center. The Environmental Information Explosion: The Press Discovers the Environment, by David Peter Sachs and David Mark Rubin. Vol. II of Mass Media and the Environment. Washington, D.C.: Government Printing Office, 1971.

_____. Public Health Service. Morbidity and Mortality, Vol. XXIII, No. 53 (July 15, 1975).

U.S. Environmental Protection Agency. Production, Distribution, Use and Environmental Impact Potential of Selected Pesticides, by Rosmarie von Rumker, Edward W. Lawless, and Alfred F. Meiners. Washington, D.C.: Government Printing Office, 1975.

U.S. Executive Office of the President. Council on Environmental Quality. Environmental Quality. Sixth Annual Report of the Council on Environmental Quality. Washington, D.C.: Government Printing Office, 1975.

Unpublished Material

Boardman, Robert C., Director, Public Information, National Audubon Society. Letter to the writer, April 20, 1976.

Coates, Vary Taylor. "Technology and Public Policy: The Process of Technology Assessment in the Federal Government." Unpublished Ph.D. dissertation, George Washington University, 1972.

"History of EDF." Unpublished material provided by Charles F. Wurster, Jr., of the Environmental Defense Fund, letter to the writer, April 28, 1976.

Olsen, Pauline, Information Coordinator, American College of Surgeons/ National Institutes of Health Organ Transplant Registry. Letter to the writer, June 22, 1976.

Straussman, Jeffrey D. "Technocratic Counsel and Societal Guidance. Unpublished paper prepared for presentation at the Annual Meeting of the American Political Science Association, New Orleans, La., September 4-8, 1973.