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FEDERAL INDUSTRIAL INNOVATION POLICY: A Review of Congressional and Task Force Activity

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16. Abstract

The issue of technological innovation, and the appropriate role of government policy, have been the subjects of many task forces and special committees. A retrospective analysis was carried out to identify changing perspectives of the causes of declining innovation, areas of consensus, proposed remedies, and subsequent response. The study examined Congressional and Task Force activity on innovation. This review identified five major studies: National Commission on Technology, Automation, and Economic Progress (1964); the Panel on Invention and Innovation (1967); Commission on International Trade and Investment Policy (1971); and Domestic Policy Review of Industrial Innovation (1979).

This review revealed that the issues of technological innovation and industrial policy were separate national concerns until recently. During the sixties, the thrust of both Task Force and Congressional efforts was centered on improving the effectiveness of Federally funded R&D. In the seventies, the relationship among technology policy, regulations, and private sector innovation came under scrutiny. In 1979, industrial revival emerged as the new policy issue, and supply side economics gained prominent attention. While these policy issues have been continually studied, they have rarely been acted upon. Causes of past inaction are discussed, and the emerging directions of Federal innovation policy in the eighties identified.

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Preface

Industrial innovation is the mainspring of economic growth. It is a critical determinant of the United States' international competitive position, and through past contributions to enhanced productivity, has allowed sizable gains in real income. Currently, there is a growing public concern that technological comparative advantage has eroded, and the U.S. is losing market share both at home and abroad. These problems are most visible in the automotive sector, where imports have captured over 25 percent of the domestic market.

The current study was initiated to identify the role of economic incentives as a policy instrument for spurring innovation in the auto industry. As the work progressed, it became clear that there existed a sizable body of literature on economic incentives. However, what was lacking was a report which put these past efforts into perspective, identified areas of consensus, and assessed why economic incentives were continually studied and rarely implemented. Thus emerged the thrust of the present review.

This work was carried out as part of the Implementation of Innovation in the Motor Vehicle Industry Program (HS-028), at the Transportation Systems Center, under the sponsorship of Sam Powel, III, Office of Research and Development, National Highway and Traffic Safety Administration, U.S. Department of Transportation.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
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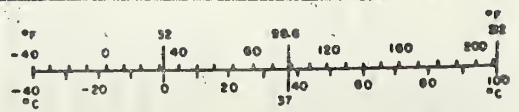

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1. INTRODUCTION

Declining productivity and a growing balance of payments deficit have focused national attention on the issue of technological innovation. There is a growing sense that innovation is languishing in our country with its rich heritage of inventors. In response a consensus is emerging that the Federal government "do something," so that the process of innovation can be enabled and its fruits tapped to reduce inflation, create jobs, and enhance the quality of life.

Concern about declining industrial innovation has surfaced periodically within government over the past twenty years. Our review of Task Forces on Innovation and activity by Congressional Subcommittees has uncovered a rich data base. Past recommendations span the entire gamut of policy options, including: Federal support for R&D; economic incentives of various types; procurement support for venture capital formation; changes in the regulatory process, and institutional reform. However, while these issues are continually studied they are rarely acted upon. The literature reveals that the failure to develop a comprehensive Federal innovation policy reflects the fact that these studies have been carried out separately from the focus of economic decision making. Past inaction can also be attributed to the disjointed nature of the Task Force studies. Done in isolation from one another,

each tends to start from scratch rather than build upon previous work. The results tend to be repetitious rather than progressive.

What emerges from our review of Congressional and Task Force activity is a picture of fragmented authority, unresolved issues of organizational structure, "abstract" policy formulation, failure to generate the credible data necessary to support policy making, and inadequate attention to the development of an appropriate institutional environment.

Furthermore, the evolution of Federal policy suggests a structuralist view of government; the focus is on responding to current national issues rather than dealing with anticipated challenges. Commensurate with the optimism of the sixties, federal policy was synonymous with technology policy. During the early seventies the thrust was industrial innovation policy, and with the close of the past decade, industrial (revival) policy rose to the forefront. The proposed policy mechanisms have followed from the selection of National goals (i.e., policy follows strategy).

In line with the above observations the intent of this paper is not to make any policy recommendations. Rather, it is to summarize the experience to date and assess its policy implications. Consequently the report will focus on reviewing past policy recommendations and the response they've evoked. Critical issues and areas where consensus has emerged will be identified. The evolving nature of policy

recommendations will be described with the role of economic incentives highlighted. Finally, based on perceptions of the flaws associated with policy formulation in the past, guidelines will be developed for more effectively inducing innovation in the motor vehicle industry.

2. TASK FORCES ON INNOVATION

The issue of technological innovation, its relation to economic growth and the appropriate role of government policy, has been the subject of study by many task forces and special commissions. A history of these studies, the proposals made and the issues raised, provides a comprehensive picture of the perceived Federal role in stimulating technological innovation from the perspectives of industry, academia, and government.

Furthermore, a retrospective analysis illuminates the subtle shifts in focus which have occurred over the past two decades, and identifies areas where a consensus has emerged. Five major studies on technological innovation have been identified for the period of interest, i.e., 1960 through 1979, and are reviewed in the following section.

2.1 HISTORY

National Commission on Technology, Automation, and Economic Progress

Accelerating changes in the Nation's technology and the impact of these changes on society led Congress in 1964 (P.L. 88-444) to create a National Commission on Technology, Automation, and Economic Progress. Chaired by Dr. Howard R. Bowen, President of the University of Iowa, the Commission issued its report[1] in January 1966.

Concluding that the pace of technological change had increased in recent decades and would continue to increase, the commission reported that there is no ground for complacency because "...our society has not met the challenge of technical progress with complete success." The Commission's report contained recommendations for improving government's role in supporting technological development and cited its benefits for economic progress. At the same time that the Bowen Commission was working on its report to Congress, the Executive Branch was also studying the issue.

Panel on Invention and Innovation

One of the most publicized studies, which has also served as the basis for subsequent inquiries, is the Charpie report on technological innovation. Created by the Secretary of Commerce in 1964, the ad hoc Panel on Invention and Innovation was asked to explore the opportunities for improving the climate for technological change through antitrust, taxation, and regulatory policies. The Panel, chaired by Robert A. Charpie, with members representing industry, government and academia, issued its report in 1967.

The Panel considered three main factors affecting invention and innovation: taxation, finance, and competition. Its final report, Technological Innovation: Its Environment and Management[2], contained recommendations aimed at improving the environment for innovation in these three areas, and

for promoting a basic understanding of the innovative process in all sectors of society.

Commission on International Trade and Investment Policy

In 1970, the President established a Commission on International Trade and Investment Policy, chaired by Albert L. Williams of IBM. The Commission was asked to examine the principal problems in the field of U.S. foreign trade and investment, and to produce recommendations designed to meet the challenges of the changing world economy. In its report[3], issued in July, 1971, the Commission recognized the relationship between industrial innovation and the state of the economy.

The Commission reported that "we must take measures to stimulate economic growth and to improve the technological capability which largely supports our export performance." As one example of the type of measures needed, the report suggested a program designed to develop the areas of potential strength in the domestic economy. Such a program, it continued, should include government support, through such mechanisms as tax incentives for investment, and R&D.

Department of Commerce Technology Policy Study.

At the direction of Eliott Richardson, then Secretary of Commerce, Dr. Betsy Ancker-Johnson, Assistant Secretary for Science and Technology, headed a study of U.S. technology policy and its relationship to the Nation's economic welfare.

Based on this 1977 study, a report entitled U.S. Technology Policy[4] was issued. It raises concern over the adequacy of existing policy, discusses possible actions for improvement, and recommends steps to achieve a more coherent policy.

The report is introduced with the statement that,

> Since technology is a pervasive force throughout society, it is affected by a large variety of government actions. In the context of this paper, U.S. technology policy is the sum of actions taken by the Federal government affecting the production, diffusion and utilization of technology. The elements comprising the policy lack unity and coherence. The pluralistic development of U.S. technology policy has resulted in a technology enterprise with considerable strengths. But the fragmentation, incoherence and sometimes contradictory aspects of the various elements of the policy hold some disadvantages for the U.S., particularly in a world no longer dominated by U.S. technology.

From this basic premise, the study proceeds to examine the background of technology and its link with economic development, and to recommend a Federal technology policy designed to promote private sector investment in technological innocation. The study differs from those preceding it in that its scope is more limited, focusing mainly on Department of Commerce concerns. As a result, many of its recommendations are directed to the Department, and are within its power to implement.

Domestic Policy Review of Industrial Innovation

On May 11, 1978, President Carter announced that he had established an interagency committee to conduct a comprehensive review of issues and problems related to industrial innovation. Substantial public involvement from

industry, small business, labor, and consumers would be solicited in the review. The President's announcement observed that,

> Innovation provides a basis for the Nation's economic growth. It is closely related to productivity and to the competitiveness of U.S. products in domestic and world markets. Efforts to enhance innovation in industry may lead to an improved economic climate in the United States.
>
> In recent years, private sector research and development has concentrated on low-risk, short-term projects directed at improving existing products. Emphasis on the longer term research that could lead to new products and processes has decreased.
>
> Although the development of new products or processes is primarily the responsibility of the private sector in the United States, Federal policies have a profound impact on the innovation process. In light of the central role of innovation in economic development, Federal policies on the economy, taxes, regulations, procurement, and foreign relations which affect innovation will be carefully examined in the study.[5]

The interagency committee was chaired by the Secretary of Commerce with members from other agencies, but the actual work was coordinated by Dr. Jordan J. Baruch, Assistant Secretary of Commerce for Science and Technology. The goal of the committee was to present the President with highly focused options along with data on: their impact on targeted sectors, the cost to the government, and windfall gains accruing to others. This information would enable the President to develop a coherent policy for influencing the rate and direction of industrial innovation in specific industrial sectors, such as steel and transportation.

2.2 PROPOSALS MADE

2.2.1 Technology and the American Economy

The Bowen Commission made a number of recommendations regarding Federal research and development. These included proposals that the Federal government do the following:

Support experiments in the application of technology to social problems. Demonstration grants were one instrument cited for stimulating research in desired fields.

Use the "vast purchasing power" of the Federal government to establish standards and promote technological innovation.

Fund university-based institutes engaged in interdisciplinary programs, and fully integrated with the educational function of the university, which would serve as laboratories for problem analysis and as community resources.

2.2.2 Technological Innovation: Its Environment and Management

The Charpie report contains recommendations made by the Panel on Invention and Innovation aimed at encouraging innovation through incentives, or by elimination of barriers to innovation. These proposals were designed primarily to enhance the environment in which small firms operate, since the Panel found that small businesses were responsible for a disproportionate share of innovation. Lack of the assets

available to large companies for surmounting obstacles to innovation were also cited as a reason small firms have a greater need for government assistance than large firms. In addition, several of the proposals focused on the individual inventor. Proposals regarding industry were as follows:

Allow small business ten years, rather than five for deduction of losses associated with technological innovation.

Liberalize stock option rules for small technology-based companies.

Allow R&D expenditures incurred to develop new products or processes as a business deduction even if unrelated to the company's current products or processes.

Place professional inventors on the same tax footing, for capital gains treatment, for example, as amateur inventors.

Permit companies making taxable purchases of technological assets some depreciation and tax write-off of these assets in excess of the value of tangible assets.

Develop mechanisms for providing information on capital availablity and the problems of new enterprise development through new Federal programs on venture capital.

Have the U.S. Department of Commerce broaden and complement its studies of the innovative and entrepreneurial processes by initiating an integrated program, in cooperation with the universities, including the preparation of empirical data and case materials on these processes, studies of the venture capital system, and experimentation with teaching methods to develop innovative and entrepreneurial talents.

Review current contracting policies and procedures of such agencies as DOD, NASA, and NTH, should be undertaken to ensure that these policies are conducive to the long-range growth of small enterprises.

Designate the Department of Commerce as the Federal agency representing the interests of new technology-based enterprises, and develop the necessary competence and organization to deal effectively with problems encountered by such enterprises.

Recommend no legislative change in the antitrust and regulatory laws, and suggest that in the interpretation and administration of these laws, the effect on innovation, in addition to competition, be taken into account.

Establish a group within the Federal government to aid and advise the regulatory and antitrust agencies regarding the impact of their policies on innovation, and in other matters.

A number of recommendations were made for increasing awareness within government regarding the effects of Federal policies and regulations on innovation, and suggested a White House conference be convened to initiate this process.

2.2.3 United States International Economic Policy in an Interdependent World

Since the main concern of the Williams Commission was not with technological innovation specifically, most of its recommendations were not related to this issue. In examining the contribution of international trade and investment to the economic health of the U.S., however, the role of technological innovation became apparent. This was particularly evident in the case of exports. Chapter 5 examined the need for export expansion and emphasized improving the U.S. competitive position in the world markets through high technology products. Proposals include:

Give high priority to new and intensified long-term efforts of export expansion

Intensify efforts to ensure that the U.S. technological lead be maintained.

Provide a much higher level of government support for R&D directed specifically to industrial objectives, as is found in other countries.

2.2.4 U.S. Technology Policy -- Draft Study

The Ancker-Johnson study concluded that "a coherent national technology policy needs to be developed in order to maximize the U.S. capacity to develop and utilize technology to achieve national purposes." Towards this end, a number of specific proposals were made. Eight areas were targeted to receive priority attention. These areas, and a summary of the proposals made for each, are as follows:

Industrial Technology Analysis Office.

Every proposed national policy, whether or not obviously technology related, should be evaluated for its potential impact on technology. Since the means for this are lacking, an industrial technology analysis office should be established in the Department of Commerce to evaluate proposed government actions against the goal of technology policy to maximize the capacity to create and utilize technology for achieving national goals.

Industrial R&D.

Some types of industrial R&D of high potential social value are not being performed because the benefits cannot be captured by the individual firm, while the risks and costs are high. The Federal government should investigate direct (grants, loans) and indirect (tax, regulation) means of promoting needed technological innovation in the private sector.

Tax incentives, for example, include:

Increase substantially the tax investment credit for R&D plant from 10 percent to, e.g., 25 percent.

Increase tax depreciation allowances for R&D plant.

Provide new special tax credits or equivalent cash payments to industrial R&D performers.

Trade the present tax credit for investment in plant and equipment (10 percent) for tax credit or equivalent cash payments for expenditures on industrial R&D.

Provide new tax credits or equivalent cash payments for incremental industrial R&D.

Modification of Regulatory Inhibitions on Innovation. The present regulatory climate contains unnecessary disincentives for technological innovation. Under the Office of Science and Technology Policy, actions should be undertaken to strengthen the required data base, and to develop more appropriate mechanisms for deciding on acceptable risks and developing optimum regulatory strategies. Also, more credible assessments of the probable impacts on technological innovation, as well as costs vs. benefits of such regulatory strategies, are needed.

Improving the Climate for Starting Technology-Based Enterprises.

The U.S. economy is losing a traditional growth stimulus because the present tax and regulatory climate is not conducive to the start-up of new advanced-technology companies. The Departments of Commerce and Treasury should work with the Securities and Exchange Commission to investigate a variety of possible remedial actions.

Innovation Information for State and Local Governments. The present programs should be administratively consolidated and strengthened.

Export Promotion of Technology-Intensive Products. Additional foreign markets must be developed for non-military technology products to realize the full economic benefits of technology-intensive products exported from the U.S. The government should work with industry to streamline the various export control procedures and reporting requirements, to shorten the list of commercial products or technical data requiring specific permission to export, to continue reducing delays in the various export licensing processes, to improve efforts in market identification and analyses for technology-intensive products, to develop better Federal promotional

practices and to improve the relevant financing policies to be more competitive with foreign countries.

Export Control of Design and Manufacturing Technology. The Executive Office of the President should assume leadership in developing an export control and technology transfer policy which better serves both U.S. economic and national security interests. Interagency cooperation in addressing these issues as well as consultation with industry must be improved.

Technological Support of Less-Developed Countries. The U.S. Departments of State and Commerce should work closely with industry to promote cooperation in industrial R&D and to assist technological infrastructure development in less-developed countries.

2.2.5 Domestic Policy Review on Industrial Innovation

The Baruch study identified seven topics relating to industrial innovation, formed subcommittees to investigate each of them, and held public symposia to receive public input. Although lengthy, these issues are included in full because they are the focus of current debate on innovation policy. The issues, and proposals made in the draft reports* for their resolution, follow.

*To-date, the Draft Reports are the only documents released by the Domestic Policy Review.

Economic and Trade Policy

"Tax policy is the only tool at the disposal of the government that can have anywhere near the required impact" to encourage innovation, according to the subcommittee. The Federal government should:

Move to increase overall incentives for savings by individuals and investment by established corporations through use of the tax code.

Review the economic assumptions used by the Government in evaluating the revenue impact of tax proposals.

Allow the immediate write off of all R&D expenditures, properly defined, including those for facilities and equipment. Failing that, allow a three or a five year write off for facilities and equipment, comparable to the special depreciation rules now being applied to capital expenditures for pollution control facilities.

Allow a research tax credit for those research-related expenditures not now eligible for the investment tax credit, allowing for appropriate carry back and carry forward provisions. This might be limited to those expenditures in excess of those made in some previous period.

Increase substantially the investment tax credit for those capital expenditures that are research related, making it refundable for this purpose.

Permit income tax credits for individuals and corporations for a substantial proportion of contributions to research-oriented, non-profit institutions, including universities, for the conduct of basic research, as long as the results of that research are available to the public.

Permit R&D expenditures incurred in the U.S. to be allocated solely to the U.S. income of the taxpayer.

Allow small businesses which spend more than a given percentage of revenues on R&D, more favorable stock option incentives. (Several other recommendations were made specifically for small businesses.)

Permit patents to be written off over a period somewhat shorter than their legal life.

Modify the concept of the "prudent man" that has been embodied in government securities regulations so as to allow institutions to hold a certain percentage of their investment portfolios in venture capital.

Simplify the regulations regarding the private placement of small investments.

Review on a more timely and aggressive basis those items which government policy prohibits from being exported.

Minimize the application of U.S. laws to extra-territorial business ventures.

Establish a Federal government-wide regulatory budget, subject to review by the Executive Branch and by Congress, that would set overall limits to the economic effect to be allowed to result from government regulation.

Increase support of basic research conducted at educational institutions.

Regulation of Industry Structure and Competition

Each regulatory agency should issue a long range statement of regulatory intent that could serve as guidelines for both the agency and the regulated. This statement of intent should require appropriate notice prior to any changes to accommodate the long-range planning of the regulated.

Whenever two or more agencies are developing regulations or policy on a single issue or interdependent issues, an interagency committee should be formed to assure consistency.

Where a single industry or company has related compliance requirements controlled by more than a single law, inter- and intra-agency consultation should occur to insure consistency between and within agencies.

Regulations promulgated to achieve desired social goals should be limited to standards of performance rather than design.

A non-adversary approach should be encouraged to increase industry participation in regulation development.

Time schedules for regulatory compliance should take into account new technology required and current plant investment.

During periods when no national emergency exists, Government price and entry controls of products or services sold in competitive markets should be rapidly eliminated.

In considering and establishing regulations, policies, and legislation, U.S. government agencies should be required to study the impact of their actions upon the worldwide competitive posture of U.S. industry.

New economic incentives are needed to offset the cost of capital investments required for regulatory compliance. Economic incentives to stimulate R&D efforts may be tax-oriented such as accelerated depreciation, or debt-oriented such as low-interest government loans which are particularly important to small firms.

Information from various existing agencies should be integrated to form a data base to support an annual report providing a statistical analysis of all U.S. business in terms of several variables,

including those to better identify businesses engaged in technological development.

Market share acquired principally as a result of the introduction of new technology should not ordinarily be considered in monopolization cases.

While the conduct of research on an individual firm basis, or among firms which are not competitors, is ordinarily to be preferred, the Department of Justice should explicitly recognize that there are certain areas in which joint or cooperative research, even among large competitors, should be encouraged.

Issues related to innovation should be given greater weight in cases involving acquisition of advanced-technology firms.

Antitrust enforcement and policy must be reevaluated.

Direct Federal Support of R&D

The concern with direct Federal support of R&D is primarily one of determining whether there are actions which the Federal government can take which involve R&D line items in the budget and can influence the innovation rate. The panel identified three sectors from which one could expect a disproportionately accelerated rate of innovation: the university, small venture businesses, and trade associations. The proposals made relate to

Federal budgetary procedures rather then economic incentives aimed at spurring R&D in the private sector.

Patent Policy

Enhance the reliability of the patent grant to the inventor and to those investing in the commercialization of his/her invention.

Reduce the cost in time and money of judicial enforcement of the rights derived from the patent.

Extend the availability of commercial exclusivity derived from patents to technological advances presently denied patentability.

Develop systems transferring the commercial rights of government supported inventions to those in the private sector capable of their innovation.

Upgrade the Patent and Trademark Office by providing adequate staff and modern search tools.

Provide for reexamination of patents.

Extend patent term to compensate for delays in commercialization caused by government regulations.

Information Policy

The Patent Office should improve its procedures in order to provide better information.

Arrangements should be made for constructive exchange of information on foreign markets.

Regulatory impediments, such as the Freedom of Information Act, should be clarified in regards to what is classified and what can be released under such Acts.

Government should establish a policy that, except for confidential and classified materials, all information created and collected by the Government be made conveniently accessible at incremental costs, to help widen its distribution and use.

Environmental, Health, and Safety Regulations

The Advisory Subcommittee endorses the stated objectives of Executive Order 12044 to improve the regulatory process.

Because regulations are proving to have serious and far reaching effects on our economy and society, it is encumbent upon Congress to be more diligent in its role as overseer of the regulatory agencies. Special consideration should be given to the impact of regulations on small business.

The Federal government should sponsor research to develop a better knowledge base with respect to the hazards to be regulated so that more meaningful regulations can be promulgated.

The risk/reward ratio should be improved for innovators/sponsors by:

reducing uncertainty of content and timing of regulations;

adjusting the timetable for compliance to take into account extenuating factors; and

adjusting where approval of a patented product is delayed through the regulatory process, the effective date of the patent to compensate for the delay.

The process of regulation should be improved by:

emphasizing performance rather than implementation methods; and

encouraging through policy, law, and attitude a resolution of problems, between regulator and regulated, through cooperative rather than adversary methods.

Action should be taken through legal reform to stem the inordinate escalation in product liability loses.

To advance the concept of industrial innovation, the Regulatory Council, and similar groups should include members who understand the process of innovation.

It is recognized that certain goals can only be achieved through government regulations. However, there are other objectives where the advantage of employing this approach is questionable and

non-regulatory means should be adopted.

Federal Procurement Policy

Secure enactment of legislation to eliminate the practice of procurement "auctions."

Through programs created by Government Services Administration improve the exchange of information between industry and Government, and thus improve the product awareness and industry knowledge of contracting personnel.

Establish a national policy statement by the Office of Federal Procurement Policy to establish the goal of having the Federal Government stimulate innovation by providing a market for innovative products in their early stages.

De-emphasize the practice by government agencies of performing a technical evaluation of industrial IR&D programs.

Propose that each Federal agency develop new Federal procurements for review by the Office of Management and Budget, which would encourage significant industrial innovation in selected areas of importance to the agency's mission.

Public Interest Advisory Subcommittee

In addition to the seven topical area reports summarized above, independent recommendations were proposed by the Public Interest Advisory Subcommittee established under the Domestic Policy Review. The recommendations of this panel cut across

the seven topical areas. Futhermore, they reflect the distinct view of this panel concerning the objectives of innovation; these include greater worker satisfaction, decentralization of capital facilities, and the use of norms other than productivity to judge the impact of innovation.

The recommendations of this subcommittee include:

The Federal government should play an ongoing policy and coordination role, providing a continuing focus for efforts to ensure that the social and economic significance of innovations coincide with public purposes.

The Federal government should play a greater exemplary role in stimulating mission-oriented innovation; through procurement, standards-setting, testing, technology-forcing yardstick projects, and through education of the public.

Voluntary standards-setting by industry should be reformed to prevent large companies from curbing competition and impeding innovation.

The patent system should be reformed to give greater protection to the rights of both the lone inventor and the employed inventor.

Small businesses should be fostered for their ability to innovate and the quality of their innovation; proposals for achieving this objective include: stimulation of competition and vigorous

anti-trust enforcement, and programs targeted at facilitating innovation in small businesses.

The potential of alternative organizational forms for improving innovation should be investigated.

Support should be given to emerging innovations utilizing appropriate technology; defined as the process of establishing social and environmental goals, evaluating the potential positive and negative social and environmental effects of a proposed technology before it is developed, and then attempting to incorporate beneficial elements into the various phases of development and utilization.

There should be avenues for a strong, effective consumer/citizen voice both in our large corporations and at all levels of government.

The degree to which government spending on R&D for defense purposes competes with civilian needs should be assessed. Planning should be instituted to determine where and how conversionfrom defense to civilian needs can be conducted.

Burdensome adjustments to innovation should not be allowed to fall on individual workers; displacement of workers by innovation should be mitigated through coordination and planning by both government and employers.

2.3 ISSUES ADDRESSED

The issues addressed by the Task Forces on innovation have evolved over time, reflecting the general concerns of their members and the objectives for which the studies were established. As a result different issues are highlighted in each study, although the basic concerns were often similar.

The Bowen Commission's efforts were focused on more effective Federal policies for supporting technological development. Accordingly the commission raised four issues which are central to the generation and transfer of technology:

> What is an optimal limit to expenditures for R&D? The Commission concluded that better information was needed, and suggested that precise figures be gathered showing the annual employment of scientific labor and expenditure of dollars in relation to the national goals they serve.
>
> The balance among R&D expenditures, particularly those by the Federal government. The Bowen commission recognized that the general thrust of Federal R&D involves political judgments; however, it felt some areas, e.g., housing, transportation, and urban development, were being neglected.
>
> Stimulating the greater use of R&D by lagging industries. Federal responsibility here is not necessarily

that of doing or even financing R&D, but one of providing incentives for getting it done.

Federal policies for diffusion of information. Mechanisms should be developed for the dissemination of technical knowledge to industrial and consumer users, if technology is to contribute to economic development.

The Charpie report addressed the issue of improving the climate for innovation through taxation, antitrust and regulatory policies. With respect to taxation, the Panel raised the issue of providing encouragement to inventors and innovators through incentives rather than legal sanctions. Proposals regarding finance raised the issue of communication of venture-capital opportunities rather than new Federal programs for financing innovation. Reviewing the subject of competition and innovation, the Panel found a need for greater understanding of this interaction, and for improvements in the coordination of antitrust and regulatory policies affecting both competition and innovation.

The Federal role in stimulating technological innovation was another central issue. Here, the Panel recommended that the Government provide a framework for innovation by identifying social problems and assigning priorities to their solution. Within this framework: (1) private enterprise would be encouraged to seek profit-making opportunities in the

development of such solutions; (2) the government would carry on the necessary technical developments only in those instances where private resources cannot be depended upon to undertake them; and (3) regulatory policies would be developed to compel or encourage industries to modify productive processes and products in such a way that they will contribute to the solution of social problems.

The Williams Commission dealt with international economic policy and, as mentioned before, considered innovation only peripherally. Some of the issues raised, however, are relevant to the development of economic policy, whether international or domestic.

> Coordination of activities among agencies with responsibility for economic policy.
>
> Development and implementation of coherent, clearly understood, long range policy concepts.
>
> Communication with constituencies. The commission found that an exchange of views on a continuing basis, among government agencies, industrial groups and private citizens, is an important aspect of developing an economic policy.

The objective of the Anker-Johnson study was to examine current technology policy, its relationship to the Nation's economic welfare, and based on this analysis formulate elements of a more effective policy. Several critical issues surfaced which the study's proposals were designed to address.

A variety of indicators firmly establish that technology has made significant contributions to U.S. economic development. Recently, however disquieting trends have appeared which demonstrate that this relationship has deteriorated as U.S. technology has been losing its preeminence.

Many elements of current policy are contradictory in their effects on innovation.

In formulating a national technology policy, it is important to consider the non-economic aspects as well as the economic ones, since market criteria alone are not adequate for making social choices and for determining the national goals which technology should serve.

The Domestic Policy Review on Industrial Innovation addressed many of the same concerns studied by its predecessors, and reached many of the same conclusions. However, the DPR study was more extensive in scope. Panels were established to address each of the following topics: procurement; direct support of R&D; environment, health, and safety regulations; regulation of industry structure and competition; economic and trade policy; patents; and information. Furthermore, through its public symposia and organizational structure the DPR conciously introduced the element of constituent perspective into each of the policy

areas. The central issues raised by the subcommittees are summarized below.

The Subcommittee on Economic and Trade Policy identified the following issues with regard to the impact of economic and trade policy on innovation:

> For established corporations significant tax disincentives exist to overall investment and to R&D; substantial revisions are needed, in recognition of changed economic circumstances.
>
> Venture capital is in short supply for new, high technology businesses, and legislated disincentives to savings and certain regulatory policies are contributing causes of this. Alleviating this shortage is an issue deserving priority attention.
>
> Foreign competition, conducted legally within the U.S., is a spur to innovation that must continue to be allowed, while certain government policies restricting the ability of U.S. businesses to compete abroad must be reexamined.
>
> The drag on the economy created by regulatory activity must be recognized for what it is, and consciously reviewed by the Federal government.

The Subcommittee on Industry Structure and Competition raised few issues that were not contained in its proposals. The critical issue identified was that economic growth and long-term economic health and stability are dependent upon

innovation. It is the essential force that generates new products and processes, creates productivity advancement and stimulates constructive competitive activity. In light of new worldwide economic forces and the diminished U.S. role in controlling them, new policies encouraging innovation must be considered. Specifically, new thinking is in order that would reward rather than penalize competitive advantage achieved through innovative actions - rewarding growth achieved through the creation of new technology as opposed to growth based on financial or market strength.

Issues raised by the Subcommittee on Environmental, Health, and Safety Regulations were highlighted in its recommendations. In addition, the Subcommittee raised the following issues regarding the negative impact of regulations on industrial innovation:

Regulations may result in the diversion of capital expenditures from productive to non-productive assets.

Bureaucratic procedures and often unrealistic standards lead to increased cost of product development. Similarly, the product development cycle is increased.

Uncertain standards, subject to short-notice change, increase investment risks. Small business has special risks.

Trade secret information is inadequately protected.

Reporting requirements are excessive.

Growing costs of product liability loss protection and prevention heavily strain the financial resources of business.

In its report on Federal Procurement Policy, the Advisory Committee stressed that since government purchasing holds such potential leverage over industry, it be used to stimulate renewed investment in innovation. Examples cited were improved procurement practices (e.g., consolidation of purchases), and stronger support for industrial R&D. The specific issues raised are reflected in the subcommittee's recommendations, cited in the previous section.

The Public Interest Subcommittee raised several issues in its proposals, and also stressed one overriding concern: the issue of corporate power setting the definitions and rules of the game. "When the corporations proclaim that it is government regulations that are impeding innovation, we must remember who it is that has defined the problem to produce that answer." The Subcommittee stressed that changes made to encourage innovation should not undermine or contradict policies designed to accomplish other, equally important goals.

Lastly, the issue of how to best achieve industrial innovation was raised by the Labor Advisory Committee. Its report conceded that industrial innovation is essential to economic growth, rising productivity, and a higher living standard. However, the Labor Advisory group concluded that

the best way to stimulate industrial innovation was to ensure that the U.S. economy is operating at full employment.

The issues raised by the various groups, and Task Forces studying innovation, have been analyzed and debated by legislators, academicians, and others. Recurrence of the same theme in numerous studies suggests that there are critical concerns which can be identified and must be addressed by policy initiatives which intend to stimulate industrial innovation.

2.4 RESPONSE TO TASK FORCE RECOMMENDATION

Response to Task Force reports and recommendations is difficult to evaluate since initial reaction is often vocal and positive, yet not followed by action. When action is taken, it may be the result of a number of factors not directly linked to a specific task force study. Occasionally, a task force report will be referred to in legislation, or cited as the basis for executive action, and its impact clearly discerned; however, this situation is not the norm.

Upon receiving the report of the Bowen Commission, the Subcommittee on Employment and Manpower, of the Senate Committee on Labor and Public Welfare, indicated that it intended to hold hearings on the report. None were held in 1966. No other direct connection between the report and legislative action is evident although the report may very well have left a lasting impression on "movers and shakers" who subsequently incorporated its recommendations into Congressional legislation or other actions.

In the case of the Charpie report of the Panel on Invention and Innovation, the Chairman himself assessed the response to his panel's study. Testifying before Congress in 1972,[6] Charpie compared the current climate for technological innovation to that which existed in 1967.

> Within the domestic economy, it is my view that the most careful audience of innovation studies,... over the last half decade has been not the Government, not the universities, not the individuals but large companies.... I find they are today doing things very much differently than they did 5 to 10 years ago in trying to encourage within their own organizations, novelty in translation of research and science into new technology and new business.

Charpie pointed to the Government's highly fragmented, sporadic interest in innovation and technology as a reason why these issues are continually studied but rarely acted upon. He deemed it essential "to find a way of sustaining a steady level of interest over a long period of time in the support of science and technology by the Federal Government"; and seeing to it that new science and technology get translated into action, impact, innovation, economic growth, products and competitive posture.[7]

In his prepared statement, Charpie reported that at the time the Department of Commerce's study was done, "none of its recommendations were followed." Yet subsequent NSF programs and Presidential initiatives incorporated several of the recommendations. This illustrates that lack of direct response does not imply a study has had no impact.

In identifying barriers to innovation as one problem in the field of foreign trade and investment policy, the Williams Commission underscored the connections between economic issues and technological innovation. However, reaction to the report focused on the issues of trade and investment rather than technological innovation. This response is not surprising in view of the primary audience of such a study. The lack of a readily discernible response to the recommendations of the Williams Commission does not indicate a lack of impact. Concurrent with the issuance of the Commissions report, concern about the causes of the deteriorating U.S. position in international trade and technological leadership, combined with the awareness of these issues created by the various task forces, elevated the subject of technological innovation to high priority. Response at the Federal level came in the form of yet another study, this time within the Executive Office of the President.

In his New Economic Policy statement in 1971, President Nixon directed the Secretary of Treasury to recommend tax proposals for stimulating industrial R&D and technological development. The proposed tax incentives for industrial R&D were never implemented. Instead, William Magruder, working in the Executive Office of the President, headed an effort to produce a plan for using the R&D and industrial capacity of the U.S. to: (1) apply high-technology knowledge to domestic problems; (2) improve the U.S.

position in international trade; and (3) reduce unemployment among scientists and engineers. Thousands of ideas were elicited through inquiries to trade associations, companies, and consultants. An interagency task force explored tax incentives and other financing mechanisms, and addressed the question of technology transfer. Government officials, including four top Presidential advisors, evaluated the proposals and estimated they would cost $1.5 billion in FY 1973 and $11 billion through FY 1977 to implement. Despite the top priority of this effort, Magruder's plan, the New Technological Opportunities Program, was never implemented. Some observers have attributed this failure to follow through to a shortage of funding for new programs, and a lack of advocates within government for technological innovation. This exercise demonstrates that even when there occurs an Administrative response to the collective results of task force studies, such response may not result in implementation of proposals.

The President's Message to Congress on Science and Technology in 1972 did reflect an increased awareness of problems in this area, probably as a result of the Magruder effort. The Message called for the Department of Commerce to be the focal point within the Executive Branch for policies concerning industrial R&D. However, there was no major initiative within Commerce for the next five years. Then, in 1977, as

part of that Department's mandate to "continually appraise the strength of American Industry, to identify barriers to industrial progress, and to propose measures to encourage and assure industrial development," the Ancker-Johnson study was undertaken.

Response to this effort involves consideration of two separate classes of recommendations. The first were directed toward the Department of Commerce and are difficult to assess since any change would be most apparent to those within the agency. However, in regards to the second group, or general policy recommendations (e.g., tax incentives, tax credits for R&D), there was little response. Commenting on this situation in her 1979 testimony before Congress,[7] Betsy Ancker-Johnson stated:

> When the administration's Domestic Policy Review on Industrial Innovation was announced over 18 months ago, I expressed the view that we could ill afford the procrastination of another study. It was obvious then, and it is obvious today, that the United States must soon establish a comprehensive technology policy which will, inter alia,
>
> Remove regulatory, anti-trust, tax and other barriers to innovation;
>
> Improve the climate for starting technology-based enterprises; and
>
> Remove the constraints on U.S. firms which inhibit them from competing effectively in foreign markets.

Response to the Ancker-Johnson study was also muted due to political changes. Secretary Eliott Richardson had directed that the study be performed, but no longer headed

the Department when the report was completed. His successor would be unlikely to share Richardson's personal concern with this endeavor.

The Domestic Policy Review of Industrial Innovation submitted its final report to the President in 1979. President Carter's response to the study's conclusions and recommendations was made in the form of a message to Congress. Without referring to the Baruch report specifically, since the President's message did not contain all of its proposals and modified many that it did accept, the message stressed the connection between industrial innovation and the economy. Initiatives announced in the President's message are the following:

> Enchance the Transfer of Information through establishment of the Center for the Utilization of Federal Technology at the NTIS, and through State and Commerce Department programs.
>
> Increase Technical Knowledge through increased Federal support for R&D.
>
> Strengthen the Patent System by upgrading and modernizing its processes, and supporting uniform government patent legislation.
>
> Clarify Anti-Trust Policy.
>
> Foster the Development of Small Innovative Firms through a $10 million increase of NSF's Small Business Innovation Research Program, and

establishment of non-profit firms to provide equity funding matched by government loans.

Open Federal Procurement to Innovation through purchasing, and the substitution of performance standards for design specifications.

Improve the Regulatory System to assure it does not adversely affect innovation, by using performance standards in regulation, requiring regulatory agencies to prepare a five-year forecast, and developing an expedited process for projects having a strong innovative impact.

Facilitate Labor and Management Adjustment to Technical Change.

Maintain a Supportive Federal Climate to ensure American technological strength.

Certainly the response to the Baruch study was the most concrete of any made to a task force report. The selection of proposals for implementation by the President, lends authority and priority to them, and increases the likelihood of successful implementation. The National Productivity Council was charged with monitoring innovation (although not the progress toward enacting these initiatives, specifically), and an ongoing evaluation can therefore be expected. The President concluded his message with a vow to evaluate the impact of tax laws on industrial innovation in conjunction with his review of fiscal policies in FY 1981.

Congress also took an interest in Baruch's work, and held hearings at which Executive Branch officials testified. From their statements it was clear that Congressional members considered the Administration's proposals an inadequate response to a critical issue, and viewed it as only "the first step." The disparity between the DPR's recommendations and the Administration's proposals was also criticized by the business community at subsequent hearings.[8]

Typical is the testimony of Franklin Lindsay, Chairman of the Research & Policy Committee of the Committee for Economic Development, who stated:

> The administration has recognized the importance of industrial innovation and has proposed some first policy steps to increase technological progress. However, it is my own view that the present Administration proposals fall short of what is needed.
>
> Further, while agreeing with many parts of the Administrations's proposals, I believe the CED approach differs with the Administration in important ways. The Administration's proposals do not deal with certain overriding problems in the economic environment today that are inhibiting savings and investment in long-term ventures involving the utilization of advanced technology. Unless much greater emphasis is given to creating an environment which will stimulate business to invest in the development and diffusion of technological innovation, we will have failed to capture the inherent innovative strength of our market economy to help solve America's economic and social problems.

2.5 SUMMARY OF TASK FORCE ACTIVITY

Taken collectively what these task force studies indicate is that support for the use of economic incentives for spurring industrial innovation has developed slowly. From an initial focus on Federal R&D, the scope of the Federal strategies considered has gradually widened reflecting a growing awareness of the interrelation between technological innovation and the Nation's economic welfare. By 1977, direct (i.e., grants, loans) and indirect (i.e., tax) economic incentives had emerged on a par with other policy instruments. In the latest study, economic incentives were identified as the most important policy instrument. In fact, the Domestic Policy Review emphatically declared that "tax policy is the only tool at the disposal of the Government that can have anywhere near the required impact (on innovation)."

One reason that a consensus, and concomitant action, has been slow to develop around the issue of technological innovation is the disjointed nature of the Task Force studies. Done in isolation from one another, each tends to start from scratch rather than build upon previous work. What results is often repetitious rather than progressive. Nonetheless, certain trends are evident when the task forces are reviewed in succession.

The Bowen Commission established that there is a legitimate role for government in facilitating industrial innovation. Subsequent task forces did not debate whether a role

existed, but instead focused on what that role should be, and how it could be performed most effectively. Charpie's Panel examined what role government could plan in improving the environment for technological innovation through its policies in the areas of taxation, finance, and competition. The Ancker-Johnson report expanded the concept of government involvement by specifying actions which would make the Department of Commerce an advocate for technological innovation, and recommended improving the general climate for technology-based enterprises. Finally the Domestic Policy Review went a step further by stressing the need for a comprehensive Federal approach to spurring industrial innovation; it would incorporate a wide spectrum of policy mechanisms from R&D to information, and fiscal policies.

Another important concept established through this series of task forces is that technological innovation and economic development are related. Evolution of this concept followed a pattern similar to that which characterized the idea government has a role to play in the innovation process. The Bowen Commission reported that there is a definite link between technology and economic progress. Subsequent studies accepted this hypothesis and focused on examining the nature of this relationship, and how it could be influenced by government. The Williams Commission found that technological development has a more widespread impact on the economy than had been previously reported. It linked technological capability and economic growth to

export performance and the U.S. position in international trade. The Ancker-Johnson study promoted institutional recognition of the connection between technology and the economy through its recommended programs and policies for the Department of Commerce. Similarly, implicit in the Domestic Policy Review's proposals is the assumption that technological innovation impacts on the economy and is therefore an issue warranting high priority concern and action.

While trends accepting and clarifying these two concepts are evident in the task force reports, there unfortunately is no accompanying convergence concerning agreement on the precise role government should fill and actions it should take. Perhaps because each study appears to have taken place in a vacuum, the issues raised previously are not refined and discussed to emerge as salient points for implementing federal innovation policy. No detailed proposals can be singled out as having the endorsement of several groups. Only general issues stand out as subjects of consensus.

There is agreement that more information is needed on the subject of innovation to allow the development of effective Federal policy. A call for such data was issued by the Bowen Commission and taken up by its successors. Similarly, there is demand for more knowledge about the impact of antitrust and regulatory policies on invention and innovation.

Improved technology transfer mechanisms were also endorsed unanimously. While some studies emphasized technology diffusion to less developed countries, others emphasized

transfer of military R&D products to civilian use. The translation of inventions into innovations for industrial and consumer use was also emphasized

Lack of coherent government policy was cited by most task forces as a problem needing immediate solution. Most reports proposed that a system be developed requiring inter-agency consultation to assure that government policies and regulations are not contradictory nor sources of confusion.

A consensus emerged that in any effort where the government is involved, its proper role is to encourage innovation rather than perform R&D itself. The Federal government was urged to support and encourage private industry's development of innovations which will contribute to economic progress and the solution of social problems. Government should only perform R&D itself in those instances where the private sector cannot or will not.

General trends and an emerging consensus regarding the critical issues do not yield much insight about which specific incentives should be employed. This is illustrated by Table 2-1, which summarizes the proposals made by each Task Force. Although generic classes of incentives have been recommended, no clear preference was suggested among the policy options within these general categories. It appears that in order to make a leap from the abstract to the specific, requires consideration of such factors as the efficiency, equity and innovation impact of a proposed policy instrument.

This in turn suggests that the development of specific policy packages to spur innovation must take place at the sectoral level, or even at the level of the firm. Thus, the Task Force activities represent only general guidelines for the development of policies targeted toward the automotive sector.

TABLE 2-1. SUMMARY OF PROPOSALS BY GOVERNMENT TASK FORCES ON INNOVATION

PROPOSALS for Government Action to Stimulate Technological Innovations	TASK FORCES Endorsing Proposals				
	Bowen (1966)	Charpie (1967)	Williams (1971)	Ancker-Johnson (1977)	Baruch (1979)
Federal Funding					
Demonstration Grants	X			X*	
Government "Purchasing Power" - Directed Use	X				X
Federal support of Interdisciplinary University Institutes -for basic research	X				X
Direct support for R&D -where it can influence the innovation rate			X	X*	X
Trade Policy					
Priority to export promotion			X	X	
-Review items prohibited from export					X
Intensify efforts to insure technological lead of U.S.			X		X
-Through DOC, Treasury, and SEC cooperation				X	
Technology assistance to Less Developed Countries				X	

TABLE 2 1. (CONTINUED)

PROPOSALS For Government Action to Stimulate Technological Innovations	Bowen (1966)	Charpie (1967)	Williams (1971)	Ancker-Johnson (1977)	Baruch (1979)
Venture Capital					
-Info on availability should be provided by government		X			
-Modify barriers to institutional purchases of venture capital					X
Government Policy					
DOC should work with universities to study innovation		X			
Review policies for assess impact of federal actions		X		X	X
on innovation		X		X	X
Interagency group should aid & advise regulatory agencies and others regarding their impact on innovation					

TABLE 2-1. (CONTINUED)

PROPOSALS for Government Action to Stimulate Technological Innovations	Bowen (1966)	Charpie (1967)	Williams (1971)	Ancker-Johnson (1977)	Baruch (1979)
Economic Incentives					
Tax Credits					
-Lengthen time allowed for deductions of losses		X			X
-Expand deductions allowed		X		X*	X
-Increase depreciation allowances		X		X*	X
-Accelerate depreciation allowances				X*	X
-Increase investment credit for R&D plant				X*	
-Increase tax depreciation allowances for R&D plant					
-Increase incentives for savings and investments through use of tax code					X
-New tax credit for R&D expenditures				X	X
-Permit tax credits for contributions to non-profit R&D institutions					X
-Permit R&D expenditures in U.S. to be allocated solely to U.S. income					X
-New tax credits or equivalent cash payments				X*	
Capital gains treatment same for amateur as pro		X			
Liberalize stock options		X			X

TABLE 2-1. (CONTINUED)

PROPOSALS for Government Action to Stimulate Technological Innovations	Bowen (1966)	Charpie (1967)	Williams (1971)	Ancker-Johnson (1977)	Baruch (1979)
Regulations					
Agencies must issue long range statement of intent					X
Performance rather than design standards					X
Reevaluate antitrust policy		X			X
Economic incentives should be provided to offset regulatory costs					X
Strengthen data base for rulemaking		X		X	X
Procurement					
Interdepartmental review of contracting policy	X				X
Use to stimulate innovation					X
Patent policy reexamined					X
Information policy should be improved					

*Proposed government study of issue for potential action. Did not recommend immediate action.

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[5] "Industrial Innovation," In: Weekly Compilation of Presidential Documents, May 15, 1978, p. 892.

[6] U.S. Congress, House Committee on Science and Astronautics, Science, Technology, and the Economy, Hearings before the Subcommittee on Science, Research, and Development, 92nd Cong., 2nd Sess., 1972, p. 71-96.

[7] Ibid., p. 77.

[8] U.S. Congress, Senate Committee on Commerce, Science, and Transportation, Hearings on Industrial Innovation Oversight, 96th Cong. 1st Sess., Nov. 14, 1979.

[9] Joint Hearing Before the Senate Committee on Commerce, Science and Transportation; Senate Select Committee on Small Business; House Committee on Science and Technology; and House Committee on Small Business. Hearing on Industrial Innovation Oversight, Oct. 31, 1979.

3. CONGRESSIONAL ACTIVITY - LEGISLATION AND HEARINGS

3.1 INTRODUCTION

The issues of technological innovation and National industrial policy have been disparate Congressional concerns until recently. However, the expansion of government involvement in private sector activity during the seventies led to a fundamental shift in the locus of economic decision making, a phenomenon termed the "second managerial revolution."[1] Concern about the impact of government's intrusion into the private sector has recently focused on technological innovation; the linkage between government technology policy and Federal regulatory actions and private sector innovation has become more fully understood as these relationships have come under scrutiny. Consequently, during the past decade Congress has paid increasing attention to the question of whether its actions stimulate or inhibit industrial development and innovation.

3.2 HISTORY

Congressional concern with technological innovation and the Nation's economic welfare can be discovered throughout legislative history. However, the two issues have not been

[1]Murray L. Weidenbaum, The Second Managerial Revolution, In: Politics, Planning and the Public Interest, New York, Columbia University Press, 1980.

closely linked, until recently. During the 1960's Congressional interest in technological innovation was almost exclusively focused on Federally funded R&D. No interest was exhibited in indirect mechanisms for stimulating industrial R&D or in the link between government policy and technological innovation. Congress was concerned with the level of expenditures, where the funds were going, and what was being produced. As a result of this concern, however, Congress reviewed its own fragmented jurisdiction over areas involving science, technology, and R&D. The conclusion reached was that Congress was not adequately organized to perform its responsibilities with respect to science and technology policy. Between 1963 and 1970, there was a series of proposals for establishing a coherent Congressional system to deal with technological issues. As a result, Congressional leaders and committees emerged with the clear mandate to study all aspects of technological innovation without restricting their examination to direct funding of R&D.

The 1970's marked the beginning of a new Congressional direction on technological issues. Hearings during the first half of the decade established a link between technological innovation and the economy, and between government policy and industrial R&D. The past five years have been most active in terms of actual legislation and in terms of issues relevant today. A review of Congressional activity over the past decade will therefore provide an appropriate background for analyzing attitudes towards a national industrial policy,

and the role of economic incentives in spurring technological innovation.

1970

The pattern of the late 1960's had been for Congress to limit its interest in technological innovation to federally funded projects and to a review of what was achieved. This held true for 1970 with one notable exception. During that summer the Subcommittee on Science, Research and Development of the House Committee on Science and Astronautics held fifteen days of hearings on House Concurrent Resolution 666. The Subcommittee Chairman opened the hearings with the following remarks:

> The reason for these hearings is twofold. First, upon careful perusal of Congressional history we have found that no committee of the Congress has ever inquired precisely into this subject -- although many have fielded parts of it in conjunction with other issues. Second, the Nation has clearly arrived at a point where the Government-science relationship, which has been in a period of stability since World War II, is now faced with radical alteration. Under these circumstances, it is our intent to obtain the advice and views from a broad spectrum of Americans as to whether or not a structured national science policy is desirable in the future and, if so, what elements of that policy ought to be.[1]

Echoing this sentiment, the concurrent resolution "declares that there is an increasing need for the development of a national science policy in the United States in order to provide a basis for the coordination of scientific and related activities both public and private...and to promote continued progress."[2] In the course of these hearings, witnesses emphasized not only the connection between financial support and scientific development

but also the relationship among industrial innovation, technological advances, and economic growth. Important points raised at these hearings gave rise to strong Congressional interest in the relationship between R&D and economic policy and development. As a result, Congress looked at technological innovation from a different perspective in the 1970's, and with more intense interest than it had previously.

1971

Economic and finance-oriented committees continued to display little concern for the impact of economic policies on industrial innovation, in 1971. The Subcommittee on Science, Research and Development continued to evidence its greatest interest in policy for scientific development. It held hearings to examine the effects on the U.S. economy of support for science and technnlogy, and to determine what resources should be invested in R&D.[3] A second question these hearings addressed was what are optimum methods for making these investments. Again witnesses linked technological development, industrial innovation, and economic growth. One witness emphasized the importance of stimulating the private sector's role in technological innovation by encouraging investment through liberalized tax policies.

In its quest for information, the Subcommittee published "Selected Readings on Science, Technology, and the Economy".[4] A recurring theme in this collection is that the U.S. is falling behind foreign countries in technological innovation and

must rectify this situation in order to sustain economic health and growth. While different viewpoints are presented, the wide range of authors demonstrated general agreement on the need for capital investment in technological development and the belief that this will promote economic growth and prosperity.

The Executive branch also took up this subject in 1971. In his August message on economic policy, President Nixon mentioned the need for new tax proposals for stimulating R&D.

1972

In 1972, hearings on science, technology, and the economy continued before the Subcommittee on Science, Research and Development. In February, an interim report[5] was issued summarizing the Subcommittee's activities and views to date, and indicating its direction for the future. Among its views, the Subcommittee stated, "Incentives must be offered to encourage innovation and commercial exploitation of new knowledge."[6] It cited foreign recognition of the role of government in providing incentives for industrial innovation, and went on to list grants, tax advantages, and other financial incentives as deserving careful consideration.

The Subcommittee resumed hearings[7] in April to examine the Federal role in private sector R&D and to consider uses of and projected needs for R&D, with the intention of determining a national R&D policy. Again, distinguished representatives of

business, labor, government, and academia stressed the interrelationship among investment in R&D, technological innovation, and economic growth.

Science policy, although not its relationship to the economy, became a topic of consideration in the Senate during this year. The Senate Committee on Labor and Public Welfare considered and recommended passage of S.32, National Science Policy and Priorities Act of 1972.[8] This bill authorized the National Science Foundation to develop national policies for applying science to national problems through establishment of a program within NSF to do research and development of civil science systems capable of providing improved public services. S.32 passed the Senate by a vote of 70 to 8 on August 17, 1972. It was referred to the House Subcommittee on Science, Research, and Development, which began hearings the following month.

In the House, a similar version of the bill had been introduced a year earlier but was not acted upon. In 1972, three versions of S.32 were introduced but had not received consideration when S.32 passed the Senate and superseded them. Hearings focused on specifics to a greater degree than previously, because of the details provided by S.32. The merits of the bill itself were debated, but its goals, to establish policies supportive of scientific development, were widely endorsed. No action on the bill was taken by the Committee.

Although not concerned specifically with technology, the Joint Economic Committee began a study of Federal subsidy programs.[9] Its approach and scope were general, but many points

relevant to economic incentives for industrial innovation were raised. That the implications of subsidies and tax credits were being studied concurrently with innovation is important, since the linkage would be sufficiently understood that these issues would merge later on.

1973

In July, 1973, the House Committee on Science and Astronautics met to begin a three part inquiry into Federal policy, plans, and organization for the support and utilization of science and technology.[10] The first part was devoted to gathering information on the background, and status of the current Federal posture on science and technology; this phase was the only aspect covered in 1973.

The Senate also began a series of hearings to examine how the Federal government could stimulate scientific and technological innovation to meet national needs.[11] According to the Chairman of the Special Subcommittee on Science, Technology, and Commerce of the Commerce Committee, the "economic strength and national security of the U.S. continue to rest on a technological foundation."[12] He therefore concluded that a legitimate concern of the U.S. government is how its policies affect innovation and what changes can be made to stimulate innovation.

1974

The House Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics resumed its

series of hearings on Science, Technology, and the Economy in 1974.[13] The hearings had two purposes, to explore the lessons of history regarding response to resource crises, and to evaluate the state and direction of American technology with respect to the future.

The full House Committee on Science and Astronautics continued hearings on Federal Policy, Plans, and Organization for Science and Technology.[14] This second phase emphasized the views of nongovernment witnesses regarding the background and status of contemporary Federal science and technology policy and institutions.

Legislation was considered in the Senate during this year, including the same bill and number, S.32, which had passed the Senate during the Ninety-Second Congress, in 1972. The special Subcommittee on the National Science Foundation of the Committee on Labor and Public Welfare met to consider three bills which had been introduced but not acted upon in 1973. Hearings[15] focused on national policy and priorities for science and technology, specifically the application of science and technology to problems such as energy and food supply, transportation, and the environment. Institutions necessary and responsible for science policy were another subject under consideration.

1975

In 1975 the name of the House Committee on Science and Astronautics was changed to the Committee on Science and Technology. It held the third phase of its hearings on Federal

policy, plans, and organization for science and technology in conjunction with consideration of two bills.[16] The first, HR 4461, a version of S.32, was entitled the National Science Policy and Organization Act of 1975. The second bill, HR 7830, was the Administration's bill, the Presidential Science and Technology Advisory Organization Act of 1975. HR 4461 incorporated the major policy and organizational features which had been recommended to the Committee during the first two phases of its hearings in 1973 and 1974. The third phase of hearings focused on this legislation and the issues it raised regarding a statutory science policy, a science advisory mechanism in the Executive Office of the President, and a new Federal department which would combine certain government agencies with functions which are primarily R&D, and the absorption of the three major government science information offices into a single corporation.

In the Senate, consideration of S.32 and related bills progressed with Joint Hearings before subcommittee of the Committees on Labor and Public Welfare, Commerce, and the full Committee on Aeronautical and Space Sciences.[17] The administration bill, S.1987, corresponding to HR 7830, was also considered. In these hearings, the institutional changes needed to establish sound science policy and priorities were reviewed. As a result of these hearings, S.32 was reported out of Committee for consideration by the Senate.

The Joint Economic Committee opened hearings which were more relevant to the subject of economic incentives for technological innovation of any summarized here so far. Dealing with the issue of technology and economic growth, the hearings[18] focused on civilian technological innovation as it relates to economic growth, to jobs, and to business and industry. In preparation for these hearings, the Subcommittee had a report prepared on Technology, Economic Growth, and International Competitiveness by Robert Gilpin, a Princeton professor.[19] This study, along with collections of prior readings and hearings, provided Congress with enough background information to begin formulating and acting upon substantive legislation in the future.

1976

Science and technology policy continued to be a topic for legislation in 1976. The House Committee on Science and Technology and the Senate Committee on Labor and Public Welfare issued their conference report[20] on HR10230, the National Science and Technology Policy, Organization, and Priorities Act of 1976. It would establish a national science and technology policy, an office of Science and Technology Policy within the Executive Office of the President, and provide for a comprehensive survey of methods to improve the Federal science research and information handling effort.

Similar in substance to HR10230 is the familiar S.32, which, under the new title of National Policy, Organization,

and Priorities for Science, Engineering, and Technology Act of 1976, was recommended for passage again this year by three Senate committees that considered it.[21] The Act would establish a framework for the formulation of national policy and priorities for science and technology, and would establish an Office of Science and Technology Policy in the Executive Office of the President. The House version, HR10230, eventually was passed by Congress (P.L.94-282).

Although Congress was expanding its interest in science and technology policy during the 1970's, it did not lose its concern for how Federal money was being spent. In 1976, oversight hearings[22] were held by the House Science and Technology Committee's Subcommittee on Domestic and International Scientific Planning and Analysis. Hearings focused on the usefulness of various science output indicators for measuring and evaluating federally supported R&D. Witnesses also raised the issue of focusing on the relationship between R&D investments and economic growth. The Subcommittee itself was also interested in this issue, having had selected readings[23] on R&D expenditures and the national economy compiled previously. The Congress also began to relate these issues to the automobile industry.

In July, 1976, the House Banking, Currency and Housing Committee's Automobile Industry Task Force issued a report[24] based on hearings held to examine the state of the automobile industry, its impact on the economy, and the effects on the

industry of government policy, interest rates, safety and emission standards. Although technological innovation was not highlighted in this report, linking government policy with the economic condition of the automobile industry would certainly lead in the future toward the issue of innovation.

Another development along these lines was the Senate Finance Committee's consideration of the impact of tax policies on R&D investment. In hearings[25] before the Subcommittee on Financial Markets held to examine future U.S. capital needs and methods of stimulating investment through tax policy, witnesses discussed tax incentives for increasing industrial R&D spending and technological innovation.

1977

The House, in 1977, was relatively inactive on the subject of technological innovation and science policy. Early in the year, however, the Joint Economic Committee published a study series analyzing trends and prospects for economic growth. One volume[26] dealt with the impact of technological change on economic growth, thus adding to the body of Congressional literature linking these issues.

The Senate was similarly inactive during 1977 on science and technology issues. Activity in the area of economic and tax policy did have implications for technological innovation, although that issue was not addressed explicitly. Both the Joint Economic Committee and the Senate Finance Committee

considered tax policies and fiscal change, and their effect on investment and capital formation. These issues are relevant to technological innovation, since capital formation is a key determinant of the ability and willingness to implement innovation.

Government patent policies were considered by the Senate Select Committee on Small Business which focused on the ownership of inventions stemming from federally funded R&D activities. Hearings[27] examined several aspects of current patent policy, including their impact on industrial innovation. Thus, another dimension emerged to the issue of policy and its impact on innovation. Congress was beginning to shift from the study and investigation of science and technology which characterized the early seventies, to evaluation of the impact of actual policies on innovation.

1978

The House continued to review government organization and policy regarding science and technology, in 1978. As required by the National Science and Technology Policy, Organization and Priorities Act of 1976, the first annual report[28] on science and technology was prepared by NSF with the Office of Science and Technology Policy. It was reviewed and published by the House Committee on Science and Technology. The report analyzes the role of government policy in science and technology, including R&D funding and general economic progress. Also reviewed is the comparative international performance of U.S. technology, and

the status and contribution of research performed by industry and academia.

Oversight of science and technology also continued with joint hearings[29] before the House Science and Technology Committee's Subcommittee on Science, Research, and Technology and the Subcommittee on Science, Technology, and Space of the Senate Committee on Commerce, Science, and Transportation. Hearings were held at the American Association for the Advancement of Science's annual meeting to examine the state of American Technology, R&D, and industrial innovation. Witnesses discussed factors affecting innovation, the current situation, and needs for the future. These hearings were continued to review the Office of Science and Technology Policy programs.[30] The need for policies and programs to encourage innovation was discussed.

1979

Activity in Congress relating to Federal support for industrial innovation intensified in 1979. In excess of 85 bills were introduced in both the House and Senate. This legislation called for a variety of actions ranging from increased federal support for R&D performed by small businesses, improving patent policies, regulatory reform, and tax incentives for business.

A major shift in Congressional concern occurred; declining international competitiveness and continuing "stagflation" raised the issue of industrial revival to the forefront. A consensus was emerging that stimulating the supply side of the economy

was the major challenge, and technological innovation was perceived within the broader context of a national industrial policy.

In the Senate S1250, the National Technology Innovation Act was introduced to "help businesses adjust to change and meet Government subsidized competition from abroad."[31] The bill would harmonize Federal technology policy and economic policy by the creation of an Office of Industrial Technology within the Commerce Department. It would provide innovation adjustment assistance, support for community technology, create centers for research on generic industrial technology, and generate the data and information needed for policy formulation.[32]

For the first time in twenty years the annual report of the Joint Economic Committee was endorsed by both the majority and minority members of the committee. The report illustrates an emerging consensus "that the major challenges today and the foreseeable future are on the supply side of the economy. ...The report emphasizes the need to stimulate job creating new investment. It recommends consideration of incentives to promote industrial research and development. It calls for a more rational and effective Federal regulatory system."[33] Reflecting this concern with stimulating the supply side of the economy, the Capital Cost Recovery Act (HR4646) received strong support; 265 House members cosponsored the bill.

Committee hearings on innovation and its impact continued and included several areas critical to the auto sector: R&D

needs for advanced automotive technology, and loan guarantees for Chrysler. Congress also followed with interest the Domestic Policy Review of Industrial Innovation. Following the release of the Administration's innovation proposals on October 31, 1979, joint hearings on industrial innovation oversight were held before the: Senate Committee on Commerce, Science, and Transportation; Senate Select Committee on Small Business; House Committee on Science and Technology; and House Committee on Small Business. The Congressional reaction to these proposals was articulated by Senator Cannon, Chairman, Committee on Commerce, Science, and Transportation:

> *Mr. CANNON. Mr. President, after 18 months of effort involving hundreds of representatives of industry, labor, academia and the public, as well as officials of 21 Federal agencies and departments, the Carter administration announced on October 31, a nine-point program to advance industrial technology and encourage innovation. At the invitation of the Commerce, Science, and Transportation Committee, four committees of the Senate and House met within an hour of the President's news conference to hear the results of his "Domestic Policy Review."*
>
> *The administration's package falls far short of the recommendations of its own advisory committee. It was criticized as inadequate by a distinguished group of economists, business executives, and labor union officials who testified to the Commerce Committee's second hearing on November 14. It is a pale reflection of the positions of the Committee on Economic Development, the Industrial Research Institute, the National Research Council's panel on technology and world trade, a Small Business Administration Office of Advocacy Task Force, and other organizations that have been studying this issue in conjunction with or independently of the Administration's effort.*

But the program's real test is not whether it satisfies everyone's wishes but whether it addresses America's economic problems in a way that will exploit our diminished opportunities.

Debating whether the United States has suffered a measurable, overall "innovation lag" in terms of domestic and foreign patent rates or R&D dollars and yen is analytical fiddling in the face of fundamental economic changes that are threatening our ability to produce and compete with the ease we have long taken for granted. The President's message did not indulge in such speculative analysis; but neither did it convey any sense of the seriousness of our predicament and the urgency of finding a way out of it. Above all, there was no call for a bold policy of industrial development and rejuvenation that is so clearly needed and many of us anticipated.

(Ref. 34)

Senator Cannon noted the failure to recommend changes in tax policy which he attributed to studying innovation in isolation from economic policymaking. Specifically:

The President's innovation message acknowledges the problems of capital formation experienced by entrepreneurs and new companies by relaxing Federal restrictions on small business investment company and private pension fund investments and by proposing to create two State or regional corporations for innovation development; but he does not admit that tax policy is the government's single most effective instrument to encourage investment. Accelerated depreciation, investment credit, R&D, corporate and capital gains tax rate and other proposals were urged on the White House in the course of the Domestic Policy Review, but all have been deferred until the administration decides whether a tax cut is necessary to counteract the recession. That is a natural consequence of an innovation study narrowly conceived in isolation from the centers of economic policymaking and subjected to the constraints of existing fiscal orthodoxies. It has happened before. The 1967 Charpie report to the Commerce Department on technological innovation included a number of modest tax recommendations, but they fell on deaf ears. President Nixon announced a study of innovation-related tax measures as part of his new economic policy in 1971 but then neglected to send Congress a single recommendation.

(Ref. 35)

The tendency of Innovation Task Forces to examine the innovation process in the abstract rather than at the sectoral level, was cited as a serious methodological error, and the consequences described:

> *This is not the first administration to treat the "innovation process" in the abstract. The studies dating back to the early 1960's have all cited examples of the Nation's past technological prowess but avoided mention of specific technological deficiencies that might arouse public concern or new technological opportunities that could generate enthusiasm and constituency support. Each study neglected the sector-by-sector assessment that is necessary.*
>
> *(Ref. 36)*

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3.3 LEGISLATIVE PROPOSALS

Numerous proposals have resulted from Congressional concern about technological innovation and related issues. Although most of these proposals were never enacted into law they are useful to examine since they highlight both the critical issues of the day and the suggested institutional response.

Science, Technology, and the Economy

Hearings[1] before the House Subcommittee on Science, Research and Development on National Science Policy, and on Science, Technology and the Economy were actually a series which should be examined comprehensively. Representatives of business, labor, academia, and government came forward to address the following two questions:

- What total resources should the United States invest in research and development in both the public and private sectors?

What are the optimum ways of making these investments? After two years, the following proposals had been made, and were to serve as the framework for subsequent hearings.

The United States must review national science policies, reorder priorities, and establish specific goals from which a coordinated policy can be developed. Steps to accomplish this should include:

Establishment of a single Federal focus for assessing and promoting industrial technology.

Establishment of a council to advise Congress on issues of technological development and innovation.

The economic position of the U.S. is related to and can be improved through technological development, through

Establishment of an agency to deal with international trade that would have authority to regulate, supervise, and curb the export of U.S. technology and capital.

Tariff controls instituted for the same purpose — to control the export of technology, capital, jobs, and production.

United States public policy should include direct and indirect financial incentives aimed at stimulating the development and industrial utilization of new technology.

Examples of indirect incentives include tax incentives such as depreciation allowances, investment credits, credits for incremental R&D, and favorable treatment of individual investors.

The government should eliminate restrictions against cooperative research among firms by modernizing antitrust legislation; in addition, voluntary standards should be utilized when standards are required.

With respect to the question of the level of expenditures the nation should invest in R&D, no one ventured a set amount. Some witnesses expressed the belief that support should be increased, and no one suggested that 1971-72 levels were too high. Various formulas for determining funding levels were advanced, but the consensus was that whatever level of R&D support Congress adopts, expenditures should remain as consistent as possible measured in terms of constant dollars.

Regarding optimum ways for making investments in R&D, no consensus emerged. Providing a favorable tax structure, support for substantive R&D areas rather than particular groups or institutions, and adjustments in antitrust policy were all suggested. Some witnesses believed the most effective role for government was support of basic research, while product-oriented R&D is the role of industry; others stressed that basic research must be directed to problem-oriented areas and linked to industrial activities.

Hearings[2] on Science, Technology, and the Economy were resumed for a different purpose in 1974, when the country was experiencing energy shortages. Based on this situation and the prospect of future crises, the Subcommittee on Science, Research, and Development held hearings to examine: the historical lessons from previous crises; and to take a look at the future and ascertain whether the current state and direction of science and technology could meet the tasks

ahead. For the most part, proposals introduced were similar to those made in prior hearings, although in some cases were more specific. Establishment of a single Federal focus for science and technology policy, and creation of an organization to provide assessments on technological issues to Congress and the Executive Branch were proposals stressed again.

As a result of this series of hearings, the subcommittee began consideration of a bill which would implement many of the suggestions. The National Science Policy and Priorities Act was first introduced in 1972, and reintroduced annually until enactment in 1975.

Federal Policy, Plans and Organization for Science and Technology

A series of hearings[3] held by the House Committee on Science and Technology (formerly Science and Astronautics) on the subject of Federal Policy, Plans and Organization for Science and Technology resulted in legislation reflecting proposals made here and in previous hearings on Science, Technology and the Economy. The hearings took place in three phases over a three year period. In 1973, the first phase was primarily devoted to eliciting information in order to derive an accurate view of policy and planning needs for science and technology. This was prompted by former President Nixon's reorganization which transferred the functions of the Office of Science and Technology, and Science Advisor from the Executive Office to NSF. At the conclusion of this phase, the Committee issued an interim report[4] summarizing the issues

raised and clarifying the points to be addressed during the second phase of hearings. This series was devoted exclusively to the view of non-government authorities in the field of science policy and its interface with government, academia, industry, and foreign affairs. Based on these two phases of hearings, a bill was drafted to incorporate the major policy and organizational features which had been recommended to the committee and appeared to have substantial support. This bill, HR 4461, the National Science Policy and Organization Act of 1975, served as the basis for the third and final phase of hearings and contains the proposals made in this series. The Administration bill, HR 7830, dealing only with the science advisory mechanism in the Executive Office, was also considered. Proposals made during these hearings, and reflected in HR 4461, include the following:

> A statutory science policy should be established and should continually be revised based upon continuing study in science, technology and policy. It should enlist science and technology to foster a healthy economy and achieve other national goals.
>
> To implement this policy, other Federal policies should be consistent with scientific and technological goals. Such policies include patent, procurement, and antitrust regulations.
>
> There should be created a Council of Advisors on Science and Technology in the Executive Office of the President. Its Chairman shall serve as adviser to the President,

and, along with the Council, develop and recommend policies which will stimulate technological development. An executive branch Department of Research and Technology Operations should be established to provide a centralized administrative resource to certain key Federal agencies whose primary mission is scientific or technical R&D, and to serve as the repository for new programs not in the jurisdiction of those key agencies. Agencies such as NASA, NSF, ERDA, NOAA, and the National Bureau of Standards would be located in this agency.

- The three major government science information offices should be absorbed into a single independent agency, the Science and Technology Information and Utilization Corporation.

National Policy and Priorities for Science and Technology

A series of hearings on this subject began in 1972 and addressed proposed legislation and related issues, and eventually culminated in enactment of the National Science and Technology Policy, Organization, and Priorities Act of 1976.[5] Originally introduced in both the House and Senate as the Conversion Research, Education and Assistance Act of 1971, S.32 was the subject of hearings before the Committee on Labor and Public Welfare in the Senate. S.32 had been retitled the National Science Policy and Priorities Act of 1972 and contained the following provisions:

Establish a national science policy and programs to focus the Nation's scientific talent and resources on its civilian priority problems and to provide scientific personnel with employment commensurate with their skills.

Create a mechanism to establish Federal procurement policies and regulations which would foster portable pensions for scientists and engineers to protect their pension credits as they change jobs.

Declare as national policy that Federal funds for science will grow in proportion to the GNP; and Federal funds for civilian R&D must be maintained at parity with military R&D. Civilian programs must focus on meeting national needs in priority areas.

The bill passed the Senate and was sent to the House where hearings had already been held on HR 34, the House version of the bill. Hearings continued and reports were issued on this bill and other legislation dealing with science policy during the Ninety-Third Congress, in 1973 and 1974. As a result of these efforts, legislation was introduced in the Ninety-Fourth Congress which embodied proposals made during the previous years. HR 10230 and S.32, both titled National Science and Technology Policy, and Organization Act were the resulting pieces of legislation which the Ninety-Fourth Congress considered and eventually passed.

The House bill, HR 10230, evolved from the following proposals made in a series of legislation as follows:

HR 4461 - March 6, 1975

Establishes a national science policy;

Establishes a 5-member Advisory Council on Science and Technology Operations, to incorporate a number of existing R&D agencies; and

Establishes a Science and Technology Information and Utilization Corporation composed of several existing technical information agencies to be placed within the Department described above,

Estimated cost: $33 million/year.

HR 7830 - June 11, 1975 (introduced at the request of the Ford Administration)

Establishes an Office of Science and Technology Policy within the Executive Office of the President, administered by a Director, also to be the President's Science Advisor.

Estimated Cost: $1 to 1.5 million/year.

HR 9058 - July 30, 1975

Establishes a national science and technology policy;

Establishes an Office of Science and Technology Policy (OSTP) as requested by the Administration in HR 7830, but requires congressional confirmation of Director and up to four Assistants and assigns stronger functions and duties;

Establishes a 5-12 member Federal Science and Technology Survey Committee in the Executive Office to survey the overall Federal Science Operation and report with recommendations for action to the President and Congress.

Estimated Cost: $2.1 million/year plus $1 million for survey.

H.R. 10230 - October 20, 1975 (25 co-sponsors)

Same as HR 9058 in major respects but with certain modifications. The main differences are: (1) assistant directors of OSTP do not require confirmation; (2) Action of the Survey Committee is an OSTP responsibility; (3) survey report comes directly to Congress from the President with his recommendations, rather than from the director.

Estimated Cost: Same as HR 9058.

The House version of the bill (H.R.10230) passed and was sent to the Senate where it passed with amendments. Differences between S.32 and HR 10230 were resolved and the National Science and Technology Policy, Organization, and Priorities Act of 1976 became public law. Of the many proposals on science policy which were considered, this was the only one enacted into law by 1976.

Federal Policy and Industrial Innovation

In 1979, the issue of industrial innovation gained prominent Congressional attention due to declining industrial productivity and a diminished technological superiority in the international arena.[6] Of primary concern was the issue of how Federal policy might stimulate industrial innovation,

and create an environment conducive to the implementation of state-of-art technology. In excess of 85 bills were introduced by the Ninety-Sixth Congress.[7] These are listed in Table 3-1 where they have been grouped in conformity with the classifications used by the Domestic Policy Review on Industrial Innovation.

A majority of the bills focused on regulations, and suggest changes in both the regulatory process and content of regulations. Their sponsors' intent was to stimulate the normal process of innovation by reducing regulatory uncertainty, and employing alternative policies for achieving the same ends. Several bills proposed screening criteria for reviewing the effectiveness of regulations (e.g., cost-benefit analysis, economic impact analysis).

Another large class of proposals were targeted at small business, a group which accounts for a disproportionately large share of new innovations. Legislative proposals included: direct Federal R&D support; enhancing the integrity of patents; permitting firms to retain title to inventions developed under Federally funded RD&D projects; and tax incentives for R&D.

The emerging consensus that the major challenge to the nation was stimulating the supply side of the economy was translated into several bills, which incorporate economic incentives. In the House the Capital Cost Recovery Bill, HR 4646, had 265 cosponsors. The bill would adopt a reduced depreciation period which:

...better enables the tax system to reflect the rapidly escalating replacement cost of plant and equipment in an inflationary period. The antiquated useful life depreciation system would be replaced with a 10-year depreciation schedule for buildings, a 5-year period for equipment, and a 3-year write-down for automobiles and light trucks ... Adoption of the 10-5-3 plan would also bring the U.S. tax system into line with the practices of almost every other industrialized nation. They long ago abandoned the cumbersome and static useful life system. Today that disparity costs U.S. taxpayers hundreds of millions of dollars because foreign competitors can writeoff new capital expenditures in 10 years while it takes almost 15 years to recover the cost of comparable new equipment here.

Congressman McKinney
Dec. 4, 1979
(Ref. 8)

Other tax incentives proposed would: provide tax credits for R&D expenditures (S1257), change the amortization period for R&D expenditures; and provide an income tax credit for corporate contributions to an institution of higher education for basic research in the physical sciences (S1065).

Government Organization

The fragmented jurisdiction of Congressional committees over industrial policy was a matter of increasing concern in 1979. This issue involved two elements; organizational structure, and institutions to generate the data and analysis necessary to support policymaking:

TABLE 3-1. SUMMARY OF LEGISLATION ON INDUSTRIAL INNOVATION, 1979*

I. Direct Federal support of R&D

A. Enhance Federal support of small business R&D
HR5126
HR5330
HR5607
S1074
S1860

B. Provide grants to disseminate technologies developed under Federally funded RD&D programs
HR4396

II. Patent policy

A. Improve patent incentives for small business
HR5427
HR5607
S1074
S1860

B. Permit nonprofit and small business organizations to retain title to inventions developed under Federally funded RD&D projects
HR2412
HR5343
HR6186
S414
S1250

C. Establish a uniform Federal system for management and use of results of Federally sponsored R&D to promote commercial use of new technology
HR5427
HR5715
S1215

*Source: Legislation on Innovation, Task Report on file at DOT/TSC, February 23, 1980.

TABLE 3-1. (CONTINUED)

III. Information policy

A. Develop and implement programs for transfer of Government-owned innovative technology to industry, transportation sector, etc., for application and use
HR5427
S1215

B. Establish Centers of Industrial Technology for research, assistance in evaluating technological ideas, technical assistance, and curriculum development and instruction in industrial innovation
HR4672
HR6186
S1250

C. Establish means of exchange of information on foreign markets
HR3783
HR4034
HR4526
HR5061
HR6008
S737
S2097

IV. Environment, Health, and Safety Regulations

A. Establish councils to study, analyze and advise on proposed rules
HR76
HR1333
HR3150
S51
S238
S1291

B. Consider regulation's overlap with other regulations
HR77
HR1312
HR2364
S53
S104
S1291
S2147

TABLE 3-1. (CONTINUED)

C. Give long-term notice of agencies' regulatory intent
HR3150
HR3263
HR 4233
S53
S93
S262
S755
S2147

D. Require timely rulemaking timetable
HR3242

E. Require consideration of alternatives to proposed regulation
HR2456
HR3150
HR3263
HR4233
HR4882
HR6040
S93
S104
S238
S262
S755
S1291
S1969
S2147

F. Require cost-benefit analysis of proposed regulation
HR430
HR1008
HR1252
HR2983
HR4882
HR6040
S1969

G. Require analysis of economic impact of proposed regulation
HR808
HR1067
HR1387
HR3150
HR4882
S104
S2042

TABLE 3-1. (CONTINUED)

H. Require agency justification for choosing design over performance standard
HR2456
S93

I. Prohibit agencies from regulatory actions which inhibit competition
S1291
S2147

J. Require President to submit plan to reform regulations and report on cumulative impact of regulation on industry
S445

K. Require regulatory analysis for each regulation proposed; may include justification for the rule, consideration of alternatives, economic impact, costs and benefits, competitive considerations, paperwork considerations, duplicative rules
HR2456
HR3263
HR4233
S53
S93
S262
S755
S2147

L. Ease regulatory burden on small business
HR5607
S1860

M. Clarify antitrust laws
HR3190
HR4118
HR5061
S864
S1499
S1744

V. Economic Policy

A. Increase tax incentives for small business R&D
HR5313
HR5607
S419
S1860

TABLE 3-1. (CONTINUED)

B. Research and experimental expenditures connected with a patent may be amortized for not less than 60 months
HR4407
S1254

C. Provide tax credits for investment in R&D expenditures
HR4405
HR4406
HR4933
HR5435
HR5881
S1065
S1256
S1257
S1345

D. Capital Recovery
HR4646

E. Exempt some research expenditures from consideration in industrial development bond rules
HR6277

VI. Trade Policy

A. Review items prohibited from export
HR2539
HR3216
HR3783
S737
S1744

B. Minimize application of U.S. laws to business conduct outside the U.S. by domestic firms
HR4034
S737
S977
S1003
S1982
S2164
S2165

C. Encourage small business exports
HR3895
HR6008
S2040
S2104

TABLE 3-1. (CONTINUED)

D. General measures to increase exports
   S937
   S1663
   S1744

"The fact is, however, that we lack the institutions to conduct the continuous and comprehensive factfinding, analysis, and policy coordination that are essential. Technology, productivity, and investment are not central to any agency's concerns, however central they are to a nation's deteriorating position in an increasingly unstable world. The President has neglected to correct that deficiency. In spite of its management of the Domestic Policy Review and new international trade functions, the Department of Commerce apparently has no responsibility for overseeing implementation of the President's recommendations, beginning to monitor technological development in key sectors of the economy, or recommending further measures to influence its rate and direction. Instead, the charge is given to the ineffectual Productivity Council, chaired by OMB and, like the Domestic Policy Review itself barred from evaluating fiscal and monetary policies."

Senator Howard Cannon
Dec. 20, 1979 (Ref. 9)

Two bills were introduced which dealt with the above problem. The legislation which received the most attention was S1250, the National Technology Innovation Act of 1979. Along with a similar bill S1215, the Science and Technology Research and Development Utilization Policy Act, the legislation contained the following proposals.

An Office of Industrial Technology will be established in the Department of Commerce with a mandate for providing data gathering and analytical support for industrial policy development

Centers for Industrial Technology will be established at universities to perform research on generic technologies

An Industrial Technology Review Panel will be established to improve the Federal government's ability to identify future sectoral problems, and opportunities to advance technologies which can make important social or economic contributions.

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[5]U.S. Congress, Senate A Legislative History of the National Science and Technology Policy, Organization, and Priorities Act of 1976, Prepared for the Use of the Committee on Commerce, Science, and Transportation and the Committee on Human Resources, 95th Cong., 1st sess., 1977. This committee Print lists dates and citations for all hearings and floor debates.

[6]Literature Review on Industrial Policy, (Material on file at DOT-TSC). Jan. 1980.

[7]Legislation on Innovation, Task Report, Feb. 1980

[8]Congressman S. McKinney, Congressional Record - House, Dec. 4, 1979.

[9]Senator H. Cannon, Congressional Record - Senate, Dec. 20, 1979.

3.4 ISSUES RAISED

Reviews[1] of congressional activity on science, technology, and public policy in the 1960's indicate that Congress did the following:

> Concentrated on technical advancements, rather than the process which brought them about or the environment for innovation.
>
> Looked at federally funded projects only, without addressing government mechanisms other than R&D funding.
>
> Strengthen technological development by focusing on education, and high-level policy directives.

This concern contrasts sharply with that which developed in the 1970's, when many, more complex issues were raised. One reason for this shift in focus was articulated by the Chairman of the House Committee on Science and Astronautics in his introduction to hearings on Federal science and technology issues:

> ...At least dollarwise, the peak Federal effort in supporting scientific research and development which took place in the mid-sixties has been diminishing. Where the Federal Government put 12.6 percent of its budget into research and development in 1965, it is today (1973) putting an estimated 6.4 percent of its budget to this use. And while Federal obligations for research and development have increased an estimated 9 percent since 1965, the inflation factor has increased from 35 to 39 percent, depending on what index is used.[2]

The decline of government support of science and technology was cited by other members of Congress, as well as by witnesses, as an issue which must be addressed. It was also an issue which led to consideration of other questions concerning science policy, technology and the economy, and a new perspective on these questions. During Congressional testimony, the following issues were raised:

Government Role

Government does have an effect on, and a role to play in, stimulating industrial technological development. Stimulation of industrial R&D must be a foremost consideration and high priority in formulating government policy.

The role of government is not limited to direct support of R&D through agency funding. Neither is it limited to support of military, as opposed to civilian, R&D.

The United States patent system, antitrust laws, and regulatory structure must be reevaluated for its impact on technological development and innovation.

Regulators must consider the impacts of their policies on innovation. Adverse impacts of regulation are felt most intensely by small firms, and therefore regulatory policies can have an anti-competitive effect as well as retard innovation.

Technology and Economic Welfare

Technological development directly relates to economic health and growth.

Utilization of new knowledge, (i.e., technological, or managerial) can, but does not necessarily, increase productivity and GNP. The important effect of technological innovation on economic growth justifies further Congressional study of this issue.

International transfer of technology must be evaluated for its effect on the U.S. position in the international market and on the U.S. international economic condition.

Productivity and employment, and the development of scientific and technical labor, are issues related to technological development which should receive consideration in policy-making.

The majority of issues raised contained implicit recognition of the fact that government policies, ranging from patent, to tax, to regulation, effect the rate and level of industrial innovation. This point was also raised explicitly by several witnesses.

Impact of Federal Science Policy on the Private Sector

We must not forget that an active Federal science policy will have varying degrees of impact on the private sector. For example, the expenditure of funds may trigger a correspondingly large expenditure in the same area by the private sector or it may equally cause a shift in private capital to an area not supported by the Federal Government.

Accordingly, in developing our Federal science policy we must constantly keep in view the type of spin-off effect it will have on the private sector.[3]

"The largest and most effective machinery for technological innovation in the nation is provided by our system of business enterprises. It is therefore essential, in my view, that national science policy focus directly on those actions which Government can and should take to improve the effectiveness of our business organizations - large and small-in achieving technological innovation.

"This point is particularly important in considering policies and actions aimed at stimulating and guiding the application of business management, capital, and technological resources to satisfy demands not currently served effectively by established market forces.

"...The Government can and should use its purchasing power to sponsor selected research and development, its regulatory and standard-setting authority to establish rules and criteria, its taxing authority to provide special incentives, and its leadership generally to help remove the deterrents which discourage or prevent private industry from making major investments of capital and technology and management skills in critical urban, social, and environmental problems."[4]

The testimony quoted above expressed the view repeated by many industry witnesses that Federal science policy has a significant impact on the private sector which should not be

underestimated. Congress is also reminded that the business community is a resource which can be mobilized to achieve national goals.

Frank Press, Director of the Office of Science and Technology Policy in his testimony a year ago, reaffirmed this assessment of government's impact on private sector R&D.

> *... I think what you're driving at is a greater sensitivity of the impact of Federal research policy in our industrial sector... We have to examine this question from many points of view, not simply R&D support. We must examine the whole area of technological innovation and its foundations, as well as, Government policy across-the-board, the patent policy, the regulatory policy, the tax policy, the monetary policy. These are very complicated issues... Many countries are showing in recent years a greater sensitivity to governmental impact on innovation than we've shown in the past.*[5]

3.5 POLICY ISSUES FOR THE EIGHTIES

The challenges of the eighties will require Federal policies which support industrial revival.

> *...there is a need for a shift in the focus of monetary and fiscal policies away from short-run crisis containment toward steady long-term economic growth. In the past two decades, there has been too much emphasis placed on "fine tuning" the economy. In the future, monetary and fiscal policy should be conducted in a stable manner.*[6]
>
> The 1980
> Joint Economic Report

Critical policy issues for the next decade include: increasing capital formation, a re-configuration of the government-industry relationship; defining market structures

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[2]U.S. Congress, House, Federal Policy, Plans, and Organization for Science and Technology, Hearings before the Committee on Science and Astronautics, 93rd Cong., 1st Sess., 1973, p. 2

[3]Prepared statement of Myron Tribus, Assistant Secretary of Commerce for Science and Technology, July 22, 1970, in, U.S. Congress, House, Committee on Science and Astronautics, National Science Policy, Hearings before the Subcommittee on Science, Research, and Development, 91st Cong., 2nd Sess., 1970, p. 115-116.

[4]loc. cit. Statement of Ruben F. Mettler, President, TRW, INC., Sept. 17, 1970, p. 537-538.

[5]U.S. Congress, House, Research and Development in the Federal Budget, Hearings before the Committee on Science and Technology, 96th Cong., 1st Sess., 1979, p. 60.

[6]Joint Economic Committee, Congress of the United States, The 1980 Joint Economic Report, p. 33, Feb. 28, 1980.

[7]Remarks of Jerry J. Jasinowski, Asst. Sec. of Commerce for Policy, Congressional Record - Senate, Oct. 23, 1979.

which spur competition while encouraging joint industrial activities; and the generation of data and analyses which will allow policy development at the sectoral level. Central to the debate over regulations is the issue of the relative priorities society attaches to economic goals, environmental objectives, and social mandates. These policy issues are discussed below:

The challenge of the 1980's, in order to address the deficiencies of economic policy and to cope with the paramount problem of inflation, is to focus on the supply side of the economy. Attention to the supply side, I would argue, means shifting from a preoccupation with the ebb and flow of the business cycle, to a searching analysis of the effect of economic policies on the long-term structure, performance, and growth of sectors and industries. In that sense, I believe supply side policies are essentially economic growth and industrial policies.

1. Supply constraints. Supply shortages, most notably energy, already constrain growth, add to inflation, and reduce the margin of freedom for both government and private enterprise actions. As we move into an era of increased scarcity, we can expect additional shortages in water, arable land, lumber, and basic metals. We must begin to recognize the real limitations posed by finite natural resources and adjust our policies accordingly to create far stronger incentives for achieving two seemingly contradictory objectives; adequate supply as well as conservation.

2. Capital formation. The shortages we are beginning to see in natural resources are also reflected in our capital stock.

The stock of fixed capital has grown at a much slower rate than the labor force, dropping from a 4.4 percent growth rate in the late 60's and early 70's to 1.9 percent in the period 1973-1976.

Technology and innovation. Hand-in hand with a rethinking of our tax and regulatory policies must come a revamping of our policies towards industrial innovation. You in the semiconductor industry are perhaps more aware than anyone else of the impact of government policy on the innovative process, whether through its investment in R&D spending, its procurement policies or its procedures governing the patent system. You

are also quite obviously aware of the deficiencies of existing policies regarding technology and innovation. Perhaps here more than anywhere else there is a trend for government policies geared to the specific technological problems of individual industries. Industrial innovation is, in my mind, the policy frontier of the 1980's. Business as well as government must work to expand that frontier.

Human capital. Increased investment in physical capital must be accompanied by increased investments in human capital on the part of both the public and private sectors. Of particular importance within an industrial policy framework is the need to identify long-term growth sectors and their future employment opportunities.

Jerry Jasinowski, Asst., Sec. of Commerce for Policy[7]

3.6 SUMMARY

The issues of technological innovation and industrial policy have been separate Congressional concerns until recently. During the sixties Congressional technology policy was synonymous with Federal funded R&D. The seventies marked the beginning of a new direction on technological issues. Hearings during the first half of the decade established a link between technological innovation and economic growth. This led to an examination of the impact of government policy on industrial R&D, and a broadening of the potential Federal policy options. It is noteworthy that economic incentives were not proposed for stimulating innovation until 1973, after this linkage had been established. In this role they first surfaced in a study of Federal subsidy programs carried out by the Joint Economic Committee.

A major shift in the focus of the debate over national technology policy occurred in the 1975-1980 period. The expansion of government involvement in private sector activity led to a fundamental shift in the locus of economic decision making. Concern about the government's intrusion into the private sector frequently focused upon the impact on technological innovation. As a result the linkage among government technology policy, Federal regulatory action and industrial innovation came under scrutiny. Faced with declining National productivity, there was widespread

Congressional belief that Federal policy should focus on improving the climate for innovation. A review of the legislative activity (in 1979) reveals that this sentiment was frequently translated into attempts to "reform" the regulatory process.

In 1979, a consensus began emerging that the major challenge to the Nation was in stimulating the supply side of the economy. In conjunction with this objective, economic incentives were given prominent consideration. Specifically the Capital Cost Recovery Bill received widespread support in the House. A variety of other economic incentives were proposed including: tax credits for R&D expenditures; changes in the amortization period for R&D expenses; and income tax credits for corporations which contribute to institutions of higher education for basic research in the physical sciences.

Looking ahead to the eighties, the question of industrial revival has emerged as a leading policy issue. Its elements include: increasing capital formation; redefining the relationship between government and industry; identifying market structures which will spur competition at the international level while encouraging joint endeavors; and formulating government policies geared to the specific technological problems of individual industries. Within this evolving context technological innovation is perceived as an element of the broader problem of national industrial policy.

Federal Legislative activity regarding industrial innovation has been slow to develop over the past twenty years, particularly with respect to economic incentives. Congress began by looking at the organizational structure within the Federal government and its implications for science and technology policy, and later focused on policy development. The lack of substantive legislation reflects the fact that technological innovation was never considered a top priority national issue. Furthermore, it is an issue which lacks a broad constituency. Although the business community would appear to be a natural advocate, its voice has been muted due to deep divisions within its ranks concerning the appropriate role of the Federal government. These institutional issues have thwarted all past attempts at developing a national industrial policy, and must be resolved if the nation is to meet the challenges of the new decade.

4. CONCLUSIONS

A review of Task Force studies and Congressional activity on technological innovation during the past two decades reveals a rich data base. The recommendations of the National Commission on Technology, Automation, and Economic Progress (Bowen Commission), Commission on International Trade and Investment Policy (Williams Commission), the Department of Commerce's Technology Policy Study (Ancker-Johnson Report), and Domestic Policy Review of Industrial Innovation (Baruch study) are summarized in Table 2-1. Recent legislation on industrial innovation is summarized in Table 3-1. Just about every conceivable policy mechanism for spurring innovation has been proposed during this period, and its merits discussed.

The issues of technological innovation and industrial policy have been separate Congressional concerns until recently. During the sixties, Congressional technology policy was synonymous with federally funded R&D. Accordingly, the thrust of both Task Force activity and Congressional efforts was centered on improving the effectiveness of federally funded R&D, and expanding its scope to include the application of technology to social problems. A critical issue was whether there was a legitimate role for government in facilitating industrial innovation. The Bowen Commission established that such a role did exist, and subsequent task forces focused on what that role should be, and how it

could be performed most effectively. Charpie's Panel examined what role the government could play in improving the environment for technological innovation through its taxation, finance, and anti-trust policies. The Ancker-Johnson report expanded the concept of government involvement by (1) specifying actions which would make the Department of Commerce an advocate within government for technological innovation, and (2) recommended a series of proposals which would improve the climate for technology-based enterprises. Finally, the Domestic Policy Review went a step further by stressing the need for a comprehensive Federal approach to industrial innovation, which would incorporate a variety of complementary policy mechanisms.

Another important concept established during the sixties and early seventies is that technological innovation and economic development are related. Acceptance of this linkage developed slowly. The Bowen Commission (1966) reported that there is a definite link between technology and economic progress. Subsequent Task Force studies accepted this and focussed on examining the nature of this relationship. For example, the Williams Commission (1971) concluded that technological innovation had a more widespread impact on the economy than had been previously reported. It linked technological capability and economic growth to export performance and the U.S. position in international trade. The Ancker-Johnson study promoted institutional recognition of

the connection between technology and the economy through its recommended policies for the Department of Commerce.

Within Congress, concern for the linkage between technology development and the economy began surfacing in 1971, and was undoubtedly influenced by awareness of the issue created by the Task Force studies. Prior to this time, the economic and finance oriented committees displayed little concern for the impact of fiscal policies on industrial innovation. The focal point for innovation was the Subcommittee on Science Research and Development, whose interest was an off-shoot of its mandate for science policy development; specifically, assessing the contributions of science and technology to the economy in order to determine an appropriate level of R&D support. In recognition of the fragmented jurisdiction over areas involving science, technology and R&D, Congress initiated a series of hearings in 1973 on Federal policy, plans and organization. This debate over government organization has continued since without adequate resolution. However, comparison of the National Science Policy and Organization Act of 1975, HR4461, with the National Technology Innovation Act of 1979, S1250 shows many important trends. The latter bill perceives technology in a much broader context and defines an activist role for the government in the development of industrial technology.

In the seventies a fundamental change occurred in technology policy in response to broader societal forces. The expansion of government involvement in the private sector had led to a shift in the focus of economic decision making. Concern about government's intrusion into the private sector frequently focused on its impact upon industrial innovation. As a result, the relationship between government technology policy, regulatory action and private sector innovation came under scrutiny, and became better understood. Also, Congress paid increasing attention to the impact of its actions on industrial development and innovation. Faced with declining national productivity and a loss of international technological leadership, there was widespread Congressional belief that Federal policy should focus on improving the climate for innovation. Legislative activity reveals that the main thrust of this sentiment was to modify the regulatory process, either to reduce regulatory related uncertainty or the cost of compliance.

In 1979, a new policy objective emerged, namely industrial revival. This concern was identified as a leading policy issue for the eighties. Implicit is the need to stimulate the supply side of the economy. Accordingly, economic incentives began receiving prominent attention. For example, the Capital Cost Recovery Bill found widespread support with 265 House members as cosponsors.

Other elements of this policy thrust include: increasing capital formation; redefining the relationship between industry and government; and gearing government policies to the specific technological problems of individual industries. Thus, it appears that in the eighties technological innovation will be perceived within the broader scope of national industrial policy.

Of the many proposals made, it is now generally agreed that tax policy is the most effective incentive for encouraging industrial innovation. Changes in the regulatory process, patent policy, information policy, direct funding of R&D and other actions were suggested by the task forces and Congressional panels. These would have a positive effect on innovation in American industry, but none would have as great or as certain an impact as tax incentives. Thus, this latter group of policy instruments is perceived as complementing economic incentives by enabling the normal process of innovation within the private sector.

It should be emphasized that although these policy issues have been continually studied they have rarely been acted upon. While many of the studies and proposals received serious consideration by the public sector, action commensurate with this interest has not followed. In some cases this was because technological innovation was studied in isolation from economic policy. Past inaction can also be attributed to the relatively low priority attached to

technological innovation in Congressional circles. Furthermore, although a consensus has been reached that the government has a role to play in fostering innovation, there is no agreement concerning what form this intervention should take. As a result it has been difficult to develop a constituency. For example, the private sector would appear to be a natural advocate for a national technology policy, yet its voice has been muted due to such differences of opinion. Lastly, past studies have been ineffective since they treated the innovation process in the "abstract." Consequently they could not identify specific technological deficiencies that might arouse public concern, or new technological opportunities that could generate enthusiasm and constituency support. Each study neglected the sector-by-sector assessment that is necessary to accomplish this.

This paper has summarized what has transpired in two areas; studies on innovation by Task Forces and Commissions, and Congressional Hearings and resultant legislation. It has laid the groundwork for future policy synthesis by identifying the evolution of concerns, critical issues, areas of consensus and the response to past initiatives. In the future as specific economic incentive policies are formulated for the motor vehicle sector, the issues of equity, efficiency, and impact on innovation must be addressed. These questions will require a greater knowledge of industry's response than currently exists; the acquisition of such information must be

initiated now lest debate over industrial policy continue to falter due to the uncertainty of the impact.

Finally, this study has underscored the critical role of institutional barriers in thwarting past attempts to implement a national technology policy. Federal policy-making must attach a higher priority in the future to developing an appropriate institutional environment if the objective of implementation is to be achieved.

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