

Chapter II

**GOVERNMENT INVOLVEMENT
IN THE INNOVATION PROCESS**
Policy Implications

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INTRODUCTION

This report is concerned with the relationship between Government action and technological innovation in the civilian sector of the economy. Because that relationship is exceptionally wide-ranging and complex and its importance is subject to considerable debate, the general effectiveness of Government influence on innovation cannot be adequately assessed in this work, nor can a thorough evaluation of individual programs be provided. Neither task is the purpose here. Rather, this document is intended to accomplish the following:

- To develop an appropriate framework for viewing the relationship between Government action and innovation.
- To provide a comprehensive overview of the major existing U.S. Government programs and policies having both intended and unintended effects on innovation.
- To understand typical responses of U.S. industry to Government programs in several selected industry contexts.
- To review some selected experiences of foreign governments in the innovation process, taking note of particularly effective or ineffective policies.
- To suggest a series of important issues concerning the Government-innovation relationship in the United States to provide a basis for considering the reorientation of existing policies.

It is important to be clear at the outset about both the definition of innovation and the range of Government programs with which this report is concerned. Innovation is the commercial in-

roduction of a new technology and is not to be confused with invention, which is the development of a new technical idea. The innovation process includes a complex and interconnected set of activities leading from invention to commercial introduction, but not necessarily in any prescribed sequence. Although R&D is often an important part of this process, it is by no means always the most important, nor is it often likely to be a sufficient condition for successful innovation.

The interaction between Government programs and innovation is very wide-ranging, and Government influence on all elements of the innovation process may be significant. This report is concerned with all aspects of that influence. Thus, the Government programs surveyed include those intended to enhance innovation as well as those intended to control it. They include not only those programs directed at the actual commercial introduction of a new technology, but also those affecting the various factors and inputs leading to innovation and the various social impacts resulting from innovation. In addition, the unintended but nevertheless important effects of programs designed to serve a variety of social purposes not directly related to technological innovation are also considered.

The Approach and Structure of This Report

There were several elements to the research involved in this report. This chapter explores the various justifications for Government concern with innovation. In chapter III, the U.S. experience was considered from two perspectives.

One element began with a comprehensive documentation of existing Government programs and drew upon a series of analytical studies, ' which attempt to understand their effects (*Government Programs*, p. 19). Although this approach was useful, it was not sufficient to understand fully the complexity of the Government-innovation relationship. Because the focus of this approach was on programs and their intended purposes, it was unable to uncover some of the unintended consequences of the program or assess programs fully in combination.

In order to have a more balanced approach, a second element of the research focused on several industries where the total effects of Government programs were felt (*A Comparison of Selected Industry Experience*, p. 35). Studies utilized here attempted to understand the nature of the innovation process in industry² and whether

²See, for example: 1) *The Impact of Governmental Restrictions on the Production and Use of Chemicals*, CPA, December 1976, 2) *An Analysis of the Effects of Public Regulation on the Copper Wire Industry*, CPA, March 1977, and 3) *Program Development Procedures and Transfer Mechanisms in the National Sea Grant Program*, CPA, November 1977. These studies focused on the overall effects of individual programs, not just the relationship to innovation. They were useful to this research effort in providing factual material about existing programs, in developing evaluative tools, and in placing the Government-innovation relationship within context of other governmental goals.

³These studies have been documented and summarized in other Center for Policy Alternatives reports, including an earlier report to the Office of Technology Assessment, *Government Action and the Innovation Process*, April 1977, the results of which have been incorporated into this document.

and how Government action has actually influenced the pattern of innovation in an industry—within the context of other forces that also influence it. The combination of these two research elements yielded a relatively full factual picture of the Government-innovation relationship. Both perspectives were necessary to obtain this understanding.

Another major element of the research drew upon a series of studies³ examining foreign government policies in regard to technological innovation (chapter IV). This analysis provided useful contrasts to the U.S. experience. None of these research efforts involved original empirical research; rather, each was a synthesis of existing studies.

The final element of this research involved utilizing all of these components in order to derive a series of important policy issues for congressional consideration (chapter V). It should be noted that these issues do not attempt to recommend specific legislative actions, but rather to suggest broad areas where Congress might consider future actions to reinforce the momentum or channel the direction of U.S. technological development.

These components of the analysis and the relationships among them are presented diagrammatically in figure 1.

⁴See *Government Support for Technology: An Examination of the Foreign Experience*, CPA 75-12, 1975. The results of this study and others were summarized in the April 1977 CPA report to OTA (see footnote 2) and are recapitulated in chapter IV of this report.

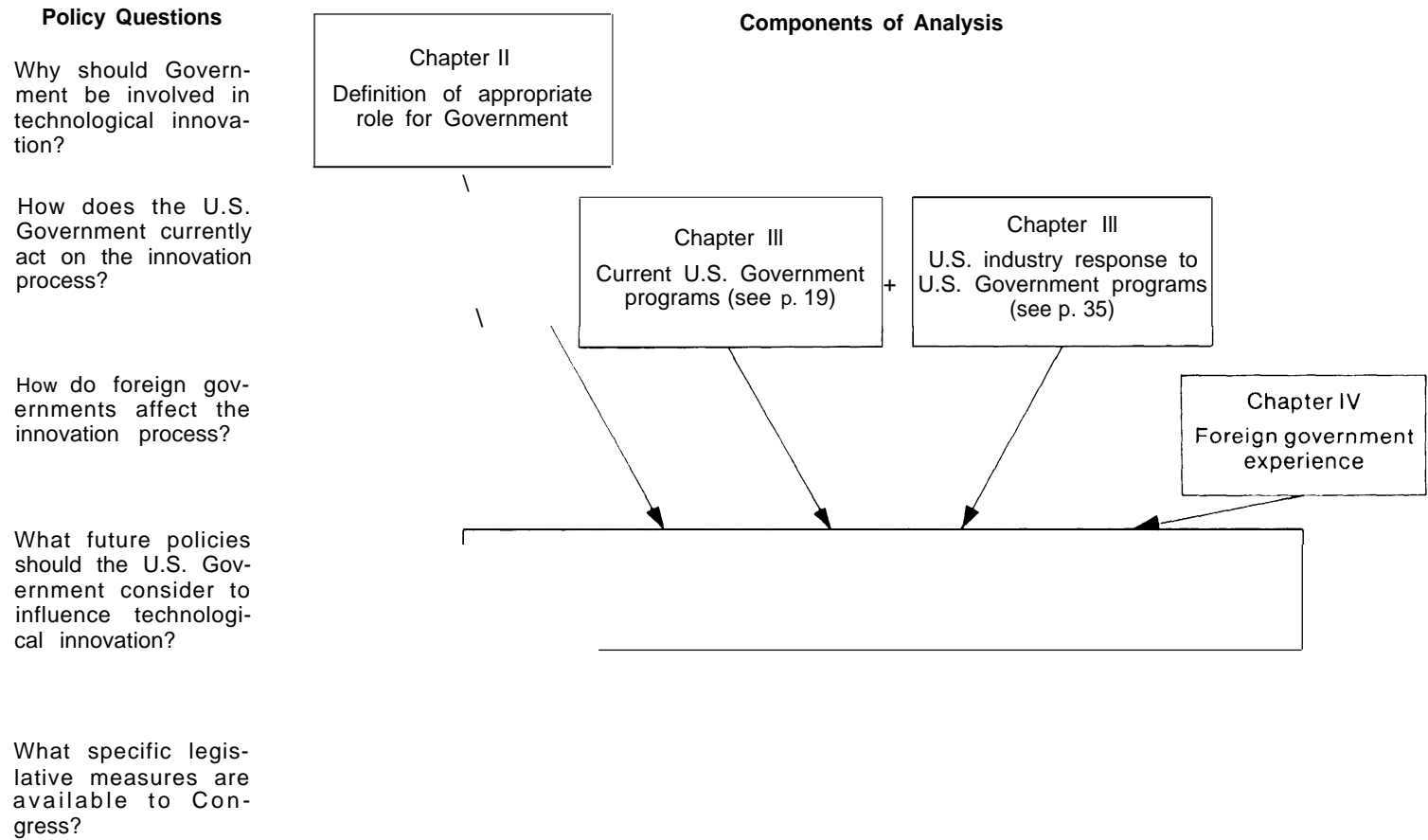
THE GOVERNMENT ROLE IN THE INNOVATION PROCESS

Technological innovation in the civilian sector of the U.S. economy occurs largely as a direct result of the activities of private firms. This being the case, one may well ask why the U.S. Government should be concerned with innovation and what, even given this concern as a legitimate governmental function, its appropriate role should be. Various governments answer this question differently and thus the degree of involvement in industrial innovation varies from country to country, influenced in part by the prevailing economic and political systems. For example, many governments, in both developed

and developing countries, own and run enterprises that would be private in the United States. This is especially true in heavy or high-technology industries, where governments often become the prime developers, users, and marketers of innovations. Even when the government does not own the producing enterprises, subsidization and or direct support for the innovation process in industry is common.

This is not to argue that the U.S. Government should necessarily do likewise. However, it should be recognized that the governmental

Figure 1.—Government Involvement in the Innovation Process
 (Diagrammatic View of CPA Analysis)



SOURCE Center for Policy Analysis

presence in the United States may be as significant as that in other countries, although it takes a different form. For example, the U.S. Government has historically been involved in supporting selected industries (see chapter III, *Government Programs*, pp. 19) and currently plays a major but indirect role in the innovation process through various economic and social policies or regulations. Although many of these programs and regulations are not directly aimed at influencing the innovation process, their impacts may often be greater than those arising from direct Government support for technological development.

Reasons for Government Concern With Innovation

Governments are not concerned with technological innovation for their own sake, but rather attempt to promote it or manage it because of the social, economic, and political effects that result. For example, because technological change has been shown to be an important contributing factor to economic growth, governments seek to encourage it. Similarly, innovation is promoted in order to increase productivity and retard inflation or to improve the international competitiveness of a nation's products and improve its balance-of-payments position. On the other hand, governments are also vitally concerned with the adverse effects of technological change, including unemployment, pollution, and unsafe products. In this case, policies may be directed toward the control rather than the promotion of new technologies. In none of these instances, however, is the relationship between the social goal and technology simple or unidirectional. For example, although technological changes may have led to pollution, they must also certainly occur in order to control it. The crucial point is that in a technologically based society, the process of innovation is intimately related to many, if not most, of the important social goals of that society and that innovation is therefore a critical element of most government policies.

Going beyond these rather general reasons for government concern with innovation, there are also strong arguments why the government should intervene directly to influence innovation under certain circumstances. These interventions

are usually justified because of market failures or deficiencies of the following kinds:

THE PUBLIC NATURE OF KNOWLEDGE

Private firms may underinvest in the development of new technology (from a societal point of view) because they are not able to capture all of the benefits resulting from such investments. This situation, often called the "appropriability problem," occurs because the knowledge which results from investments in technical development can usually be readily acquired by others who will compete away part of the benefits from the original developer. Basic research in particular suffers from this problem because its output is usually an advance in scientific or technological knowledge that can subsequently be used in applied research and commercial development by a wide and often unforeseeable range of firms. Moreover, new technical developments also tend to be highly uncertain in terms of results and utility. Thus, direct government support of this class of R&D is necessary to correct for underinvestments. In addition, government support for technical development may have positive effects for firms other than those in which the research is performed, thus creating "positive externalities."

STRUCTURAL CHARACTERISTICS OF INDUSTRY

The problem of indivisibility exists where economies-of-scale requirements prevent small organizations from undertaking certain activities viably and efficiently. For example, certain industries may be too fragmented and firm size too small to support an adequate research and product development effort. Furthermore, large oligopolistic firms may concentrate their resources on short-term improvements in existing products rather than on risky and market-disturbing long-term innovations. Individual consumers face a similar problem in that they often lack the information to make wise purchases or the market power to be effective bargainers. In these situations, the large economies of scale suggest that support from the Federal Government is needed for some types of R&D, or that cooperative industrial or consumer efforts must occur in order to attain the minimum efficient size.

SOCIAL AND POLITICAL NEEDS

The “public goods” problem refers to the fact that there are certain goods whose benefits are difficult or impossible to deny to a citizen who is unwilling to pay for them. For example, all U.S. residents enjoy the full benefits of national defense even though they might not want them. Therefore, for public goods, the decision of how much to supply to individual units cannot be made by the market, but must be made by the political system. This is in contrast to the situation where the market can provide the appropriate results if the government attaches the right costs and benefits to the appropriate decision making units. It is thus justifiable for the government to directly support the R&D for these types of goods.

There is also another direct, intended role for government. In part, this role is one of control. Technological innovations are frequently accompanied by undesirable social or economic consequences, such as environmental pollution, health or safety hazards, and displacement of workers. In these cases, the government as overseer and protector of the public interest must play a very direct role in ameliorating such undesirable effects, via planning, controls, regulations, or transfer payments. The government presence is necessary either because the private market has not eliminated or cannot be expected to eliminate these undesirable effects, or because efficient market solutions are not desirable social policy.