GOVERNMENT INFLUENCE ON THE PROCESS OF INNOVATION IN EUROPE AND JAPAN

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INTRODUCTION

The process of industrial innovation does not occur in a vacuum. It is very strongly influenced by such environmental factors as the general state of technological knowledge, market conditions and resource availability. To an increasing extent these environmental factors are influenced directly or indirectly, intentionally or unintentionally by government policies and activities.

Since there are a number of countries that have had a relatively long experience with governmental policy to stimulate innovation, it is appropriate to attempt to measure the actual impact of such policy. In this way, different forms of policy, activity and institutional form can be compared in terms of effectiveness, and individual countries can learn both from self-examination and from comparison with others.

In addition to direct policy aimed at stimulating innovation, there are many government policies that are intended for other purposes, but can often have a serious effect on the process of innovation. Fiscal and trade policies, for example, certainly influence the innovation process, although this is seldom their principal intent. Consequently, any examination of governmental influence on innovation must consider the unintended as well as the intentional impact.

RESEARCH METHOD

To assess the impact of government on the innovation process a sample of projects, aimed at new product or process development, was chosen from firms in five industries in France, West Germany, Holland, The United Kingdom and Japan.[1] Firms were asked to nominate three R&D projects, around which interviews would be focussed. The first of these was to be one re-

[1]For a more complete report on the entire study see Center for Policy Alternatives (1976).

garded as a commercial success; the second was to be a project which was commercially unsuccessful; and the third was to be a project, still underway. The successful and unsuccessful projects were to have been initiated after 1968.[2] In order to better test the effects of more recent government policies, data were also gathered on an ongoing project, from the post 1971 era.

The idea of sampling successful and unsuccessful projects was very simply to see whether in a large sample government influence of different sorts would be more often associated with one or the other. The ongoing project was added to see whether changes in government policies over the last few years would have any discernible effect on the conduct of the projects.

Distribution of the Sample of Projects

Each of the projects studied was identified with its country, industry, and sampling category (successful, unsuccessful, and on-going) and confidentially with a firm and respondent(s). The distribution of these sample descriptors are shown in Tables I and II.

Germany, with 47 cases (28.7%), the United Kingdom with 46 cases (28.0%), and France with 35 cases (21.3%) make up the bulk of our total sample of 164 projects followed by Japan with 21 cases (12.8%) and the Netherlands, with 15 cases (9.1%). We would like to have had larger representation from Japan and the Netherlands, because each country is unique in its industrial structure and industry, government relationships. To our knowledge this is the first time that any number of extensive project case histories have been included in a comparative study from either country.

Several industries were included in the study, because the influence

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[2] There were two purposes for this. First, it was desirable to have all projects in roughly the same time period. Second, if they were fairly recent, people would be better able to remember events and circumstances. In fact, not all of the projects were this recent. In a few cases, it was necessary to go further back in time to find an unsuccessful (or a successful) project.

and effectiveness of government actions and policies should be expected to differ on an industry to industry basis. The sample is about evenly divided among five industries: computers, with 30 cases (18.3%), consumer electronics, with 32 cases (19.5%), textiles, with 30 cases (18.3%), industrial chemicals, with 44 cases (26.8%), and automotive, with 28 cases (17.1%) of the total. The proportion of projects from each industry is similar for West Germany and the United Kingdom as shown in Table I. France has a slightly greater number of textile projects and fewer from the computer and auto industries. No projects were included from the textile industry in Japan or from the computer or auto industries in the Netherlands.

By design the sample should be evenly divided among industries and countries across categories of the remaining dimension. In fact this is roughly true. There are 66 successful cases (40.2%), 51 unsuccessful cases (31.1%), and 47 which are on-going (28.7%), and these are divided in the same proportion among industries as shown in Table II and among countries.

Project interviews were conducted in 59 companies, at 64 separate field sites. The study included projects from both the industrial chemical divisions and the textile divisions of two chemical firms and from the comsumer electronics and computer divisions of two electronics firms. One computer firm contributed projects from divisions in two countries.

Nearly all the sites were quite large, with only seven reporting sales of less than 100 million dollars. Nearly all of the sites, with the exception of three in the computer and three in the textile industry, were divisions of multi-divisional firms. Only nine of the sites were foreign subsidiaries, while the rest were national firms. Most of the firms were private corporations with widely held stock, but two were owned by governments, six by families, and four were closely held. All but 13 of the firms had production facilities lo-

TABLE I

NUMBER AND PERCENTAGE OF THE SAMPLE OF PROJECTS IN FIVE COUNTRIES REPRESENTED BY EACH INDUSTRY

Industry	Germany	Japan	France	Nether-lands	United Kingdom	Total
Computer	9	7	4	0	10	30
Consumer Electronics	8	6	7	3	8	32
Textiles	6	0	11	7	6	30
Industrial Chemicals	12	6	9	5	12	44
Automotive	12	2	4	0	10	28
n=	47	21	35	15	46	164
Percent of total sample	28.7	12.8	21.3	9.1	28.0	100.0

cated in several countries. Most served multiple markets, with 14 of the remainder serving solely the consumer market and five solely industrial markets. Most of the firms had several research and development laboratories with only 12 of the sites reporting having only a central laboratory. Thus, this was not a study of small technical enterprises, but rather of large firms with multiple owners, divisions, production facilities and laboratories.

Data Collection and Interviews

The Critical Incident Approach For any number of reasons, respondents might consciously or unconsciously bias their results, when asked for their opinions concerning the efficacy of government programs. To avoid this possibility, the research program was described (quite truthfully) as being concerned with the environmental factors surrounding successful industrial innovation. The

non-governmental aspects of our analyses are reported in Utterback, et.al. (1976). Nothing was said about government policies or actions, per se; they were merely included among a range of environmental parameters, about which respondents were queried.

To further avoid bias, respondents were not asked for their opinions, but rather were asked to recount what had happened in a specific incident. There were told that our interests lay, not in the typical case that they faced, but in a specific instance, no matter how atypical that might have been.

Interviews were conducted with project managers and key personnel from each project. It was again stressed that the interviewer's interest lay, not in their usual methods of conducting business but in that specific project alone. It is important to stress this point, since it is the heart of the critical incident approach as used here. We didn't want to hear the people's opinions concerning what was usual or unusual.

TABLE II

NUMBER AND PERCENTAGE OF PROJECTS WHICH WERE SUCCESSFUL, UNSUCCESSFUL OR ON-GOING IN EACH INDUSTRY

Project Sampling Category	Computer	Consumer Electronics	Textiles	Industrial Chemicals	Auto-motive	Total
Successful	13	13	12	16	12	66
n = Percent	43.3	40.6	40.0	36.4	42.9	40.2
Unsuccessful	9	10	10	14	8	51
n = Percent	30.0	31.3	33.3	31.8	28.6	31.1
On-Going	8	9	8	14	8	47
n = Percent	26.7	28.1	26.7	31.8	28.6	28.7
Total	30	32	30	44	28	164
n = Percent	100.0	100.0	100.0	100.0	100.0	100.0

Rather, we would make an independent determination from the distributions revealed in tha data.

Aim of the Interviews There are three broad classes of input to any R&D project (Figure 1). Each of these can be influenced by government action or policy. Project performance can potentially be affected by controlling

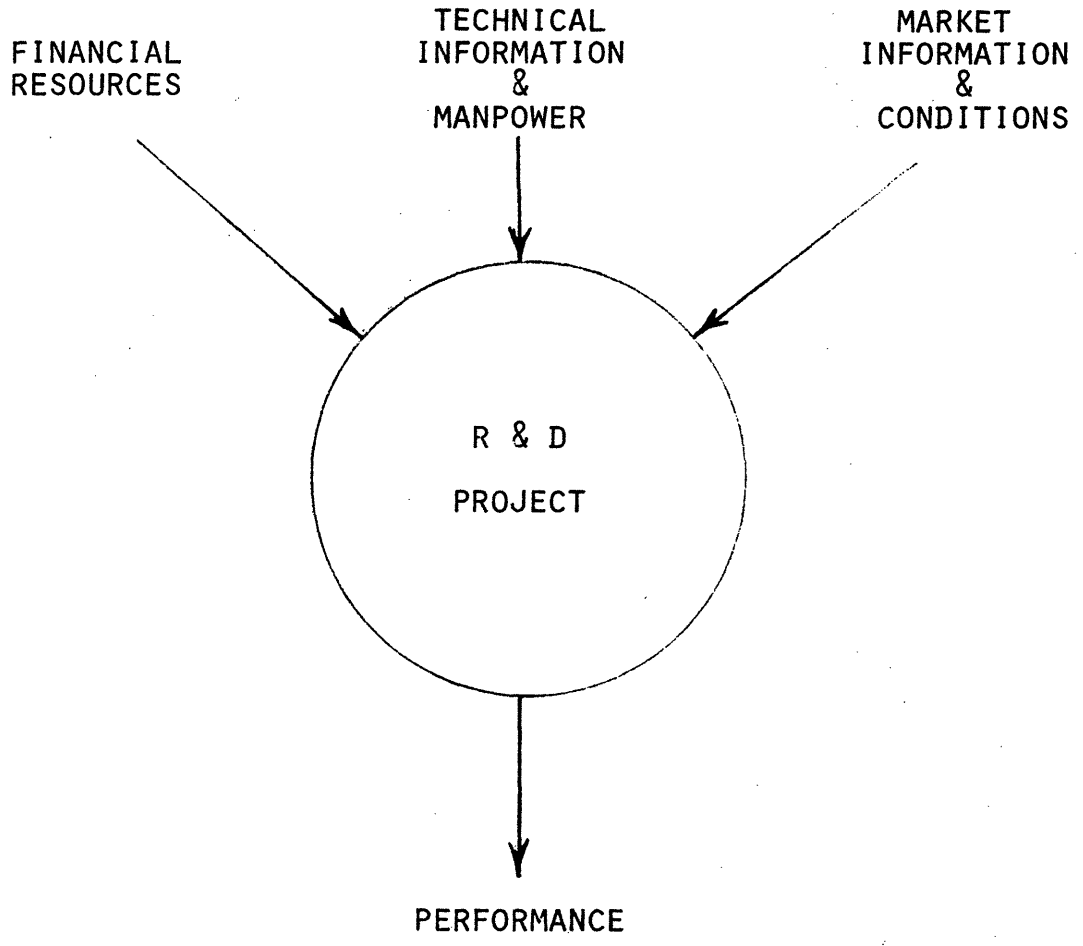

Figure 1. Inputs to a R & D Project that can be Potentially Influenced by Government

any one or more of the three. Interviews then aimed at determining:

a) How the project was financed (both directly and indirectly)

b) How the necessary manpower and technology were obtained.

c) How the market was assessed, and the nature of any external influences on the market.

An interview format was developed addressing each of these areas, which further sought to determine the specific forms or mechanisms through which governments exerted influence in these three areas.

Mechanisms Through Which Government Influence May be Exerted

Governments are able to control the inputs to R & D projects and thereby to influence the rate and direction of technological change through their ability to alter the industrial environment -- market forces, industrial organization, the structure of rewards, and the regulatory constraints within which industry operates. Governments can also alter the resources available to firms -- information, financial and human resources -- and the allocation of these resources. In affecting either the environment of or resources available to industrial firms, governments may help to initiate technological change, to sustain change, or to regulate change in such a way as to ameliorate its effects. Since the number of possible modes of action available to government to influence technological innovations is large, it is necessary to use some sort of simplifying concept to facilitate further analysis. This should not be so gross as to obscure important differences nor so fine that the number of categories approaches the number of actions classified.

Direct actions will be categorized into twelve "mechanisms" or "manners of action". These are listed below based on the way in which they affect some area important to the innovation process. The categories are not mutually exclusive, because a given action may have several different effects. For example, government procurement practices may be both a way of creating market demand to stimulate innovation and a way of encouraging the formation of new firms or the entry of existing firms into a new market. The categories are intended to be collectively exhaustive to allow for reasonable classification of all the diverse actions and programs found in our study of five countries. The twelve categories to be used in subsequent analyses are:

MECHANISMS AFFECTING "THE INNOVATION PROCESS" ITSELF (INITIATING)

These are direct attempts to stimulate innovation where it might otherwise be non-existent.

1. Stimulating innovation by working through market forces.
2. Reducing the cost to firms of undertaking innovative activities.
3. Reducing the probability of technical or commercial failure.
4. Increasing the rewards to the firm for successful innovation.
5. Encouraging innovation via market invasion
    a. by new firms;
    b. by old firms invading new markets.
6. Re-structuring an industrial sector.
7. Influencing the organization and management of individual firms.

MECHANISMS AFFECTING RESOURCES (SUSTAINING)

These are attempts to enhance the quality or performance of R&D activity.

8. Influencing the availability, utilization and mobility of managerial and technical manpower.
9. Assisting institutions (universities, research institutes, private consulting firms, industries and governments) with regard to the generation and utilization of technical knowledge.
10. Increasing and transmission and transfer of technical knowledge between institutions.

MECHANISMS AMELIORATING THE CONSEQUENCES OF TECHNOLOGICAL CHANGE (RESTRUCTURING)

Projects are sometimes initiated to enable a product or process to meet government regulatory standards.

11. Ameliorating the adverse consequences of technology with respect to the environment and natural resources.

12. Influencing labor's receptivity to technological change and internalizing the human costs associated with innovation activity.

For purposes of this study, then, a mechanism is a behavioral concept and is characterized by a collection of specific programs, institutions, laws, and regulations which influence technological change. Thus, reducing the cost of firms of undertaking innovative activity is viewed as one mechanism. This mechanism, or manner of action, is made operational through several specific government programs, policies, and regulations, which directly or indirectly affect technological change. For example, any of a number of means might be used to reduce the cost to firms of undertaking innovation activities, including low cost or interest-free loans, loan guarantees, direct subsidies, tax deductions for R&D, tax holidays, investment tax credits, loans or grants for regional development, direct contracts, direct provision of equipment or services, accelerated depreciation (on pilot plant), rules-regarding capitalization of R&D, and so forth.

RESULTS

Government influence was felt in one way or another on about 43 percent of the 164 projects in the sample (Table III). There was, as one would expect, a wide variety in the ways in which this influence was felt. In about nine percent of the cases more than one government program operated. In one case, there were actually four programs affecting a single project.

Operation of Specific Mechanisms

Government mechanisms are classified according to the scheme described in the previous section. Following this general format, the highest proportion of mechanisms encountered were of the initiating class (Table IV). Most of

TABLE III

PROPORTION OF PROJECTS ON WHICH GOVERNMENT PROGRAMS WERE FOUND TO HAVE OPERATED

Number of Government Programs Operating on Project	Proportion of Projects (Percent) (N = 164)
0	57.3%
1	34.1
2	7.3
3	0.6
4	0.6

these were policies which directly paid a portion of the R&D costs, of a project. Such programs as the Aid to Development in France or the New Technologies Program in Germany are representative of this class. The next category in importance was Environmental or Safety Controls (a restructuring mechanism). This included such instruments as environmental and auto safety standards as well as pollution control regulation. The third most frequently encountered mechanism is Technology Transfer (a sustaining mechanism). This included instruments designed to improve the transfer of information from the university or government sectors to industry as well as those aimed at importing technology, through document transfer, people transfer, patent licensing, and so on. Fourth in frequency was the manipulation of Market Forces (an initiating mechanism) to stimulate innovative activity. The remaining mechanisms were encountered at a relatively low frequency, with little difference among them.

TABLE IV

OPERATION OF GOVERNMENT MECHANISMS ON THE PROJECTS

Mechanism	Proportion of All Projects with Government Involvement, in Which Specific Mechanism Operated (Percent) (N = 70)*
Initiating Mechanisms	57.2%
Reduce Costs (2)	38.6%
Market Forces (1)	11.4
Market Invasion (5)	4.3
Re-structuring Sector (6)	2.9
Sustaining Mechanisms	37.2
Technology Transfer (10)	22.9
Manpower/Mobility (8)	4.3
Generate Knowledge (9)	2.9
Reduce Risk (3)	5.7
Organization & Management	0
Increase Rewards (4)	1.4
Restructuring Mechanisms	27.2
Lessen Labor Resistance (12)	2.9
Environment/Safety (11)	4.3

* The figures in the above table are not additive for two reasons:

1. There may be several government programs associated with a given project as indicated in Table IV.
2. In several cases, a single means of government action was reported to have operated through more than one mechanism.

Trends Over Time

One might expect from the increased concern with international competition and the need for innovation, coupled with legislation in the areas of environmental pollution and worker and equipment safety standards, that government involvement in R&D projects would be on the increase. Since the sample consists of both completed and ongoing projects, there is an opportunity to make at

least a rough test of this possibility. Completed projects were with few exceptions started after 1968 and completed by the time of the study. These make up about 70 percent of the total. Ongoing projects were begun after 1971 and had not yet been completed at the time of the interviews.

There is no evidence in the data that governmental involvement is increasing (Table V). In fact, the proportion of projects in which government was felt actually decreases among the ongoing projects. Of course these projects were as yet incomplete, so there was still time for the government influence to be felt in one way or another. Thus it would not be wise to make too much of the decrease. Nevertheless, the failure to find an increase with time may be important.

TABLE V

OPERATION OF GOVERNMENT MECHANISMS AS A FUNCTION OF TIME PERIOD FOR ALL PROJECTS IN THE SAMPLE

Classification of Project	Proportion of Projects on Which Government Mechanism was Found
Completed (post '68; N = 117)	44.4%
Ongoing (post '71; N = 47)	38.3

$X^2 = 0.03$, N.S.

Influence on the Firms's Commitment to the Project

In many cases, the government's influence, while felt by the firm, had no significant effect either way on the firm's commitment to the project. Interviewers were asked to indicate whether there was any evidence from the

interview, that the firm's commitment to support the project had been affected in any way by government policy or activity. In half of the cases, there was an indication that the firm's commitment had been so influenced. The interesting point lies in the fact that this influence is more pervasive among the ongoing projects (Table VI). One might surmise that governments are either becoming more adept at influencing the conduct of industrial R&D projects, or are shifting their influence attempts to different areas in which an effect on the firm's commitment is more likely to be felt.

To further examine the latter possibility, a comparison of different forms of influence over time, is made in Table VII. The data show that although there has been some change with time, the shift is not a significant one. Although a slight shift from initiating to sustaining or restructuring mechanisms is evident, a statistical test fails to show that this can be attributed to more than random variation in the data.

TABLE VI

GOVERNMENT INFLUENCE ON FIRM'S COMMITMENT TO THE PROJECT AS A FUNCTION OF TIME PERIOD

FOR 70 PROJECTS WITH SPECIFIC GOVERNMENT VEHICLES

Time period	Proportion affected by Government Influence
Completed Projects (post '68; N = 52)	46.3%
Ongoing Projects (post '71; N = 18)	72.2

N = number of projects with government instrument

$X^2 = 3.66$, $p = 0.06$

mechanisms is evident, a statistical test fails to show that this can be attributed to more than random variation in the data.

Since there is no evidence that government strategy has changed significantly with time, one is left with the conclusion that either governments have in fact become more adept at administering strategy or that firms later perceive that completed projects were less influenced than ongoing projects. More important, however, is the question of whether the innovative process has been either aided or hindered by government policy.

Perceived Influence on Project Success

Interviewers were asked to determine whether the government's influence had functioned in a positive, negative or indifferent manner, with respect to the success of the project. This measure is somewhat independent of the final outcome measure, since many projects were failures despite positive government influence, and even more were successful, in spite of negative government influence.

TABLE VII

CLASSIFICATION OF MECHANISM EMPLOYED AS A FUNCTION OF TIME PERIOD

Time Period	Classification of Mechanism: initiating	sustaining	restructuring
Completed Projects (post '68; N=64)	46.8%	25.0%	28.1%
Ongoing Projects (post '71; N=31)	35.5	35.5	29.0

N = number of mechanisms (not projects)

$X^2 = 1.44$, N.S.

Overall, governments' influence was more often perceived as negative than positive (Table VIII). Furthermore, while the amount of negative influence may appear to be diminishing, the results are far from significant, statistically.

TABLE VIII

PERCEIVED GOVERNMENT INFLUENCE ON PROJECT SUCCESS AS A FUNCTION OF TIME PERIOD

FOR 70 PROJECTS WITH SPECIFIC GOVERNMENT VEHICLES

Time Period	Proportion in Which Government Influence was Perceived to be:	
	Negative	Positive
Completed Projects (post '68; N = 52)	19.2%	9.6%
Ongoing Projects (post '71; N = 18)	11.1	11.1
Overall (N = 70)	17.1	10.0

Government Mechanisms and Performance

When successful and unsuccessful projects are compared in terms of the mechanisms encountered (Table IX), it can be readily seen that government involvement as perceived by the firm does not guarantee project success. Only in the case of Environmental/Safety Control is there anything even remotely approaching a significant difference between successful and unsuccessful projects. Furthermore, given the number of comparisons being made, this could result from random variation. In general, we have not been able to demonstrate from the firm data that projects which are affected by government programs are more likely to be successful than those which are not.

TABLE IX

OPERATION OF GOVERNMENT MECHANISMS RELATED TO PROJECT SUCCESS OR FAILURE

Mechanism	Proportion of Projects in Which* Mechanism was Observed (Percent) Successful Projects (N = 66)	Unsuccessful Projects (N = 51)	Level of Significance of Difference
Initiating Mechanisms			
Reduce Costs (2)	22.7%	15.7%	N.S.**
Market Forces (1)	6.1	5.9	N.S.
Market Invasion (5)	1.5	3.9	N.S.
Re-structure Sector (6)	3.0	3.9	N.S.
Sustaining Mechanisms			
Technology Transfer (10)	4.5	11.8	N.S.
Manpower (8)	3.0	3.9	N.S.
Generate Knowledge (9)	1.5	2.0	N.S.
Reduce Risk (3)	4.5	2.0	N.S.
Organization & Management	0.0	2.0	N.S.
Increase Rewards (4)	1.5	0.0	N.S.
Restructuing Mechanisms			
Lessen Labor Resistance (12)	3.0	3.9	N.S.
Environment/Safety Controls (11)	10.6	3.9	0.11
One or more government vehicles associated with the project	48.5%	39.2%	N.S.

*The figures in the above table are not necessarily additive for two reasons:
1) There may be several government programs associated with a given project as shown in Table III.
2) In several cases, a single program was reported to have operated through more than one mechanism.

**N.S. = Not statistically significant

Other Forms of Government Involvment

Interviews were coded to determine whether a project was: (1) a direct response to a government action, (2) an indirect response, or (3) conducted any differently because of regulatory constraints (Table XI). Here we find that it makes no difference whether a project is initiated in either direct or indirect response to government action. But government regulatory constraints are more likely to be found in association with successful projects.

This may come as a bit of a surprise. None of the policies directly aimed at stimulating innovative performance show any relation to performance, while regulatory constraints not directly aimed at stimulating innovation (mostly environmental and safety; Cf. Table X), are related to performance. One way of viewing environmental/safety regulatory constraints is that they add critical performance dimensions to the problem space faced by the engineer. An engineer faced with a technical problem attempts to fit a solution into an envelope defined along a number of critical dimensions, e.g., cost, weight, energy consumption, resolution, channel isolation, etc. (Frischmuth & Allen, 1969). The introduction of regulatory constraints increases the number of critical dimensions, making the problem space that much more complex.

Problem dimensions can vary in the extent to which improvements along them will yield to technical effort. Cost, for example, might be very difficult to reduce, while power output could be relatively easy to increase. To some extent this might be a function of the total amount of effort expended in attempting to force improvements along a given dimension. As technology advances, its potential along particular dimensions may in some cases be fully utilized. In others it may be underutilized. In the case where available technology has been underutilized in its application to a specific dimension, improvements along that dimension should be relatively easy to accomplish.

In addition, government regulation gave a very high priority to the project. It was not the usual case in which the outcome of the project would have an influence of a few percentage points on sales, important as that might be. Government requirements for entering or remaining in a market affect a very large proportion sometimes even 100 percent of sales. In the extreme, either the regulations are met, or there will be no sales. This obviously accords the project high priority. The "crash" project phenomenon can then occur. Formal organizational channels are bypassed, new informal links are established, and the potential for creative solution is enhanced. In addition, older established technologies are often re-examined in a new light with a concomitant opportunity for significant improvement. Units dealing with these technologies are accorded a new status in the organization, and the resulting esprit can also increase the probability of significant advancement.

TABLE X

OTHER FORMS OF GOVERNMENT INVOLVEMENT RELATED TO PROJECT SUCCESS OR FAILURE

	Proportion of Projects in Which Factor was Present (Percent)		
	Successful Projects (N = 66)	Unsuccessful Projects (N = 51)	Level of Significance of Difference
Project authorized in direct response to government action	9.1%	2.0%	N.S.*
Project authorized as indirect result of government action	16.7	9.8	N.S.
Government regulatory constraints were perceived to be highly significant in the conduct of the project	15.2	2.0	0.01

*N.S. = Not statistically significant

This is what has happened in the case of many of the new government regulatory constraints. Government regulation demands innovation. The technology for accomplishing innovation in product safety, pollution reduction, etc., is often readily avialable. The only reason these improvements had not been introduced is because the dimension of safety or reduced pollution was not seen by the engineer as a critical dimension in his problem space, or was given a lower rating relative to other dimensions. Government regulatory action re-orders priorities among dimensions. Once long-neglected dimensions are given some importance, a reservoir of technology can be tapped, which will allow relatively rapid improvement.

Furthermore, since government regulations are often stated in terms of fairly precise specifications, the problem solver is allowed, indeed tempted, to place these fixed requirements on the critical dimensions. There is no pay-off for optimizing along the dimensions, one need only meet the specification. When this is the case, Frischmuth & Allen (1966) argue that such dimensions operate as a filter, through which each potential solution is passed with a go/no-go decision on each dimension. Such dimensions are viewed as more important than those along which there is some freedom of movement. Consequently, greater resources are applied to meeting the fixed requirements, and this coupled with the availability of untapped technology increases the likelihood of successful accomplishments.

Related to this, at least in the case of the auto industry, is the fact that most of the regulations had been developed by the United States government. U.S. standards for emission control and auto safety tended, at the time of the study, to be the most restrictive. European and Japanese manufacturers hoping to export their products to the U.S. were therefore forced to set their design goals to the most severe case, viz. U.S. standards. These standards did not present the firms with unattainable design goals, or goals that were unlikely

to be successfully achieved. The reason for this is very simple. They were not set in a vacuum. There was a considerable degree of industry involvement in the establishment of the standards. Industry may not have desired the standards, and probably would have never imposed them on themselves. However, once it became apparent that standards would be set, the U.S. auto industry set about to influence the government regulatory bodies in order to set goals that could be realistically attained.[3] In other words, they recognized the fact that there was an available reservoir of technology that could be applied to increase product performance along the critical dimensions of emission control and safety. They evidently worked to assure that standards were established which were within reach of this available technology.

Industry Variations

Governmental influence is felt in all five industries (Table XI), albeit to varying degrees. Industrial chemicals is the most heavily affected industry, followed closely by computers and autos. Consumer electronics and textiles, not surprisingly, are the least affected.

The type of mechanism also varied considerably by industry (Table XII). Initiating mechanisms were most frequently employed in the computer industry. This industry has come to be recognized as important in assessing national prestige. Consequently, several countries have launched programs to build, or enhance their computer industry. The principal technique, employed in doing this, has been the initiating mechanism, wherein the government directly subsidizes research and development, or guarantees a market for domestic computer developments.

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[3] In particular, the National Highway Traffic Safety Administration (NHTSA) charged with proposing safety standards for automobiles may only propose such regulations as are known to be "technically feasible".

TABLE XI

GOVERNMENT INFLUENCE BY INDUSTRY
FOR ALL PROJECTS IN THE SAMPLE

Industry	Proportion of All Projects on Which at Least one Program was Found (Percent)
Computers (N = 30)	50.0%
Consumer electronics (N = 32)	28.1
Textiles (N = 30)	26.7
Industrial chemicals (N = 44)	54.5
Automobiles (N = 28)	50.0

$X^2 = 9.72$, $p = 0.05$

Sustaining mechanisms are found most often in chemicals and textiles and seldom in consumer electronics. The most frequently encountered form of sustaining mechanism is that which attempts to stimulate technology transfer out of the university/government sector and into industry. In textiles, technology transfer is attempted, principally through the use of intermediary institutions, e.g. research associations and research institutes under joint industry/government auspices. In chemicals, attempts have been made in several of the countries to promote university - industry interaction in the chemical industry.

Restructuring mechanisms are found principally in the automobile industry. These have to do mainly with pollution control and safety standards introduced, to the industry, in recent years.

TABLE XII

OPERATION OF GOVERNMENT MECHANISMS BY INDUSTRY

Mechanism	Computers (N = 30)	Consumer Electronics (N = 32)	Industrial Chemicals (N = 44)	Textiles (N = 30)	Automobiles (N = 28)	Overall (N = 164)
	Industry					
Initiating Mechanisms	46.6%	28.1%	27.3%	16.7%	28.6%	29.2%
Reduce Costs (2)	33.3%	18.8%	15.9%	13.3%	10.7%	18.3%
Market Forces (1)	10.0	9.4	2.3	0.0	10.7	6.1
Market Invasion (5)	0.0	0.0	6.8	0.0	3.6	2.4
Re-structure Sector (6)	3.3	0.0	2.3	3.3	3.6	2.4
Sustaining Mechanisms	13.3	3.1	22.7	20.0	17.9	15.8
Technology Transfer (10)	3.3	3.1	13.6	16.7	10.7	9.8
Manpower/Mobility (8)	3.3	3.1	0.0	6.7	7.1	3.7
Generate Knowledge (9)	0.0	0.0	4.5	3.3	0.0	1.8
Reduce Risk (3)	6.6	0.0	2.3	3.3	3.6	3.0
Organization & Management (7)	3.3	0.0	0.0	0.0	0.0	0.6
Increase Rewards (4)	0.0	0.0	2.3	0.0	0.0	0.6
Restructuring Mechanisms	0.0	0.0	18.2	3.4	39.2	12.2
Lessen Labor Resistance (12)	0.0	0.0	0.0	3.3	3.6	1.2
Environment/Safety (11)	0.0	0.0	18.2	0.0	35.7	11.0
Total*	50.0	28.1	26.7	54.5	50.0	43.3

*Total percentage of projects in which a government mechanism was encountered may be less than the sum of percentages in the Table because several mechanisms have been associated with one project (see Table III and Table XI).

Influence on the Commitment of the Firms

Governmental influence on the commitment of firms to specific projects did not vary significantly across industries (Table XIII). The range of values extends from 57 percent of projects, on which project commitment was influenced in the auto industry, to 33 percent in computers. A statistical text, however, indicates that this could be merely random variation. The net conclusion must be that the present evidence is insufficient to support any possibility of inter-industry variation in government-induced commitment.

Effect on Perceived Project Success

Government influence has been more of a negative than positive factor in project success, as perceived by the firms (Table XIV). Despite this, in nearly half (42 percent) of the cases in which government influence was perceived as negative, the project, itself, was successful.

TABLE XIII

INFLUENCE ON FIRM'S COMMITTMENT BY INDUSTRY FOR 70 PROJECTS WITH SPECIFIC GOVERNMENT VEHICLES

Industry	Proportion of Projects in Which Government Significantly Influenced Firm's Commitment
Computers (N = 15)	33.3%
Consumer electronics (N = 9)	55.5
Textiles (N = 8)	62.5
Industrial chemicals (N = 24)	50.0
Automobiles (N = 14)	57.1

$X^2 = 2.71$, p = N.S.

Government influence was perceived to be detrimental in the computer, chemical and auto industries. It was perceived as beneficial in the electronics and textile industries. The reasons behind the negative view of government influence in chemicals and autos is fairly obvious. In these industries, government influence most frequently took the form of restructuring mechanisms designed to control pollution or improve product safety. The purpose of such government action is not to make the process of innovation any easier. While it very often stimulates innovative activity, it is viewed by industry as increasing problem difficulty, rather than aiding problem solution.

In textiles and electronics, government influence usually took the form of initiating or sustaining mechanisms. These were naturally viewed as a positive contribution to project success.

TABLE XIV

PERCEIVED GOVERNMENT INFLUENCE ON PROJECT SUCCESS BY INDUSTRY

FOR 70 PROJECTS WITH SPECIFIC GOVERNMENT VEHICLES

Industry	Proportion in Which Government Influence was Perceived to be:	
	Negative	Positive
Computer (N = 15)	20.0%	6.7%
Consumer electronics (N = 9)	11.1	22.2
Textiles (N = 8)	0.0	25.0
Industrial chemicals (N = 24)	12.5	4.2
Automobiles (N = 14)	28.6	0.0
Overall (N = 70)	14.3	8.6

$X^2 = 7.31$, $p = 0.13$

The computer industry is more puzzling. In the four countries in which this industry was studied, the government had attempted very strongly to stimulate its development. One would expect government's contribution, in this industry, to be perceived as at least somewhat positive. In fact, government had little perceived impact in three of the four countries. In the fourth (the U.K.) the impact was viewed as negative on several projects, because in the government's attempt to rationalize the industry, through the strengthening of one firm, other firms felt that they had suffered. This effect was seen on specific projects, in the pronounced shortage of certain forms of competence, which had been transferred out of the firm. In restructuring the industry, government had brought about the transfer of certain critical talents out of these firms. These individuals were then no longer available for either direct staffing or consulting support to the projects. Hopefully, they were making a contribution in their new organization, but this was not without a serious cost to their former organizations.

In consumer electronics and particularly in textiles, government influence is, on balance, perceived as positive. The emphasis in these two industries is on initiating and sustaining mechanisms, with particular weight given to technology transfer in the textile industry (Table XII).

National Variations

The five countries varied to some degree in the extent to which mechanisms were found in the sample (Table XV). The greatest government involvement (19 out of 35 projects) was found in France, and in Holland the least (4 out of 15 projects). This variation is, however, not sufficient to be considered significant, statistically.

TABLE XV

OPERATION OF GOVERNMENT MECHANISMS BY COUNTRY FOR ALL PROJECTS IN THE SAMPLE

Country	Proportion of Projects On Which at Least One Mechanism was Found (Percent)
France (N = 35)	54.3%
West Germany (N = 47)	36.2
Japan (N = 21)	47.6
Netherlands (N = 15)	26.7
United Kingdom (N = 46)	43.5
$X^2 = 4.69$, p = N.S.	

Country Strategies Countries differ considerably in the strategies undertaken to influence innovation. France, for example, has had a very heavy emphasis on initiating mechanisms while Britain has used this approach hardly at all (Table XVII). West Germany shows little evidence of the use of sustaining mechanisms on the projects in the sample: France and the Netherlands did not rely very heavily on restructuring mechanisms. [Note, however, that the Netherlands sample is rather small. Furthermore, there are reasons to believe from other sources that both labor and environmental policies do influence Dutch firms. (cf. Center for Policy Alternatives, 1976)].

In comparing successful and unsuccessful projects in the five countries with the forms of mechanism used, one finds essentially no difference in any

of the countries studied. The comparative differences do not have statistical significance. This is in agreement with earlier findings that, with the exception of environmental/safety regulations, there was little or no relation between the presence of a government mechanism and project success. The same results occur at the individual country level. In summary, it made little difference in the aggregate as to what strategy a country pursued, insofar as the ultimate criterion of project outcome, i.e. success or failure, was concerned. Again this may merely be a reflection of the observation that government involvement may be a necessary condition but is not a sufficient condition for project success. Some government programs (e.g., French aid to Development) are reserved for projects which are considered significantly more risky than the average (though presumably with greater payoff if successful). Thus one should not expect to find use of this type of mechanism strongly correlated with project success.

Influence on the Commitment of the Firm

The degree to which a firm's commitment to a project was influenced by the government varied significantly across countries (Table XVII). France and West Germany were the most successful in this respect, while Britain was least successful. In Table XVI may be found a possible explanation. Both France and Germany rely primarily on initiating mechanisms. The United Kingdom made very little use of this class of mechanism. An initiating mechanism is almost certain to influence firm commitment. If the concept of an initiating mechanism is working properly, projects will be undertaken which otherwise wouldn*t have been considered. The data in Tables XVI and XVII provide some support for the proposition that this is, in fact, happening.

TABLE XVI

OPERATION OF GOVERNMENT MECHANISMS BY COUNTRY

Mechanism	France (N = 35)	West Germany (N = 47)	Japan (N = 21)	Netherlands (N = 15)	United Kingdom (N = 46)	Overall (N = 164)
Initiating Mechanisms	37.2%	32.0%	38.1%	26.7	17.4%	29.2%
Reduce Costs (2)	31.4%	14.9%	33.3%	20.0%	4.3%	18.3%
Market Forces (1)	2.9	12.8	4.8	0.0	4.3	6.1
Market Invasion (5)	2.9	4.3	0.0	6.7	0.0	2.4
Re-structure Sector (6)	0.0	0.0	0.0	0.0	8.7	2.4
Sustaining Mechanisms	25.7	4.3	14.3	20.0	19.6	15.8
Technology Transfer (10)	17.1	0.0	9.5	13.3	13.0	9.8
Manpower/Mobility (8)	2.9	0.0	0.0	13.3	6.5	3.7
Generate Knowledge (9)	0.0	0.0	0.0	6.7	4.3	1.8
Reduce Risk (3)	5.7	4.3	4.8	0.0	0.0	3.0
Organization & Management (7)	0.0	0.0	0.0	0.0	2.2	0.6
Increase Rewards (4)	2.9	0.0	0.0	0.0	0.0	0.6
Restructuring Mechanisms	5.7	10.6	19.0	0.0	19.6	12.2
Lessen Resistance (12)	0.0	0.0	0.0	0.0	4.3	1.2
Environment/Safety (11)	5.7	10.6	19.0	0.0	15.2	11.0
Total*	54.3	36.2	47.6	26.7	43.5	43.3

*Total percentage of projects in which a government mechanism was encountered may be less than the sum of percentages in the Table because several mechanisms have been associated with one project.

TABLE XVII

INFLUENCE OF FIRM'S COMMITMENT BY COUNTRY FOR 70 PROJECTS WITH SPECIFIC GOVERNMENT VEHICLES

Country	Proportion of Projects in Which Government Significantly Influenced Firm's Commitment (Percent)
France (N = 19)	68.4%
West Germany (N = 17	64.7
Japan (N = 10)	40.0
Netherlands (N = 4)	50.0
United Kingdom (N = 20)	25.0

$X^2 = 11.66, \quad p = 0.02$

Arguments have been raised that initiating mechanisms do not achieve their purpose, since firms use them to support projects to which they are already committed (Sirbu, in press). That is, they see a greater possibility of getting government support for "safe" projects; they then use the money thus freed in the budget to support more marginal projects, which themselves would not have been able to attract government interest. The interviews revealed a few instances in which things happened just this way. A more complete look at the data, however, indicates that this may not characterize the entire sample. The possibility of government support did influence the commitment to a project. The proportion of successful projects was no different for those projects receiving government support than for those which did not.

Influence on Project Success

The Netherlands is the only country in which government activity was per-

ceived to have had any positive influence on project success (Table XVIII). The number of projects in The Netherlands was very small, however, and not much should be concluded from the firm study alone, other than the fact that noe of the larger countries was perceived to be as outstanding in its ability to influence success.

TABLE XVIII

PERCEIVED GOVERNMENT INFLUENCE ON
PROJECT SUCCESS BY COUNTRY
FOR 70 PROJECTS WITH SPECIFIC GOVERNMENT VEHICLES

Country	Proportion in Which Government Influence was Perceived to be:	
	negative	potitive
France (N = 19)	10.5%	15.8%
West Germany (N = 17)	23.5	5.9
Japan (N = 10)	10.0	0.0
Netherlands (N = 4)	0.0	50.0
United Kingdom (N = 20)	25.0	5.0

$X^2 = 6.82, \quad p = 0.08$

SUMMARY

The major findings of the study can be summarized around six points.

1. Government involvement was found in a fairly high (42.7%) proportion of the projects studied.

2. Of the twelve possible mechanisms which describe government influence, three were predominant: reducing costs to the firms (18.3% of all projects), regulations for environmental quality and product safety (12.2%) and technology transfer (9.8%).

3. Government involvement did appear to increase a firm's commitment to a project. Overall, government influence was more often perceived by the firms as negative rather than positive. However, in general the proportion of successful and unsuccessful projects was about the same whether or not the government was involved.

4. There is an important exception of this last statement. Regulatory constraints of various kinds, primarily environmental and product safety requirements in the industrial chemical and auto industries, were more often associated with project success.

   More importantly, however, with regard to environmental/safety regulations, is the perception by the managers that the projects were conducted differently because of these regulations. This occurred far more often for successful, in contrast to unsuccessful, projects.

5. There were some striking differences among industries in the types of government actions encountered. The mechanisms found were primarily:

   . Funding (reducing the cost to firms) in the computer and electronics industries

   . Technical assistance (technology transfer) in textiles

   . Environmental/safety regulation in industrial chemicals and autos.

   However, the number of projects affected in each industry is too small to discern anything about the effects on success or failure by industry.

6. There were also striking country differences.

   . The contrast between Germany and the United Kingdom is particularly notable, and about the same industry proportions are represented in these subsamples.

For the most part German firms reported primarily government actions which we would expect to influence product development in its early stages. British firms, on the other hand, reported government actions which we expect to be important at late stages of a product's evolution.

. Japan also stands out as a notable case emphasizing mainly funding, technology transfer and regulation. However, here the sample is biased and relatively small.

Again the number of projects affected in each country is too small to discern much about the effects on success or failure by country. However, there are significant differences in the governments' influence on the firm's commitment in the different countries.

Of course, the most significant aspect of the study lies in its failure to detect any effect, on project performance, of government attempts to stimulate innovation. Governments have tried in a variety of ways, as can be seen through the study, to do just this. If project success or failure can be taken as any measure of effectiveness of these actions, then little can be said to have resulted from all of this expenditure of effort and money.

Finally, there is the somewhat unexpected effect of government regulation. Government regulations, by establishing new criteria for defining a successful product or process, force innovation to occur, often in areas that have been long neglected by market or technological forces.

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