Raelin, Joseph A.

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THE VARIABLES OF STRATEGIC REGULATORY RESPONSE: A DISCRIMINANT ANALYSIS

By

Joseph A. Raelin

Institute for Public Service
School of Management

Boston College
Chestnut Hill, MA 02167

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ABSTRACT

Research is undertaken to identify variables which might distinguish proactive from reactive regulatory strategies on the part of a sample of business firms engaged in industrial R&D. A discriminant analysis of the data reveals one function containing 17 factors which correctly classifies 95% of the cases in terms of their strategic regulatory response. The policy significance of each of the findings is discussed.

THE VARIABLES OF STRATEGIC REGULATORY RESPONSE: A DISCRIMINANT ANALYSIS*

Scholars examining the role of government in business, especiallv in terms of business' productivity and innovation, have focused on the potential proactivity of business in the face of government regulation. Sethi (1975) referred to a proactive stance under a corporate strategy of social responsiveness, which if implemented could conceivably forestall regulatory action. Proactivity, as defined in Sethi's framework, refers to an anticipatory response on the part of a corporation which minimizes potential side effects from its present or future activities. Post (1978) identified three patterns of corporate response (reactive, proactive, and interactive) which were later made conditional upon two agency types --buffer or change agent (Post and Mahon, 1980). Leone (1977) urged management to develop greater political acumen in order to better "second-guess" politicians as well as to improve forecasting in order to correctly perceive the competitive consequences of government regulation. Mitnick (1981) has detailed a number of strategic uses of regulation and challenges management to take advantage of them. Raelin and Sokol (1982) identified three "filters" which moderate the relationship between regulation and business in the R&D area; these were: industry/market, public policy, and enlightened management conditions.

Another body of research has focused not so much on business' disposition regarding regulatory constraints, but rather on the actual effect of regulation on industrial productivity. Such researchers as Leibenstein (1969) and Klein (1975) have found that regulations tend to eliminate business risk, resulting in a corporate laxity considered inconsistent with innovative

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activity. Rubenstein and Ettlie (1979) have further argued that regulations tend to retard the development of alternative processes which might entail better solutions to the problem originally addressed by the regulations themselves. Gerstenfeld (1977), however, has disputed these findings by showing that his sample of regulations actually stimulated innovation.

The upshot of these scholarly discussions is that although we know that regulations affect productivity, in the words of Jordan Lewis (1977) in his statement to the House of Representatives' Committee on Science and Technology: "...we simply do not know enough about it to draw many useful conclusions." Yet, in spite of the ambiguous findings regarding regulatory effects, there are clearly options available to business in the regulatory environment.

Unfortunately, there has been some confusion in the literature regarding the definition of these strategic options of business in response to regulation. Part of the confusion stems from the disciplinary traditions of the writers who do research in the area of strategic regulatory response. For example, one can approach the subject from the viewpoint of an organizational theorist, using the organization-environment perspective. Following Thompson (1967), Aldrich (1979) and others, this perspective sees organizations as responding to regulations in order to maintain their autonomy and identity and to reduce the dependence and uncertainty that regulations provoke. The responses classified under this perspective may be viewed as intraorganizational, in which case organizations respond internally by changing structures or processes in order to conform to or avoid the regulatory mandate, or as interorganizational, in which case organizations respond externally to influence the regulatory process (Cook, Shortell, Conrad, and Morrisey, 1983). Examples of responses empirically examined under this tradition include product diversification,

board membership changes, and trade association membership (Birnbaum, 1984).

Another tradition views the firm's role within the context of behavioral political science, particularly the perspective of pluralistic interest groups (Dye, 1981), wherein business responds to government regulations as one among many actors in the political environment (Epstein, 1973). Responses empirically examined under this tradition include strategies based on information (submitting technical reports), those relying on public exposure and appeals (mounting media campaigns), those employing direct pressure (withdrawing financial support), and those depending upon political contacts (constituent contact). These responses may be further classified as positive or negative depending upon the satisfaction of the receiving party. Accordingly, the information and political strategies would be positive whereas public exposure and direct pressure would be negative (Aplin and Hegarty, 1980).

A third tradition originates out of the process of strategic planning which defines successful business policy as a match between environmental needs and internal financial and organizational resources. Particularly in light of the growth of the 'social issues in management' field, the environment is not seen simply as an indicator of consumer demand but rather as a complex mix of economic, political, and social pressures which affect corporate action. Regulation, as one form of environmental pressure on the firm, requires some type of strategic response (Mahon and Murray, 1981). Firms may choose to offset regulatory effects by engaging in reactive strategies which offer the possibility of avoiding the imposition of costly regulatory actions, preventing confidential information from reaching one's competitors, or evading concessions which may appear as admissions of guilt (Zashin, p. 191). On the other hand, consistent with the views of the authors cited at the outset, firms can engage in proactive strategies which would recognize the economic and social opportunities created by regulation and in-

corporate them into the corporate strategic planning process. This might include accentuating existing technological practices or innovating new ones which could give a firm competitive advantages in light of a potential regulated market, lobbying to bring about favorable interpretation of regulatory controls, or choosing which regulatory agency, in a policy area under the jurisdiction of several agencies, to respond to (Hirschman, 1970; Owen and Braeutigam, 1978).

This paper adopts the third tradition as a basis for defining the strategic responses of business management. The analysis continues to dichotomize the responses as proactive or reactive. However, succeeding research which has identified the nature and even relative effectiveness of these responses, it considers the actual conditions, both internal and external to the firm, which might distinguish proactive from reactive regulatory response strategies. For example, Marcus (1981), in an extensive review of the literature, concluded that firms would react differently according to their size and the type of industry that they are in. By carefully delineating some recognized properties affecting managerial response patterns under regulatory constraints, it is a further hope that this paper might fill some of the remaining gaps leading to the ultimate formulation of a testable model of strategic regulatory response.

CRITICAL VARIABLES AFFECTING STRATEGIC REGULATORY RESPONSE

The literature has identified a number of variables which might distinguish firms that exhibit proactive or reactive strategic regulatory responses. A listing of some of these variables with brief descriptions follows.

Size

According to Weidenbaum (1979) and Mitnick (1981), the large firm may have an advantage in responding to regulatory directives due to such factors as its resource base and economies of scale. For example, it can more comfortably afford the cost of paperwork and reporting, the capital costs needed to pay for equipment (as in pollution control), and the expense of trained personnel needed to draft appropriate regulatory responses. It has also been alleged that regulation has created the need for firms to grow in order to cope with regulatory growth (see Arnett and Danos, 1980). A residual or continuing benefit to the large firm is the expertise developed in what could be a new market area. The large firm may recoup some or all of its investment in compliance R&D, for example, by selling the results of its research to smaller companies unable to conduct their own research. On the other hand, as Raelin and Sokol (1982) have pointed out, the unstructured nature of the small firm places it in a good position for initiating innovative responses to regulatory constraints. In addition, it can adopt "piggyback" regulatory strategies. This means hiding out when regulations are first issued, knowing that regulators are likely to pursue the larger, more visible targets. Once the regulations and appropriate responses are ironed out, the small firm can then "copy" the appropriate strategy. Finally, as Mueller and Tilton (1969) have pointed out, early on in the product life cycle, when economies of scale do not apply, the larger, well-financed laboratories of giant firms are no better equipped to handle a new problem posed by regulations than a small lab.

Market Concentration

Market concentration normally operates in conformity with size. Arnett and Danos (1980) assert that government rules and regulations have been responsible to some extent for bringing about a greater level of concentration in professional accounting. Once reaching a state of relative concentration, firms can work with

certain types of economic regulators to stabilize their markets and reduce competitive threats (Owen and Braeutigam, 1978). This might mean, however, narrowly construing their market position or even withholding information within their industry for fear of anti-trust suits or accusations of collusion or market manipulation.

Product Life Cycle

Process-oriented regulations, such as record-keeping requirements, audits, and enforcement actions, besides increasing costs, are likely to increase the product cycle time from invention to market (Birnbaum, 1984). Firms which depend upon their ability to cope with fast product life cycles may be adversely impacted by these time-consuming regulations.

Markets

Certain economic regulations serve to "buffer" firms against unfriendly market forces (Mahon and Murray, 1980). Markets are consequently protected for such firms. Four varieties of protection have been classified by Stigler (1971). These include: direct subsidies, control over entry by new rivals, protection against substitutes and complements, and price-fixing and price discrimination.

Financial Policies

According to the "Averch-Johnson effect" (1962), economic regulations may also induce the firm to waste capital and to capture adjacent markets by pricing for low or negative profitability. Regulations, on the other hand, may create price floors which underpredict demand (Strassman, 1980). With respect to investment, regulations may change the firm's ability to calculate fair returns due to what Eads (1980) has labelled the "regulatory risk premium."

Industry Nature

Regardless of whether regulations are of the traditional economic type or the newer social type, some industries are more affected by regulations than others. Due to any number of political and economic circumstances, regulatory commissions operate at different times with varying degrees of power. Simon (1980), reporting on an Arthur Andersen study for the Business Roundtable, found the electric and gas, chemical, primary metals, and transportation equipment industries to be most severely impacted by EPA regulations. Gerstenfeld (1977) found safety regulations to have predominant effects in the textiles, shoes, and wood products industries.

Depending upon the nature of the regulatory environment, firms in some industries may prefer regulation over de-regulation. The trucking and airline industries generally opposed attempts to require them to face the costs of operating in unregulated markets.

Location

Due to opportune location, some firms are simply at an advantage in complying with regulations as compared to others. An example would be having a location near a certified waste facility for dumping purposes.

Technology

Firms with responsive technologies are better equipped to adapt to certain regulatory requirements than those firms lacking such technologies. The principal reason accounting for American Electric Power Co.'s resistance against installing scrubbers in 1975 as compared with Louisville Gas & Electric's passive acceptance is the mere fact that the latter possessed functional scrubbers whereas the former did not (Weaver, 1975).

Technical Expertise

Technical expertise may offer a firm a competitive advantage in meeting certain regulatory requirements (Mitnick, 1981). However, where regulatory agents do not possess the same level of expertise as personnel within the firm, frustration may occur over standards and requirements (Fox, 1981). Further, technical expertise developed under regulatory constraints may come at the expense of traditional economic planning, pricing strategies, and other critical strategic concerns (Mahon and Murray, 1980).

External Management

According to Raelin and Sokol (1982), external management can be defined as a style of management which recognizes and even profits from the social role of the modern business organization. The external manager recognizes that he or she is not simply accountable to stockholders and consumers, but is indeed a trustee to a number of external groups in society. Today, even with the retrenchment in OSHA standards, companies need to be alert to citizen demands in the area of toxic hazards. The Love Canal chemical waste incident is a case in point. It has been estimated that in the early 1950's had Hooker Chemical Co. spent $1.5 million to build a landfill for its toxic wastes, it could have ultimately saved three or four times that amount it is having to bear today in liability (Siegel, 1972). Mahon and Murray (1980) contend that in a regulated environment, the firm's capability in managing the relationship with external factors, the regulatory agency in particular, becomes a strategic advantage. They suggest that under regulatory constraints, strategic planning and action require political analysis and negotiating skills as opposed to the more traditional marketing and financial competencies typically called for. Leone (1977) identifies these political skills as entailing more than public relations or lobbying. They also involve direct interaction with the technical staffs of the regulatory agencies. External management may additionally incorporate socio-political forecasting (Wilson, 1974a).

Meyer (1980) has proposed a counterargument to the conception proposed above. He finds industry/government confrontations on regulatory issues to be a distraction, keeping management away from focusing its energies on the substantive economic concerns of the business.

Organizational Design

Mahon and Murray (1980) suggest that regulated firms are able to operate under traditional functional structures as opposed to the more flexible forms (such as the matrix) required by unregulated firms. On the other hand, flexible designs may allow more effective responses to new regulations. Communication patterns are obviously of import here. The time it takes for a good idea to travel before it triggers a budget decision by a top manager has considerable impact on a firm's regulatory response posture. Hence, independent corporate entities are likely to have faster response channels than divisional structures.

Organizational Behavior

Besides structural considerations, behavioral chracteristics can discriminate firms in their ability to respond successfully to regulations. Dailey (1978) found that team cohesiveness which in turn produces high worker commitment can increase problem-solving in R&D environments. Likewise, leader influence, characterized as people who can get things done in natural or ad hoc task groups within the company due to their position or prestige, can be a critical factor in solving problems posed by regulatory standards. Managerial effectiveness, defined as being able to accomplish the goals of the company or unit being managed, is also critical, but Mahon and Murray (1980) have cautioned that effectiveness be divided into two important parts when operating in a regulated environment: the substantive part which treats the specific economic purpose of the enterprise and the political part which concerns the firm's ability to

successfully manage its relationships with external entities. Effectiveness may also incorporate the ability of the firm to respond to both internal and external pressures.

RESEARCH METHOD

Data Collection

The intent of this study was to identify those variables which might discriminate between proactive versus reactive strategic regulatory responses on the part of corporate executives. Accordingly, a set of discriminating variables were selected from a survey of 114 in-house R&D projects in 40 firms representing a wide variety of industries and located in four areas: Boston, New York City-New Jersey, the Research Triangle of North Carolina, and the Silicon Valley of California. The survey, originating out of a larger study of R&D decision making, was designed to elicit information regarding the economic, technical, organizational, and socio-political climate surrounding project development. A large number of variables, including the ones mentioned above as cited in the literature, were included in the survey. A complete list of the close-ended variables accompanied by substantive category and definitions is provided in the Appendix. Most of the data obtained for these variables were collected through questionnaires administered to R&D managers and/or project leaders from the companies surveyed. However, many of the questions constructed from these variables were augmented by open-ended queries used in follow-up interviews with the respondents. A single respondent procedure was followed when the respondent was deemed to have been the sole authority on the project in question or at least the most knowledgeable. In cases where the single respondent procedure was deemed to be unreliable, i.e., where that individual may not have had sufficient information or where there may have been disagreement on some of the responses, a multiple respondent procedure was adopted.

Cooperating companies and contacts were chosen either from referrals supplied by informed persons and colleagues or by reference to the Standard and Poor's Register of Corporations. Selection was based on four criteria: diversity of industry, size, and geography, and nature of R&D function. Time and cost implications were also considered. There was indeed a wide range of industrial representation as the 40 participating companies came from 12 separate industries (shown in Table 1). With respect to size, companies ranged from a mimimum of 20 employees to a maximum of 65,000, the average size falling at 4500 employees. Average volume was $240 million in sales. The criterion of geographic diversity did not meet with total success due to cost constraints. Although cases were drawn from the four areas mentioned earlier, the majority of cases were from the Boston 128 beltway. Finally, with regard to R&D nature, only commercial R&D projects were accepted. This criterion excludes those which were dependent on government funding. Not only do such projects face and handle regulatory pressures in a unique way but they have generically different R&D patterns compared to civilian, commercial projects which must contend with market constraints.

Insert Table 1 about here

Of the firms ultimately selected, contact was made with either a person referred to the researcher by outside professional sources or with top managers of identified firms listed in the Standard and Poor's Register. Only rarely was the initial contact person the subsequent liaison contact. The liaison

contact was typically the individual in the firm whose role it was to sanction cooperation with outside research endeavors. This liaison contact would also make the appropriate arrangements for subsequent questionnaire and interview administration. Respondents were designated on the basis of their being the corporate officials most familiar with the projects chosen for study.

Regulatory Framework

As the term "regulation," referring to ways (both legal and administrative) in which the government intervenes in the marketplace to serve the public interest, encompasses a wide variety of forms, it is important to define the regulatory forms under consideration in this study. This will serve to set a boundary around the potential applications of the study in terms of strategic regulatory behavior. Most of the regulations referred to by the respondents were of a "social" variety; that is, they were aimed at a particular social function, normally requiring an assumption of part of the costs of a negative externality. This type of regulation tends to operate across industries. The most common agencies involved were the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA).

Other regulations can be characterized as "economic." These regulations tend to be industry-specific. The predominant need for such regulations occurs in instances of natural monopoly, but the respondent companies were not of this character. Rather, they operated for the most part in a competitive atmosphere, but were subject to market restrictions placed upon their respective industries; i.e., the instance of the Federal Communications Commission (FCC) in the communications industry or the Federal Drug Administration (FDA) in the pharmaceutical industry. Since firms in these industries must receive permission before marketing their products, the regulatory constraint is referred to as the preclearance. The final regulatory form considered in this study is the patent. Patents are issued to protect trade secrets, thus insuring opportunities for competitive advantage.

Although the three forms referred to above cover a wide set of regulatory action, they do not encompass regulations imposed for the following reasons: natural monopoly, destructive competition, excess profits, emergencies, or qualification (see Millstein and Katsh, 1981, for a detailed treatment).

Another way to classify regulations is to focus on their change orientation. According to Post and Mahon (1980), regulation may serve as a "buffer" against direct public pressure for change or as a "change agent" to force change in business practice. In this study, with the exception of six cases involving patent protection, the regulations in question are of the "change agent" variety. This is consistent with the expected role of government regulation in the R&D environment (Balachandra and Raelin, 1980).

Methodological Approach

The method undertaken used the project as the unit of analysis as opposed to the company. This was found to be an efficient practice for data-gathering purposes and is not expected to affect the results. Regulatory responses vary at the project level as do most other organizational properties. For example, different personnel are typically assigned to different projects, and projects are accordingly managed differently. The average number of projects considered per company was three.

The dependent variable of the study was constructed from two questions in the survey. The first question asked respondents their attitudinal reactions, using a 6-point Likert favorability scale, to the effect government regulations, laws, and/or patents had on the production and marketing of a development project in their portfolio. This question was then immediately followed up with an open-ended question which queried respondents on their specific responses (or actions) in light of the regulation(s) cited. Although the initial question included laws as a possible source of external involvement with the firm, in each case where a law was cited, it was a regulatory act.

Responses to both questions formed the basis for defining strategic regulatory response. The first question indicated managerial resistance, neutrality, or support of particular regulations. The second question revealed behaviors, including actual changes made in a project, whether they be product or process changes, in response to a particular regulation. It was in particular these behaviors or changes in project management which were later classified as either proactive or reactive regulatory responses. Before detailing these, a word is in order regarding the chain of causation outlined above.

The methodological procedure used in this study assumes that a firm may take a strategic approach to social intervention, as implied by an "interpenetrating systems" model of management and society (Preston and Post, 1975). This is in contrast to the purely defensive approach implied by a "command-and-control" model of regulation (Schultze, 1977). The "command-and-control" model assumes that firms in maximizing their self-interest occasionally cause market failures or create externalities that must be rectified in some way. Regulations are then instituted by government in an effort to represent the public interest and typically cause firms to do things they otherwise would not do. In most instances, the reaction of the controlled firms is hostile since the regulations have a negative impact. One would expect, under this scenario, that the negatively impacted firms would in turn attempt to thwart the regulation in some way or apply some kind of reactive behavioral response, such as providing less information than requested, initiating litigation, proceeding slowly in negotiations, not complying with administrative orders, etc. (Zashin, 1982). Of course, there is the possibility that some of this regulation may create markets for other firms or even stimulate new and productive activities within the regulated firms themselves. In this instance, one would expect this positive impact to produce favorable reactions, likely leading to some kind of proactive behavioral response, such as negotiating a favorable compliance schedule with the regulatory agency, changing a technological process in order to compete in a new market, etc. Under this defensive approach, the methodological procedure would have the researcher, working backward, pick up the behavioral response and then ask for the attitude attached to the behavior which in turn was affected by the regulatory impact.

The alternative, strategic approach to social intervention offers a different view of reality. Here, it is no longer assumed that the firm is captive to a dominating external force, but that both the firm and the government are part of a complex interactive system wherein the actions of one can have important strategic and structural effects on the other. Indeed, the firm can anticipate regulatory action and attempt

to affect the regulation through bargaining and political activity even before it is issued. This anticipatory behavior in light of the increasing politicization of the corporate environment has been argued as the basis for a new definition of the strategic planning process which would entail an integration of economic and socio-political needs (Wilson, 1974b; Windsor and Greanias, 1982).

The strategic approach sees the management, with acknowledged prior views about particular regulations, acting in the regulatory area at all times. This activity, which again is a complex interaction among managerial attitudes, behavioral responses (both proactive and reactive), and the raw effects of the regulation itself, produces either positive or negative impacts on the firm which, in turn, generate both favorable and unfavorable attitudes. These final attitudes may or may not sustain the prior attitudes of management in the area of the regulation. To analyze this strategic approach to social intervention, the methodological procedure requires that the researcher first pick up the attitude of the manager and then work backward to the response which, being strategic, occurs around the same time or even before the regulation.

The two methodological approaches outlined above are quite distinct. If one assumed the defensive approach were in operation, then the appropriate questioning pattern would be to first ask the respondent the behaviors or responses exhibited in light of the regulation in question. One might, for example, produce a list of potential responses from which the respondent would choose the one(s) most frequently engaged in. To inquire as to the nature of the response, including the manager's motivation, the relative impact of regulation in comparison to other factors, etc., it would be advisable to pursue the attitudes which shaped the response. This approach would not reveal a strategic posture per se, that is without further questioning. On the other hand, the second approach, by starting with attitudes and working backward to behaviors, is conducive to the detection of strategic responses.

This study, focusing on the strategic approach to social intervention, worked backward from attitudes to the specific responses of the research managers to particular

regulations. Only attitudes classified as "very" or "generally" favorable or unfavorable were considered. Those which indicated that a regulation had only "somewhat" or "no" effect were discarded from the sample. Admitting these intermediate cases could have produced spurious effects, since regulation was obviously not deemed to be a critical factor compared to other factors in affecting project outcome. These attitudes were then traced back through the respondent's evaluation of the impact of the regulation to the ultimate proactive or reactive response. The author made the final assignment to the respective category but was guided by the respondents' own statements regarding their actions in light of the regulation(s) in question. This procedure produced 42 usable cases (24 proactive and 18 reactive) which were then subjected to simple discriminant analysis.

Proactive responses were very prevalent among companies which were interested in taking advantage of markets in pollution control devices and also among those which needed market protection. Several respondents indicated that their products were modified because of existing regulations. For example, some products were designed and then completed because management perceived an opportunity for products which monitored or reduced pollution in order to comply with EPA regulations. In these cases, projects were often undertaken in spite of additional costs directly attributed to the regulations.

Patent law is another area which was associated with proactive responses. Many of the companies surveyed indicated that since protection of ideas was essential to innovation, patents were a desirable form of government regulation and were consequently aggressively pursued. Management would be more willing to spend time and money on idea generation when there was a perception that government regulation would serve to increase product protection. One respondent commented outright that: "the patent encouraged project completion." Finally, other proactive responses were generated by respondents who saw the government as favoring a product in their particular industry.

Reactive responses toward regulatory activity were prevalent among many of the companies surveyed. Some R&D managers complained about the excessive costs and paperwork associated with particular regulations and sought ways to reduce the burden, even including preparations to thwart compliance. There also seemed to be a widespread belief that government should not be interfering with research. One project leader complained that: "the FDA set bounds which prolonged production." Another respondent bemoaned that: "30% of his time was spent to consider government regulations." Reactive responses tended to focus not merely on the marginal costs precipitated by regulations on individual projects, but on their burden on the industry as a whole.

Discriminant Analysis

The principal statistical technique used, discriminant analysis, mathematically combines a list of variables, associated with a discrete dependent variable, so as to isolate as distinctly as possible the observations according to their classification in terms of the dependent variable. In the instance of this study, there are only two dependent variable categories under consideration: proactive and reactive regulatory response. Therefore, the discriminant analysis will create one discriminant function or one linear combination of the discriminating variables. The variables are assigned coefficients which, comparable to usage under regression techniques, can be interpreted as weights indicating relative contribution to the discrimination along the function.

Also common to regression techniques, discriminant analysis can be performed using a stepwise feature. Accordingly, variables are entered into the equation in order of their discriminating power. In this study, a partial multivariate F ratio was used to control the selection and also the removal of variables in the ultimate set of discriminating factors. All variables not having interval properties were converted using dummy coding procedures. The final set of vari-

ables submitted to discriminant analysis were also tested for multicollinearity through factor analysis. The resulting variables were deemed to be sufficiently orthogonal in their single-indicator state except for the size variables which were combined into a composite using factor coefficients as the appropriate weighting device.

Discriminant analysis was considered to be the appropriate methodological technique for the study since it clearly identifies whether the discriminating factors make a positive or negative contribution. Further, it avoids having to work with imprecise, subjective scaling, which is susceptible to regression to the mean. Discriminant analysis provides usable statistics to judge the adequacy of the discriminant function, but in addition, offers a classification technique which permits a cataloguing of the original set of cases according to how many were correctly grouped by the variables under consideration.

In order to generate policy implications from any results of the study, a post-analysis policy survey was conducted with six R&D officials from local companies which were not involved in the original study. One official from the regional office of a federal government regulatory agency also participated. The purpose of the policy survey was to elicit reactions from informed respondents regarding the results of the study. In particular, respondents were shown the results of the discriminant analysis and asked to comment in an open-ended fashion whether the findings would "make any difference in the way they approached R&D in their company/agency."

RESULTS

The results of the discriminant analysis are displayed in Table 2. They reveal that the one discriminant function produced is very important. The canonical correlation squared can be interpreted similarly as the more familiar R^2

in regression analysis. It discloses that 85% of the variance in the discriminant function is explained by the two regulatory response groups. The associated F-ratio is significant at the .001 level. As a further validation, the classification results displayed in Table 3 reveal that the discriminant function correctly classifies 95 per cent of the cases in the analysis.

Insert Table 2 about here

Looking at Table 2 more closely, it is apparent that market share and volume contribute to proactive regulatory response whereas ROI (return on investment) and profitability contribute to reactive response. This seeming inconsistency might be resolved by the "Averch-Johnson effect" (1962) which depicts firms under regulatory constraints trading off profitability for market share. However, a more convincing argument for the firms under study might be that constraining regulations by extending the time horizon on projects, by increasing unpredictability of results, and by contributing to imprecision in measurement, create severe downward pressures on ROI (Mechlin and Berg, 1980). Market share, on the other hand, creates conditions for a proactive response. A market leader, for example, may be in a good position to favorably negotiate a regulation. Moreover, as was pointed out by one respondent of the post-analysis policy survey, under conditions of a large or growing market share, the future is considered to be sufficiently promising that companies feel they can afford the expensive paperwork which is required by compliance. A further comment from another respondent was that an increase in market share reflects an active management team which is actively building a company's market share by "taking advantage of regulations." This might mean developing process technologies in compliance with regulations which might have the ultimate effect of lowering unit costs-- a clear-cut strategy for widening market share. Finally, early entrants into markets newly created by regulations can gain a considerable competitive advantage.

Insert Table 3 about here

Beyond share and volume, another strategic variable of import is number of end uses. End uses refer to the number of distinctly separate applications which may emanate from any one project. The greater the number of end uses, the more latitude management is likely to have in facing regulatory requirements. Further, some regulations create markets. One company in the electronic component industry enjoyed expanded opportunities for its test equipment due to OSHA and EPA regulations as well as FAA airplane guidelines.

Contrary to much of the literature, size appears on the negative side of the ledger of strategic regulatory response. In this study, as pointed out earlier, size was a composite variable made up of five collinear components: sales, personnel, R&D budget, R&D personnel, and total number of R&D projects. The larger companies were apparently more vulnerable to regulatory constraints and used their resources to resist the regulations. A large drug manufacturer in the sample felt completely bound by FDA documentation requirements. Small firms are structurally in a better position to systematize the handling of the mass of paperwork generated by compliance. Two respondents cited some other specific advantages of small size. In one instance, a small firm learned how to cope with solid waste disposal requirements by benefiting from privileged information made available by a larger firm of which it was a customer. In a second instance, a large firm facing a declining share of government sponsored R&D decided to purchase research services from a small entrepreneur.

Besides the size factor, organizational structure per se was addressed in the finding that independent companies, as opposed to divisional or subsidiary entities, tended to react favorably to regulation. This suggests greater flexibility of response. A division or subsidiary may be constrained by the need to check out its policies with headquarters. One respondent of the policy survey

confirmed this implication indicating that subsidiary managers often must conform to parent company policies on compliance. Furthermore, a subsidiary manager has to go to the parent company to request budget funds, since compliance costs money. Due to geographical location, a subsidiary might also interpret particular regulations differently from the parent company. Finally, the manager of a subsidiary may require guidance from headquarters. As this could take time, it might give the appearance if not the actuality of being reactive.

At first glance, a rather disturbing finding is that managerial effectiveness, defined as management's ability to accomplish its internal goals, is the most powerful negative factor in the discriminant function. However, as we have learned from Mahon and Murray (1980), internal managerial effectiveness doesn't automatically imply external effectiveness. Moreover, since technical expertise is also a negative factor, it is conceivable that the reactive firms - which have high ROI's, which are dealing with products at the infant stage of product development, and which have large R&D departments - have not developed the necessary political expertise to manage their regulatory response. Unfortunately, this perhaps also suggests some stultification of the vigor needed in infant-stage product development. One official, who responded to the policy survey, when confronted with this set of findings, indicated that companies with high technical expertise, profitability, and effective management might feel that a regulatory agency is meddling in the affairs of its business. One related problem, he went on to point out, "is that very often you have engineers who are very competent at engineering, but who are forced into a general business management role, and who are not good at that. They are easily upset by any business management problem. Also, they feel they know more technically than the compliance officers." A spokesman for another company put it this way:

"Technical expertise would indicate that a particular company is more capable than a regulatory agency in assessing the problem." An EPA official agreed in substance with this finding indicating that from his experience, the more informed a manager was or the more aware he was of his rights, the more likely he would be to resist EPA enforcement efforts. However, in most instances, the EPA official preferred to deal with these technically competent individuals since they tended to be less defensive.

The proactive firms appear to display greater political acuity. Their project leaders sustain a lot of influence in the company, and there is a good deal of top management support and worker commitment. In other words, the companies might conceivably be of the type that speakswith a single voice. Further, they tend to allocate greater budgets to their projects than the reactive companies.

Finally, the proactive companies face a high level of pressure, some of which emanates from within, but a good deal of which occurs due to the threat of external competition. These firms, already satisfied with adequate market share, also orient their research to productivity-enhancement as opposed to sales-expansion. This last finding is consistent with Marcus' conclusion (1981) that process changes may benefit more from regulation than product changes.

DISCUSSION

Discriminant analysis has proved to be a worthwhile methodology for examining strategic regulatory response. In this study, 17 variables were produced in the analysis, 11 of which were associated with favorable response, 6 of which were associated with unfavorable response. The discriminant function correctly classified 40 of the 43 cases under analysis. The sample size is not large enough to offer concrete conclusions in considering strategic response

to all types of regulations, but it is adequate for the type of regulations under consideration: social regulations, preclearances, and patents. Further research would be needed to consider the wide array of economic regulations. This study also did not break down the two response categories by managerial intention. A manager could initiate a proactive response, for example, with an underlying uncooperative intention. This kind of analysis would require a much more probing, case orientation than what was available through the data here.

This study does offer insight, however, into regulatory change orientation. All of the cases but six were of the "change" as opposed to "buffer" variety. However, in a separate analysis, a discriminant function was produced for the same sample minus the six patent cases. The results were almost identical. The same discriminating variables with the exception of external competition were produced, and the coefficients did not vary by any more than .3. Hence, the findings of the study apply to the "change agent" regulatory orientation. Future regulation studies should continue to identify which regulation type they are referring to.

In conclusion, the findings of this study are that in the regulatory environment under consideration, proactive responses occur under conditions of high market share, volume, and number of end uses, where the research orientation is towards productivity-enhancement, where there is top management pressure but also support for the project and its leader, and where the firm is an independent corporate structure facing pressure from external competition. On the other hand, reactive responses are inclined to occur among large companies with large R&D departments, where there is effective technical management, and where infant-stage product development yields relatively high returns. Although there is an insinuation from the findings that regulation impedes the technical development of infant-stage products--a vital component of R&D growth--there is the possibility that by developing greater socio-political skills, management in these reactive firms might turn regulation to their advantage.

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Table 1

Participating Companies by Industrial Classification

No. of Companies	Industry	SIC* Code
1	Oil and Gas	13
1	Food	20
3	Apparel	22, 23
1	Pulp and Paper	26
3	Chemicals	28
1	Plastics and Pharmaceuticals	30
2	Fabricated Metals	34
8	Machinery	35
7	Electrical Machinery	36
8	Instruments	38
1	Communication	48
1	Durable Goods	50
3	Business Services	73
40 total		

* Standard Industrial Classification

Table 2

Proactive vs. Reactive Strategic Regulatory Response:
Results of Discriminant Analysis

Proactive		Reactive	
Variable	Coefficient	Variable	Coefficient
Market share	1.74	Managerial Effectiveness	-2.08
Independent Corporate Structure	1.68	Size	-1.86
Productivity-Enhancement Research	1.35	ROI	-1.39
Budget	1.31	Technical Expertise	-1.22
Leader Influence	1.15	Infancy State of Development	-.43
Pressure	.83	Profitability	-.42
Number of End Uses	.79		
Top Management Support	.78		
External Competition	.75		
Volume	.60		
Worker Commitment	.53		

* Discriminant Function Statistics:

Eigenvalue 5.70
Canonical Correlation: .92 Canonical Correlation Squared: .85
F-ratio: 8.05 N: 42 Significance: .001

Table 3

Classification Analysis of Discriminant Function

		Predicted Group Membership	
Group 1	N	1	2
Proactive Response	24	23 (95.8%)	1 (4.2%)
Group 2			
Reactive Response	18	1 (5.6%)	17 (94.4%)

Percent of Known Group Cases Correctly Classified: 95.2%

APPENDIX

List of Substantive Categories, Variables, and Definitions

Category	Variable	Definition
Strategic		
	Product life cycle	Stage of product/process in its life cycle: infancy, growth, maturity, obsolescence
	Product turnover	Period of time in which a relatively new product/process or significant adaptation is introduced
	Nature of research (1)	Innovative or aligned
	Nature of research (2)	Productivity-enhancement or sales-expansion
	Market share	Expected annual market share as a percent for each identified market
	Volume	Expected volume in total dollars
	Commercial success	Probability that product/process after actual completion in development would achieve commercial success as defined by corporate objectives
	End uses	Perceived number of distinctly separate alternative end uses to which the results of the project could be applied
	External competition	Probability of competitors coming up with a competing product within a relatively short period
	Corporate alliance	Extent to which project was allied with other ongoing corporate activities
Economic		
	Company profit	Profitability of company, division, or subsidiary of company as per cent of sales
	Budget	Total budget allocation for the project and final total expenditure
	Profit margin	Projected gross profit margin (as per cent of sales) of product when fully commercialized
	Rate of return	Forecasted annual rate of return of project
	Capital availability	Probability that capital required for project could be obtained through easily available resources
Environmental		
	Interest groups	Disposition of external interest groups towards the outcome of the project
	Government regulations	Effect of government regulations, laws, and/or patents with respect to the production and marketing of the product/process
	Chance event	Occurrence of unanticipated chance event in the project's wider environment and impact, if any, on the project
Technological		
	Technical success	Probability that product/process would be successfully completed under the originally designated technological route
	Technological route	Characterization of technological route as being disjointed or smooth
	Technical expertise	Availability of adequate technical expertise for the project
Operational		
	Completion time	Estimated and actual project life time
	Time schedules	Percentage of times that the project met its milestones within a week's time
	Cost schedules	Percentage of times that the project met its cost schedules within 5% of scheduled costs
	Coupling	Degree of association between the project's commercial and technological aspects
Behavioral		
	Top management support	Degree of support from top management with regard to the project
	R&D management support	Degree of support from R&D management with regard to the project
	Pressure	Degree of pressure faced by project management during the life of the project
	Management commitment	Degree of commitment of project management
	Worker commitment	Degree of commitment of the project workers
	Influence of project leader	Relative influence of project leader given his/her position and/or prestige in the company
	Project champion	Emergence during the life of the project of a person who became identified with it and championed its cause, the project champion's position and purpose, and the approximate time of emergence
Organizational		
	Size	Size of company, division, or subsidiary to which project was attached in terms of number of employees and annual sales; size of R&D department in terms of number of employees, annual budget, and number of projects in the portfolio; and size of project in terms of number of project staff
	Corporate structure	Status of company: independent, division, subsidiary
	R&D structure	Organizational structure of R&D function in the company: line, matrix or project, unstructured
	Adaptability	Adaptability of project management to unexpected events during the life of the project
	Effectiveness	Ability of project management to accomplish the goals of the project
	Internal competition	Extent to which project was in competition with other R&D projects inside the company
	Project alliance	Extent to which project was allied with other ongoing projects