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PROFILES OF PRODUCT INNOVATORS AMONG LARGE U.S. MANUFACTURERS*

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This paper identifies four groups among 113 *Fortune* 500 manufacturers that approach innovation quite differently. The groups are based on 27 measured elements of corporate environment, corporate strategy, and formal and informal organization. Both product innovation and financial performance differ significantly over the groups, and a group of 42 firms that invest heavily in innovation perform best financially. A smaller group of firms that are not innovative but which follow a strategy of acquisition perform nearly as well financially. Firms focusing research resources on process innovation perform poorly, although process research complements product research among the effective innovators. Particularly important for explaining both product innovation and financial performance of these firms are salient combinations of classic elements of good environment, good strategy and good organization—strong positions in growing markets, investment in research and development, open and creative organizational structures and supportive organizational climates.

(INNOVATION; FORTUNE 500; FINANCIAL PERFORMANCE; ENVIRONMENT; STRATEGY; ORGANIZATION)

Profiles of Product Innovators Among Large U.S. Manufacturers

The importance of product and service innovation to a firm's long-term financial success is acknowledged in many fields (e.g., Comanor 1965; Kay 1979; Mansfield et al. 1971; Schmookler 1966). Drucker (1973) cites innovation as one of two factors (along with marketing) crucial to long-run corporate health, and a meta-analysis of literature on firm financial performance (Capon, Farley and Hoenig 1990) shows that profitability is particularly sensitive to inputs to innovation (primarily expenditures on product and market development). Innovation is particularly difficult in large, complex organizations; managers in the U.S. and abroad are often aware of these difficulties (Capon, Farley and Hulbert 1988, Capon and Farley 1990). This paper explores how elements of environment, strategy, formal organization and informal organization relate to product innovation and financial performance in a sample of 113 major United States manufacturers.

Our goal is integrative and holistic in the spirit of Burns and Stalker (1961) and more recently Van de Ven (1986). We believe an integrative approach is needed because so many determinants of innovation are suggested in the literature, and because these determinants, often of quite different types, may interact. For example, Walcoff et al. (1983) found that barriers to innovation include a mixture of technical (35% of barriers they identified), organizational (20%), strategic (29%) and environmental (16%) factors. Innovation is difficult to program, direct or even predict, but it is possible to create a combination of favorable economic and organizational conditions (Jewkes et al. 1969; Van de Ven 1986; *Fortune* 1984).

In this paper we analyze a combination of environmental, strategic and organizational factors that might be correlated with innovation. We also develop environmental, strategic and organizational profiles of firms whose approaches to innovation differ, and assess

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the effectiveness of each profile in terms of financial performance. We view our integrative approach as complementary to the large body of research on innovation, most focusing on a relative handful (often single) of determinants or correlates of innovation. In the next section we attempt to motivate our operationalizations of the correlates with individual results from the voluminous innovation literature.

Operationalization

We use four indices of innovation and 27 correlates measuring various aspects of environment, strategy and organization that by hypothesis affect innovation. The data, collected in personal interviews with senior corporate managers, are described later in the paper. Figure 1 shows the 31 items used in the analysis, along with hypothesized (partial) signs of relationships of each correlate with innovation.

The Dependent Variable: Innovation

There is no agreed-upon way to characterize a firm's innovativeness; we selected four variables to measure product innovation. The first two innovation measures are market-based measures of realized growth and technology-related revenues; the third measures tendency of firms to pioneer; the fourth measures technological sophistication. While there are some conceptual differences among the innovation measures, there is every reason to expect they will be correlated.

The market-based variables are:

(1) *percent of corporate revenues in the introductory and growth stages of the product life cycle* (I1). Firms with only modest tendencies in business mix towards early phases of the life cycle have been shown to be significantly more profitable than others (Capon, Farley and Hulbert 1987).

(2) *percent of corporate revenues resulting from new technology* (I2); new technology is defined as technology not commercially available ten years earlier.

Management practice is represented by efforts of some firms consistently to pioneer new products.

The *first-to-market* measure (I3) captures the idea that the firm attempts to be ahead of rivals. Although there is debate over the impact of pioneering on firm performance, and dominant firms are not necessarily the first to innovate, there is evidence that on balance pioneers benefit in terms of market share and ROI (Robinson and Fornell 1985; Urban et al. 1986). Product innovators may also benefit from the fact that early adopters of new products or practices differ from those that follow (Rogers and Shoemaker 1971). (Quick imitation may also be profitable (Spence 1984); while this may be good management, it does not reflect the spirit of innovation we are seeking.)

The technological measure involves the degree to which the firm purposively attempts to be at the *cutting edge of technology* (I4) in its new product and service introductions.

The Correlates of Innovation

For convenience, we organize our discussion of innovation correlates into four conventional major, interrelated, categories—environment, strategy, and formal and informal organization. As indicated in Figure 1, we expect to find elements of each category associated with innovation.

Environment

Most of the copious discussion about how environment affects innovation has focused at the business as opposed to the corporate level. For example, based on PIMS business level data, Hambrick and MacMillan (1985) found that new product outputs were significantly and positively related to new product sales in the industry (basically environmental), as well as to relative product line breadth, innovative experience and R&D

FIGURE 1. Items Used to Measure Product Innovativeness and Its Correlates.

	Hypothesized Relationship of Correlates with Innovativeness
Product Innovativeness	
I1. Please estimate the fraction of total corporate revenues in 1979 from the introductory and growth stages of the product life cycle?	*
I2. What percent of this year's sales will be generated by products dependent on technology which did not exist or was not commercially feasible in 1970?	*
I3. In new product and service introductions, how often is your company first-to-market with new products and services (1 = never, 5 = always)?	*
I4. In new product and service introductions, how often is your company at the cutting edge of technology (1 = never, 5 = always)?	*
Environment (*E*)	
E1. Over the past five years, what percent of your sales were in markets growing at real rates of:	
a. over 20 percent per annum (%)?	+
b. between 10–20 percent per annum (%)?	+
E2. The life cycles of most new products seem to be getting shorter and shorter (1 = disagree, 5 = agree)?	+
E3. Over your long-term planning horizon, for what percent of your sales volume will government regulation increase (%)?	+
E4. What percent of your company's total sales volume is achieved in competitive environments where your sales are more than twice the sales of the second competitor and other competition is minor (%)?	+
Strategy (*S*)	
S1. On average over the past five years, what percent of corporate revenues have been allocated to R&D activities (%)?	+
S2. Of the R&D allocations, what was the split between:	
a. new product (%)?	+
b. new process (%)?	−
S3. What percent of your R&D budget is allocated to R&D consortia of which you are a member (%)?	?
S4. Has your company made any significant acquisitions since 1974 (1 = yes, 0 = no)?	−
S5. This company prefers to seek growth through acquisitions rather than internal R&D (1 = disagree, 5 = agree).	−
S6. How important was growth via existing products into new markets in your corporate strategy over the last five years (1 = not-at-all important, 5 = very important)?	−
S7. In your new product and service introductions, how often is your company an entrant into mature, stable markets (1 = never, 5 = always)?	−
S8. The emphasis of our R&D expenditures is highly applied (1 = disagree, 5 = agree).	+
Formal Organization (FO)[1]	
FO1. New product development is the responsibility of a special organizational unit of our company.	+
FO2. Development of new markets for existing products is part of a special organization unit.	−
FO3. The organizational form and structure encourage entrepreneurial behavior.	+
FO4. There are special incentives for entrepreneurial behavior.	+
FO5. Currently we are successful in obtaining talented scientific personnel.	+
FO6. We develop plans for products which span their expected life cycles.	+
Informal Organization (IO)	
IO1. New ideas are always being tried out here.	+
IO2. Unusual or exciting plans are encouraged.	+
IO3. A discussion about the latest scientific inventions would be common here.	+
IO4. There is cooperation among people in getting things done.	+
IO5. A friendly atmosphere prevails among people in this company.	+
IO6. Management is quick to criticize poor performance and seldom forgets a mistake.	−
IO7. Overall, the decision-making style of senior management in this company is authoritarian.	−

* Element of dependent variable.

[1] All items in Formal Organization and Informal Organization were scaled (1 = disagree, 5 = agree).

spending (basically strategic). Our view is that innovation is related to the extent to which the firm (1) is exposed to pressures that require innovation to survive and prosper, and (2) can secure sufficient resources to support innovation.

Environmental Pressures. Mueller (1967) suggests that presence in high-growth mar-

kets increases confidence in securing benefits from uncertain R&D investments while providing greater leverage from cost-reducing innovation. Several authors have argued that innovation leading to new product introductions is a function of stage of the product life cycle (e.g., Levitt 1965). Moore and Tushman (1980) suggest that major product innovations are likely to occur in the introductory and growth stages of the product class life cycle, whereas production process innovations are more important in maturity and decline. They argue that product innovation in the introductory stage is frequently radical and discontinuous but that later in the life cycle a dominant design emerges to become the basis for product standardization. (See also Hayes and Wheelwright 1979; Abernathy and Utterback 1978.) Firms that compete in rapidly growing markets should thus be active product innovators. This view is also consistent with the notion of a corporate life cycle in productivity (Quinn and Cameron 1983; Miller and Friesen 1984).

We use four measures of environmental pressures. The first two measure the degree to which the firm is involved in *high growth markets*—fraction of corporate sales in markets (1) growing over 20% annually (E1a), and (2) growing between 10% and 20% (E1b). The third measure relates to *shorter life cycles of new products* (E2). Ansoff and Stewart (1967) assert that markets with shorter life cycles require more frequent innovation. Finally, since government intervention tends to freeze competitive positions, innovation is expected to be negatively related to *anticipated increases in government regulation* (E3). Government involvement in an industry can act both as spur to, and inhibitor of, product innovation. Patents seem helpful in industries like chemicals and pharmaceuticals (Mansfield 1986); similarly, large R&D funding for military and space exploration provides both the stimulus to research efforts and an assured demand for new products (Schnee 1978). Furthermore, Mansfield and Switzer (1981) found that, rather than displacing private sector funding, government funding facilitated and expanded the profitability of private sector efforts. Conversely, government intervention and regulation of markets can stifle innovation through creation of artificial or protected markets (Holloman 1979); deregulatory actions can temporarily spur innovation in previously protected environments.

Environmental Resources. Business-level research has shown a strong relationship between market share and profitability (Buzzell et al. 1975). Firms with positions of *market dominance* (E4) should have the financial ability to fund R&D to support high degrees of product innovation.

Strategy

Innovation is often considered an element of strategy, so we focus on how related strategic inputs affect innovation as a strategic output. Research on corporate strategy (Bettis 1981; Christensen and Montgomery 1981; Meyer and Roberts 1986; Mintzberg 1978; Rumelt 1974) has shown that diversification around core competencies (of which technology is one component) results in superior financial performance. Pitts (1980) showed that the most successful mergers occurred when firms acquired companies that were strong technological additions and had complementary management styles. Research on business strategy has shown that product innovativeness is particularly related to financial performance early in the product life cycle, and that not only high, but also consistent R&D spending is necessary to produce good results (Maidique and Hayes 1984; Miles and Snow 1978, Hambrick and MacMillan 1985).

Five of our measures relate to growth through resource commitment; R&D (internal) and acquisitions (external). The R&D measures were *percent of corporate revenues allocated to* R&D *activities* (S1) and the split between *new product* (S2a) and *new process* (S2b) R&D. Managing R&D resources is a dominant theme of economists' contribution to the innovation literature (Kay 1979; Mansfield et al. 1971). The overall R&D allocation and share spent on new products should be positively related to product innovation; the

share spent on new process may be negatively related since it diverts resources from product innovation. There is ambiguity about the effect of *research consortia* (S3)—this may be an effective way to leverage research outlays, but consortia limit the firm's ability to develop product-based differential advantage. *Acquisition* (S4) is an alternative to internal investment for growth; it represents diversion of effort from internal R&D and was expected to be negatively related to innovation as values created by R&D may be discounted in acquisition prices.

Expressed innovation strategy relates to plans or strategic directions regarding product innovation. Of four measures of expressed strategy, three were expected to have negative relationships to product innovativeness (Ansoff and Stewart 1967): a preference for growth through *acquisition* (S5), a growth strategy emphasizing *existing products for new markets* (S6), and a preference for introducing *new products into mature markets* (S7). Emphasis on *highly applied* R&D (S8) was expected to be positively related to innovation.

Formal Organization

The formal arrangement of structures, processes, methods and procedures that detail how organization members are to behave can affect innovation. Examples are incentive systems that encourage risk taking and special product development teams (Walcoff et al. 1983). Formalization of tasks within the firm appears to affect all types of innovation negatively (Hage and Aiken 1968; Burns and Stalker 1961; Miller 1971). Burns and Stalker argue for "organic" organizations that allow the firm to adapt and innovate so as to survive and prosper in changing environments. Finally, certain structures can lead to radical, versus incremental, innovation (Ettlie, Bridges and O'Keefe 1984). Our six measures of formal organization comprise three involving structure and three involving process.

Organization Structure. The presence of a *special unit for new product development* (FO1) represents a special commitment to new product innovation and was expected to be positively related to innovation. Conversely, the existence of a *special unit for the development of new markets for existing products* (FO2) was expected to be negatively related (Walcoff et al. 1983). An organization structure believed by managers to *encourage entrepreneurial behavior* (FO3) was expected to be positively related to product innovation.

Organizational Process. All three of these measures were expected to be positively related to product innovation: the presence of *special incentives for entrepreneurial behavior* (FO4), success in *attracting talented scientific personnel* (FO5) and the development of *life cycle plans* for products (FO6). Life cycle planning represents an explicit recognition that products age and must be systematically replaced or improved.

Informal Organization

Much has been written on how informal organization (including culture and climate) can encourage innovation in large multi-product, multimarket firms; these companies are often not especially innovative (Hamburg 1963). Informal organization complements formal organization by providing an implicit or unwritten set of arrangements that operate where formal structures cannot cope, are dysfunctional, or do not exist (Nadler and Tushman 1980). Unsurprisingly, an open atmosphere is especially helpful for idea generation (Walcoff et al. 1983) and smaller R&D organizations may outperform larger (Yeaple 1987). On balance, several elements of informal organization seem to contribute to innovation (Schollhammer 1982): (1) psychological security and fair rewards for success (Lehr 1979); (2) continued stimulation and challenge (Atkinson 1957); (3) diffusion of authority and a noncoercive management style (Quinn 1985); and (4) flexible time and resource schedules. Informal ability to avoid formal barriers to innovation may also be important (Kidder 1983). Ebadi and Utterback (1984) conclude that frequency

and ease of communication between people is the single most important factor for successful product innovation; Zmud (1984) finds management attitude and receptivity to change positively related to process innovations. Von Hippel (1976, 1982) found that openness to the outside world (particularly to customers) contributes materially to innovativeness; Maidique (1980) argues that individual product champions are important to spearhead product developments through to fruition; and Lee and Allen (1982) document the importance of integrating new technical staff quickly.

Our seven measures of informal organization embrace the degree of openness in the internal environment, individual autonomy and the absence of tight structures that restrict cooperation and congeniality. The greater the extent to which *new ideas are tried out* (IO1), to which *unusual or exciting plans are encouraged* (IO2) and to which *discussion of scientific advances is common* (IO3), the greater the expected degree of product innovation. Also, openness of the internal environment in terms of *cooperation in getting things done* (IO4) and in general being *friendly* (IO5) are expected to be positively related to innovation. Conversely, the lower management *tolerance for mistakes* (IO6) and the more *authoritarian the decision making* (IO7), the lower the degree of innovation we expect to find.

Data

Responding Firms

The items just described were selected from a much larger set of measurements collected from a representative sample of 113 large U.S. manufacturers participating in a comprehensive study of planning, strategy and organization (Capon, Farley and Hulbert 1988). Each firm was a member of the *Fortune* 500 manufacturers when the data were collected; the companies invited to participate were sampled randomly from a population of 258 with corporate headquarters located east of the Mississippi. Of 165 firms contacted, 113 participated in the study. Three MBA students with work experience worked full time as interviewers on the project; they were trained and managed by a market research company.

Respondents

The data were collected in personal interviews with the senior corporate planning officer of each firm. Senior planning officers have a unique perspective on overall strategy and operations in these multi-product multi-market firms that compete in an average of 5.6 2-digit SIC code industries. Their planning experience is complemented by an average of 15 years with their firms, including line management experience in nearly all cases. Further, corporate planning personnel are unhampered by direct responsibility for financial performance targets related to specific businesses. Despite the good characteristics of the respondents (there was only one such person in each firm), single-respondent issues arise. This study comes close to meeting Brown et al.'s (1985) criteria for use of single informants with unique process insights.

Reliability

The standardized Cronbach α of 0.71 for the innovation indices indicates acceptable reliability of the innovation construct. In fact, the correlates produce a Cronbach α of 0.74 as well.

Results

There is increasing evidence regarding the existence of complex contingency relationships among elements of environment, strategy and organization such as those in Figure

1 (Hoenig 1990). Since we have a set of four correlated indices of innovation and 27 potential correlates of innovation, canonical correlation offers a useful way to establish the degree of interrelationship among the innovation measures as a set and the correlates as a set. This procedure also allows us to seek substructures of relationships among subsets of the measures.

There are two significant canonical compounds (Table 1) between the four innovation measures as a set and the 27 measures of environment, strategy and organization as a set. The presence of the second significant grouping indicates that we are not analyzing one simple set of co-varying measurements.

The variables associated with first canonical correlate (Table 1) confirm our general expectations about how the innovation indices relate to the correlates. The first dimension is significantly and positively correlated with all four innovation measures. Nineteen of 27 correlations with explanatory items are significant with the first canonical compound, indicating a strong but complex pattern of relationships between the innovation indices and hypothesized correlates. Further, items in all four categories—environment, strategy, formal and informal organization—have significant correlations. Signs of items conform to the expected signs in all 14 cases where positive correlations are significant; the five significant negative correlations have the expected reverse relationships with innovation. The overall pattern confirms the classic importance of environment, strategy and organization—with the important addition that effects hold up in a partial sense when other important factors are held constant. Innovation is greater in growing markets; where the firm has dominance; where resources are committed to R&D, for product (in contrast to process) development; where the formal organization facilitates investment of human resources in entrepreneurship; and where the informal organization is open to new ideas. Innovation is negatively related to acquisitions, strategies involving existing products and mature markets, and to process R&D. The weakest effects are with informal organization where only two of seven items correlate significantly.

The second canonical correlate is most heavily weighted on *First-To-Market* indicating that this innovation measure contains unique informational content. Three of the five organizational climate items that are absent in the first canonical compound correlate in this case; a nonauthoritarian, cooperative and friendly atmosphere is conducive to early product introduction. Success in hiring and life cycle planning are also apparently helpful in getting products to market quickly. The negative correlation with fraction of sales in growth markets may indicate the second order effect noted earlier of market leaders not necessarily being pioneers.

Overall, only five of the 27 items do not relate to either canonical correlate. It appears that government regulation and membership in R&D consortia are neutral with regard to impact on innovation, although these conclusions are highly tentative.

Profiles of Innovators

The contingency relationships among our measurements imply the possibility that identifiable groups of firms with different but complex profiles of how innovation is approached may exist. A cluster analysis of the 113 firms based on the correlates of innovation (i.e., using neither innovation indices nor performance measures) produced four interpretable firm clusters. (The next clustering step divided one group into two similar subgroups, one of which was very small.) The cluster profiles (Table 2) include significant differences in 22 of 27 innovation correlates and indicate that the firms group into internally consistent patterns of environment, strategy, formal and informal organization; innovation performance differs significantly across groups. Mean financial performance also varies significantly over the groups (Table 2), but over-time variability at the firm level does not, indicating that we are not merely cataloguing risk differences.

The four firm groups approach innovation in quite different ways. Some invest in

TABLE 1

*Significant Correlations of Innovation Indices and Correlates of Innovation with Canonical Variates**

	Correlation of Measure with Canonical Variate		Hypothesized Sign of How Correlates Should Relate to Innovativeness
	1	2	
INDICES OF INNOVATION (Standardized Cronbach α = 0.71) (Variable Group 1 in canonical correlation)			
I1 Corporate Revenues in Introduction and Growth Stage (%)	0.90	−0.32	
I2 Corporate Revenues from New Technology (%)	0.68	0.31	
I3 Firm First-to-Market	0.56	0.73	
I4 Firm at Cutting Edge of Technology	0.56	0.27	
CORRELATES OF INNOVATION (Standardized Cronbach's α = 0.74) (Variable Group 2 in canonical correlation)			
Environment			
E1a Market Growth, over 20% per annum	0.43	−0.33	+
E1b Market Growth, 10–20% per annum	0.40	NS	+
E2 Product Life Cycles Is Shortening	0.31	NS	+
E3 Government Regulation Is Increasing	NS	NS	+
E4 Market Dominance	0.29	NS	+
Strategy			
S1 R&D as percent of Sales	0.50	NS	+
S2a R&D Intensity—New Products	0.49	NS	+
S2b R&D Intensity—New Processes	−0.30	NS	−
S3 R&D Intensity—Consortia	NS	NS	?
S4 Significant Acquisitions	NS	NS	−
S5 Acquisition versus Internal R&D	−0.21	NS	−
S6 Growth Strategy—Existing Products/New Markets	−0.17	NS	−
S7 Growth Strategy—New Products/Mature Markets	−0.35	0.20	−
S8 Applied R&D	0.26	NS	+
Formal Organization			
FO1 Special Unit for New Product Development	0.23	NS	+
FO2 Special Unit for New Markets, Existing Products	−0.18	NS	−
FO3 Organization Structure Encourages Entrepreneurial Behavior	0.22	NS	+
FO4 Special Incentives for Entrepreneurial Behavior	0.19	NS	+
FO5 Hiring Success for Scientists	0.37	0.24	+
FO6 Product Life Cycle Plans	0.35	0.17	+
Informal Organization			
IO1 Investment in New Ideas	0.22	NS	+
IO2 Unusual or Exciting Plans Encouraged	NS	NS	+
IO3 Scientific Discussions Common	0.35	NS	+
IO4 Cooperation Between People to Get Things Done	NS	0.18	+
IO5 Company Atmosphere Friendly	NS	0.23	+
IO6 Poor Performance Criticized	NS	NS	−
IO7 Decision-Making Authoritarian	NS	−0.19	−
CANONICAL CORRELATIONS	0.82	0.68	
NUMBER OF SIGNIFICANT CORRELATIONS OF INNOVATION MEASUREMENTS WITH CANONICAL VARIATES			
Innovation Indices	4	4	
Correlates of Innovation	19	7	

* All correlations shown are significant at α = 0.05; two canonical correlations are significant.

TABLE 2

Significant Differences in Cluster Profiles for Four Groups Based on Correlates of Innovation[1]

	Number of Firms	Correlates of Innovation (used in clustering)				Innovation and Performance Indices (not used in clustering)	
		Environment	Strategy	Formal Organization	Informal Organization	Innovation Indices	Mean ROC (1977–1981)
Investors	42	Highest on: • Market growth —over 20% —10% to 20% • Life cycles shortening	Highest on: • R&D • Fraction of R&D budget spent on new product R&D Lowest on fraction of R&D budget spent on new process R&D	Highest on: • Special entrepreneurial incentives • Hiring success High on: • Life cycle planning • Structure encouraging innovation	Highest on: • Investment in new ideas • Unusual or exciting plans encouraged • Scientific discussions common	Highest on all four	12.8%
Process improvers[2]	36	Low on: • Market growth —over 20% —10% to 20%	Highest on fraction of R&D budget spent on new process R&D Lowest on fraction of R&D budget spent on new product R&D Low on: • R&D (total) • R&D consortia	Highest on structure encourages entrepreneurial behavior	Highest on: • Cooperation • Friendly atmosphere	Low on fraction of sales in growth markets	8.0%
Noninnovators	25	Lowest on: • Market growth over 20% • Life Cycles shortening Low on market growth 10% to 20%	Lowest on: • R&D • R&D consortia	Lowest on: • Special units for —new products —new markets • Structure encourages innovation • Special incentive for entrepreneurs • Hiring success • Life cycle planning	Lowest on: • Investment in new ideas • Unusual or exciting plans encouraged • Scientific discussions common • Cooperation • Friendly atmosphere	Low on fraction of sales in growth markets Lowest on other three innovation measures	10.0%
Acquirers	10	Low on: • Markets growing over 20% • Shortening life cycles	Highest on: • R&D consortia • Acquisition Low on R&D			Lowest on fraction of sales in growth markets	12.4%

[1] Table contains items with cluster means significantly different, based on one-way ANOVAS, from the overall mean of the item. When an item does not appear in a cell, it is not different from the sample mean.

[2] Next step in clustering divides this group into two subgroups, one with a small number of firms, with generally similar profiles that differ chiefly in degree.

process and/or product innovation, some avoid investing in innovation and some acquire it:

The Investors. The largest group includes 42 firms that are both product and process developers. They also have clear profiles in terms of environment, strategy and organization. They invest heavily in R&D—3.5% of revenues or about double level of the other groups; focus heavily on new products; are structured to encourage entrepreneurship; and have an informal atmosphere in which new ideas can flourish. These efforts bear results: as a group, these firms are highest on all four innovation indices. They also have the highest average return on capital but only average over-time variability in return.

The Process Improvers. This group of 36 firms commits its relatively modest research resources to process (as opposed to product) innovation. (The Investors nearly match this group on process R&D spending.) Entrepreneurial behavior is encouraged in a friendly and cooperative atmosphere but this does not help overcome an ineffective strategy. The Process Improvers appear to focus attention on doing what they now do but doing it better and more happily (Davies 1979). The results are not very good—low participation in growth markets, and low but variable returns on capital.

The Noninnovators. These 25 firms do not encourage or invest in innovation either strategically or organizationally. They are low in all aspects of innovation, and their formal and informal organizations are not what would generally be thought of as "good." However, they are not the poorest group of financial performers; they rank ahead of the Process Improvers. We have found elsewhere that poor performance does not necessarily parallel low measured values on those characteristics on which good performers excel (Capon, Farley and Hulbert 1987).

The small group of 10 *Acquirers* substitute acquisition and contribution to research consortia for internal innovation. They have simple profiles and their organizations have no special characteristics. The acquisition strategy yields the lowest average fraction of sales in growth markets and average values on the other innovation indices, but their returns are nearly as high as the Investors. This result is consistent with our earlier conclusion that there are quite different alternative approaches to excellent performance (Capon, Farley and Hulbert 1987).

Discussion

This study investigates factors related to product innovativeness of 113 large U.S. manufacturers. The goal was to examine many factors believed to affect innovation and to identify profiles that characterize different ways in which firms approach innovation. The results support our view that a holistic, integrative view involving environment, strategy and organization is required to analyze innovation.

Innovation was measured four ways—sales volume from early life cycle stages, new technology products, technological leadership and new product pioneering. Twenty-seven hypothesized correlates of innovation were drawn from strategy, environment, and formal and informal organization. Unsurprisingly, the measures of innovation were correlated and there is strong evidence of complex contingency relationships of environment, strategy and organization to innovation.

In most cases the individual correlates were related to innovation in expected ways. Seeking high growth markets and avoiding mature markets, heavy expenditures on product R&D, incentives for entrepreneurial behavior, ability to hire good scientists, life cycle product planning and a cooperative work environment are related to all aspects of innovation. Pioneering seems to provide an additional dimension of innovation related to having good scientists working in an open friendly atmosphere.

Four profiles of firms classified in terms of environment, strategy, and organization were different in terms of both innovativeness and financial performance. However, it

is important to remember that whereas firms in the various groups are significantly different on average with regard to almost all of our measurements, there is considerable within-group variability, and we are not suggesting that we have uncovered formulae to be followed for success or avoided for failure.

A group of 42 firms, the best performers in terms of both innovation and return on capital, invested heavily in R&D, and provided incentives and a climate that encouraged innovation; they scored highest on all four innovation measures. A second group of 10 firms that were active in acquisition, but did little innovation, performed almost as well in terms of return on capital. Thirty-six firms that invested in process improvement performed poorly in terms of return even though they had a cooperative organizational climate. A group of 25 rigid, noninnovative firms performed about average in terms of return on capital but poorly on all indices of innovation.

Our results have implications for managers wishing to make their companies more innovative. Setting goals to increase the fraction of revenues generated by new technologies and achieved in growing markets should improve innovation. A variety of more directly controllable actions—investing in R&D, designing appropriate incentive structures, and encouraging the development of an atmosphere in which creativity is permitted to flourish—should also be helpful. However, our results on contingencies show that these actions tend to work together, no one promising success. An important caveat is that the results are cross sectional and we do not know if there is a "most effective" order in which these measures should be implemented. Clearly it would be difficult to do everything at once for an organization trying to develop a more innovative strategy.

On the negative side, a focus of spending limited R&D resources on process innovation does not look promising; tight control with no effort to innovate on average yields better financial results. Creating a cooperative and friendly atmosphere apparently does not help innovation or financial performance *per se.* In fact, firms that apparently do not try to innovate and have poor organizational climates (at least according to conventional wisdom) perform near the average for all firms.

Finally, whereas innovation appears to contribute to financial performance, it was somewhat surprising that the noninnovative firms involved in acquisitions appear to perform almost as well as firms committed to innovation. Other research in this area (Chakrabarti 1990) indicates that the impact of acquisitions on profits depends on both strategic fit and organizational integration, so that acquisitions are not a guarantee of improved performance. Perhaps firms that chose to make acquisitions differed in important ways from those that did not, and these differences, rather than the acquisition strategy, explain their relatively strong performance. In any event, future research is needed on internal innovation vs acquisition as growth strategies, as well as on determinants of success for each strategy.[1]

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