

Differences in Strategies and Performance of Different Types of Innovators

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Abstract

The strategies and competencies of small and medium-sized firms are explored here using the responses to the *Survey of Growing Small and Medium Size Enterprises*, conducted by Statistics Canada. The paper classifies small and medium-sized firms by innovator type and explores the complementary strategies in management, marketing, human resources and financing that are adopted by each innovator type and the success of each type of innovator.

A taxonomy of innovative types is developed that is based on the product/process development orientation of the firm. Differences in competencies in the area of human resources, management, marketing and finance that are possessed by firms in each group are examined. Firms are classified into one of four groups—*product innovators*, *comprehensive* (product and process) *innovators*, *process innovators*, or *non-innovators*—based on their responses to 22 innovation-related questions on the survey. These groups correspond to different stages in the development of a product market. *Product innovators* occupy the first stage, the time when the product is initially introduced. *Comprehensive innovators* represent the second stage, when the product demand is still growing, and firms in addition to producing new products, have begun to make dramatic improvements in their production efficiencies, by concentrating on process innovations as well as product innovations. *Process innovators* represent the third phase in the development of a product market, when the product characteristics have become established, and firms seek to improve their market share mainly by improving their production efficiencies. Finally, the last phase is characterized by a relatively stable product line, with a mature production technology.

The competencies of firms differ across these innovative types. *Comprehensive innovators* tend to develop greater capabilities than the other innovators in a wide range of areas. *Comprehensive innovators* also tend to outperform the other innovators in terms of growth in sales, market share, and employment size.

Innovators also tailor their financial strategies to their innovator type. *Product innovators* focus on a low debt/asset strategy with non-standard sources like venture capital. In later stages of the innovation life cycle—*comprehensive*—place greater emphasis on higher debt/asset ratios. Firms move from being highly reliant on just innovative sources of financing to using both innovative and more traditional sources of financing. In the third stage, comprehensive innovators make more use of retained earnings and move back to lower debt/asset ratios and increase their use of bank financing.

JEL 03, M00

Keywords: Innovation, Life-cycle, Financial Structure

1. Introduction

This paper classifies small and medium-sized firms by innovator type and explores the complementary strategies in management, marketing, human resources and financing that are adopted by each innovator type. It also investigates differences in the performance of each group of firms.

Innovation types are chosen as the broad theme around which the paper is based for several reasons. First, studies of innovation regimes (Lundvall, 1992; Nelson, 1993) have emphasized the differences in types of innovators, across nations, industries, and firms in terms of innovation types. Firms can focus on their existing customers or on new markets. They can concentrate on introducing new or improved products; they can devote their efforts to improving the efficiency of the production of their existing products; or they can introduce radically new processes. Some will focus just on product innovations; others just on process innovations; still others will combine both product and process innovations. Thus, firms differ substantially in their innovation stance.

The second reason that an innovation taxonomy is used here is that others who have studied the relationship between the strategy that a firm adopts and its success have found it to be a useful way to classify information on firm activity. Because firms are complex entities pursuing heterogeneous policies, a classification methodology is required to reduce the complexity of the analysis of the factors associated with success. Some, like Ansoff and Stewart (1967), Freeman (1974), and Miles and Snow (1978), have developed a general classification system to organize the wealth of information on firms' activities. Miller (1988) builds on the classification systems of Ansoff and Stewart (1967), Freeman (1974), and Miles and Snow (1978), which focused primarily on the production system of the firm—batch, assembly, continual process—and argues that it is the innovativeness of each that adds the necessary additional dimension for understanding differences among firms.

Others have chosen to reduce the dimensionality of the classification task by examining the determinants of success within a particular industry, size class, or technological emphasis. Chaganti (1987) finds that attention to production costs are associated with success in small firms in the industry growth stage; competitive pricing is associated with small-firm success in the mature industry stage; and aggressive marketing strategies are associated with success in small firms in the declining-industry stage.

This focus on the life-cycle model of product-process innovations has also been used by Hayes and Pisano (1994) and the Ministère de l'Industrie (1995) to suggest that manufacturing and innovation strategies will differ across the life cycle of a product or industry, with the early stages of the life cycle being driven primarily by product innovation while process innovation becomes relatively more important in the later stages of the product life cycle. The importance of the life cycle of a product market that was emphasized by Kuznets (1953) and its connection to different types of innovation strategies is developed by Gort and Klepper (1982) and Klepper (1996), who argue that the stage of the life-cycle affects the type of strategies that will be found in an industry.

While innovation *in general* is related to success (Baldwin et al. 1994; Nelson, 1993; Mowery and Rosenberg, 1989; Utterback et al., 1988), the type of innovation *in particular* may affect a firm's probability of success. It may also be the case that certain conditions—firm characteristics or

strategic orientations—are necessary for success and that these vary across innovator types. For example, firm size is emphasized in the Schumpeterian literature as being a key to success. In previous studies, success has also been related to export activity (Edmonds and Khoury, 1986), merger activity (Reid, 1969), and human resource strategies (Rosenbloom and Abernathy, 1982). The type of competencies in the area of financing, human resources and management that are necessary complements to an innovation strategy may be constant irrespective of the market within which a firm is operating, or they may vary across innovator types.

This paper builds on the life-cycle literature and uses an innovation taxonomy to study the strategy profiles of firms. Firms are classified into four basic types based on their innovation strategies. These different innovation types conform to the product life-cycle model that others have described. Differences across innovation types both in terms of success and complementary strategies in marketing, finance, and human resources are then explored.

In the following sections, the existence of distinct innovation types is first established. Subsequently, differences in the complementary strategies and the performance of firms in each of the innovation groups are explored. A brief description of the data, which is taken from the Survey of Growing Small- and Medium-Sized Enterprises, is presented in the next section.

2. The Data

Two types of data are used in this paper. Survey data are used to evaluate the emphasis on and the importance of firm strategies and activities. Administrative data on these firms are used to provide objective information on the size of firms, their growth and their profitability so as to evaluate how strategies are related to a firm's performance.

Administrative Data Measuring Success

Administrative firm-level data on sales, assets, employment, profits and equity for both 1984 and 1988 were used to calculate objective measures of success for firms in the survey. Success has many dimensions. It can be measured in terms of profitability or rate of growth, or market share. There are also decisions to be made as to whether success should be measured in absolute terms or in relative terms—whether it is the firm's growth or its growth relative to industry growth (market share change) that is important.

Not all of these measures are independent of one another. Baldwin (1995) reports that manufacturing firms that gain market share tend to be those that also increase productivity and profitability. In order to take into account the multi-dimensionality of success and at the same time to recognize that many of these dimensions are not independent of one another, a large number of measures were combined via principal component analysis into a general success index. The variables included in the analysis are presented in Table 1. Measures of market share change, labour productivity and profit/sales margins are weighted most heavily in the principal component used here to capture success (Table 1).

Table 1. Weighting Factors in the General Success Index

	Weight
Output share change	0.48
Asset share change	0.49
Equity share change	0.42
Profit share change	0.31
Labour share change	0.21
Change in profits/asset relative to industry	-0.02
Change in profits/equity relative to industry	-0.01
Change in profits/sales relative to industry	0.30
Change in sales/assets relative to industry	-0.03
Change in sales/labour relative to industry	0.16
Equity/assets in 1984	-0.05
Profits/assets in 1984	0.02
Profits/equity in 1984	0.02
Profits/sales in 1984	-0.26
Sales/assets in 1984	0.03
Sales/labour in 1984	-0.14

Source: Baldwin, et al. 1994, p. 59

Survey Data

The second source of data that was utilized to perform this analysis comes from the Survey of Growing Small and Medium-Size Enterprises. The survey was conducted in 1992 using firms that grew, in terms of sales, assets and employment over the last half of the eighties. Small- and medium-sized firms were defined as having less than 500 employees and less than 100 million dollars in assets in 1984. The sample was drawn from all major industrial sectors, with the exception of public administration. The survey of 2,157 firms was conducted by mail with telephone follow-up. The response rate was 69 percent. Only those firms that answered each question, and for which there were corresponding administrative data, amounting to some 661 firms, are used in this study.

The survey was developed with a view that firms are heterogeneous—that there is no unique recipe for success. Consequently, the survey investigates the competencies of firms in a variety of areas—their characteristics, activities, and strategic emphases—across a range of industries.

Answers to two types of questions allow us to gauge the types of competencies that firms develop. First, respondents indicated the importance they attributed to a variety of factors that contributed to their success including marketing, technology policy, human resources, and management practices. Respondents scored the factors on a scale of 0 to 5, with 0 corresponding to not applicable, 1 to *unimportant*, 2 to *slightly important*, 3 to *important*, 4 to *very important*, and 5 to *crucial*. Second, firms rated their performance relative to their competitors with regards to prices, quality of products, customer services, costs of production, R&D spending, labour climate and employee skill levels relative to their competitors, on a scale of 0 to 5, with 0 corresponding to *not applicable*, 1 to *much worse*, 2 to *somewhat behind*, 3 to *about the same*, 4

to *somewhat better*, and 5 to *much better*.¹ Additionally, questions pertaining to the exporting, investment, training, and innovating activity of firms were also posed. Finally, the importance of various sources of innovation were investigated.

Strategy Types

Data on a number of competencies are developed here. These include such areas as innovation, marketing, human resources, financing and management. In addition, the firm's innovative stance is carefully investigated. Since the survey contains a number of questions that probe each area, principal component analysis was adopted to summarize the wealth of data available. The following sections describe the variables that were used in this procedure, and the resulting constructs that are employed to investigate the relationship between a firm's innovation strategy and the other competencies and activities that it pursues. The first examines the taxonomy of innovation types that is used in the remainder of the paper. Then summary measures of investment, marketing, human-resource policy, financing, and management strategies are developed in turn.

Innovation

The first strategic variable to be analyzed is the innovativeness of the firm. Previous research (Baldwin et al., 1994) found that innovation is strongly related to success. Technological improvements in communication and transportation, coupled with globalization of markets, have exposed Canadian firms to intense competition. The most successful are those that out-perform their competitors by continually introducing new products and processes. However, the previous work did not attempt to provide a comprehensive classification of the different innovation strategies that firms pursue, as is done in this analysis.

A large number of both subjective and objective measures of innovative activity are available from the GSME survey. In addition to traditional questions such as the number of employees in an R&D unit and expenditures on R&D, subjective questions relating to the innovative stance of the firm and the importance of innovation-related strategies are also employed. Firms rated their R&D spending relative to their competitors on a scale of 0 to 5 (0 corresponding to not applicable, 1 much worse and 5 to much better). They also scored the importance of R&D innovation capability or the ability to adopt technology, on a scale of 0 to 5, as a factor in past growth. Questions on general development strategies queried firms on the importance they attribute to strategies related to developing new technology, using others' technology, using new materials, using existing materials more efficiently, reducing labour or energy costs, just-in-time inventory control, and process control. Finally, the stimulus for innovative activity is sought by asking firms to rate a variety of factors—both internal and external—on a scale of 0 to 5, in terms of the importance of that factor as a source of innovation.

¹ For a discussion of the merits of this approach, see Baldwin and Johnson (1996).

Table 2. Weights for Innovation Principal Components

	Process innovators	Comprehensive innovators	Product innovators
	Weights		
Percent of investment devoted to product innovation	0.14	0.10	0.25
Percent of investment devoted to process innovation	0.08	0.07	0.14
R&D spending relative to competitors	0.18	0.17	0.23
Importance of R&D/innovation capabilities as a factor in success	0.22	0.21	0.25
Importance of ability to adopt technology as a factor in success	0.16	0.18	-0.03
Importance of introducing new products in existing markets	0.04	0.22	0.16
Importance of introducing new products in new markets	0.01	0.23	0.14
Range of products relative to competitors	0.02	0.14	0.09
Frequency of introduction of new products relative to competitors	0.04	0.16	0.18
Importance of developing new technology	0.20	0.25	0.10
Importance of using others' technology	0.12	0.19	-0.07
Importance of using new materials	0.21	0.23	-0.21
Importance of using existing materials more efficiently	0.21	0.22	-0.31
Importance of cutting labour costs	0.19	0.20	-0.32
Importance of reducing energy costs	0.18	0.17	-0.38
Importance of just in time	0.08	0.17	-0.15
Importance of process control	0.17	0.22	-0.15
Importance of the R&D unit as a source of innovation	0.05	0.22	0.26
Importance of the marketing unit as a source of innovation	-0.22	0.25	0.04
Importance of management as a source of innovation	-0.28	0.23	-0.05
Importance of related firms as a source of innovation	-0.17	0.13	0.13
Importance of Canadian patents as a source of innovation	-0.14	0.17	0.22
Importance of foreign patents as a source of innovation	-0.07	0.17	0.26
Importance of government contracts as a source of innovation	-0.23	0.15	-0.04
Importance of competitors as a source of innovation	-0.36	0.20	-0.14
Importance of customers as a source of innovation	-0.37	0.22	-0.11
Importance of suppliers as a source of innovation	-0.35	0.21	-0.17

Principal component analysis was used to summarize the dimensionality in the set of variables capturing innovative activity. As will be demonstrated below, the first three principal components correspond to three different innovation types. The mean scores of each of the variables that were used to define the components are reported in Table 2, the standard errors in Appendix Table A.1.

The first prototype, *the product innovator*, represents firms that emphasize product innovation, as opposed to process innovation. These firms devote a significant proportion of their investment spending to product innovation. They place a high value on strategies related to continually developing and offering new products. They pay little attention to enhancing their technological capabilities or improving their production efficiency.

The second prototype is *the comprehensive innovator*. This component weights all of the innovation variables positively. Firms that receive a high score on this component are those that are innovative in a broad sense—firms that are seeking to innovate both their products and processes, and draw on a variety of sources for innovative ideas. They perceive that their capabilities with regards to technology (both developing new technologies and using others' technology), R&D-innovation, reducing energy costs, using new materials, just-in-time inventory control, and process control are critical factors contributing to their success and they obtain innovative ideas from a number of sources (marketing, management, the R&D unit and patents).

The third component is *the process innovator*. Firms that rank high on this principal component are those that are primarily devoted to process innovation. These are firms that perceive their success to be dependent on continually enhancing their technological capabilities and improving their production efficiency, by using new materials, using existing materials more efficiently, and reducing their labour and energy costs. These firms place little value on developing new products.

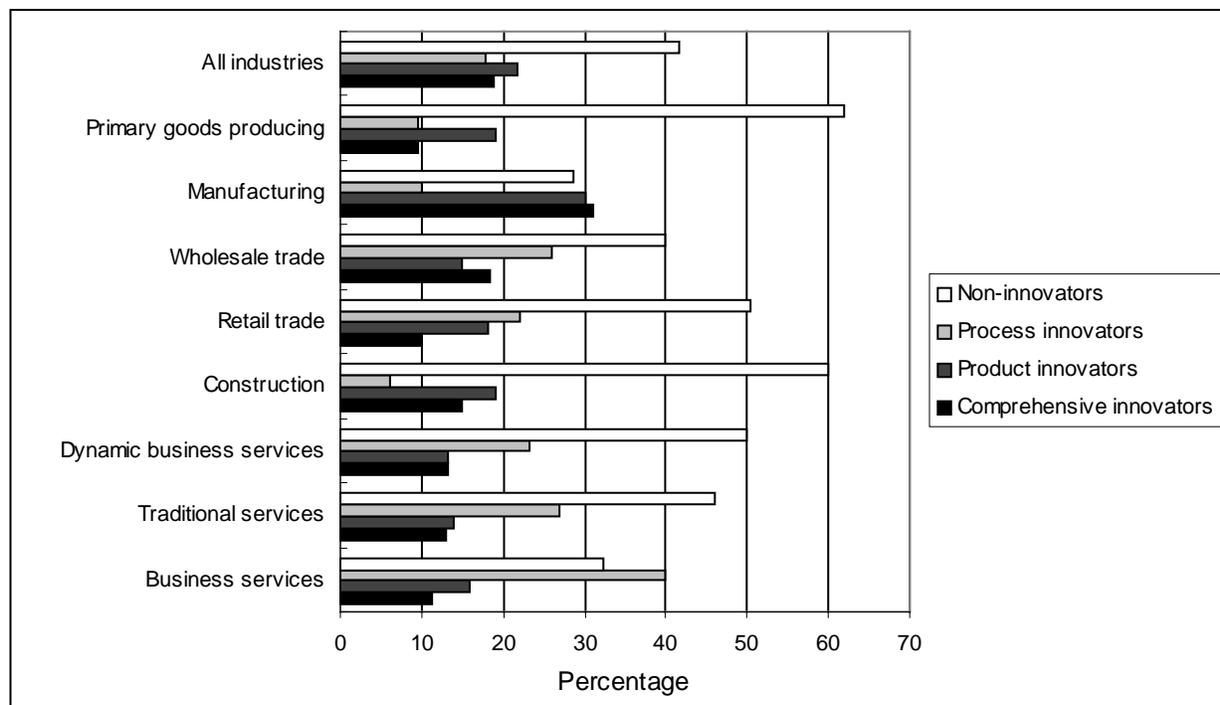
In order to interpret the differences in the policies that occur across the innovative types and within each type, it is useful to think of the three innovation components as corresponding to different stages in the product life cycle. The *product innovators* are those who focus purely on product development. At this stage in the product life cycle, product specifications are changing so quickly that firms have not yet had time to focus on process technology. *Comprehensive innovators* are those firms that have begun to integrate rapid product evolution with improvements in process technology. The *process innovators* operate in the third stage of the product life cycle when product specifications have more or less stabilized and a firm's attention is concentrated on moving down the cost curve via process innovations. Firms that do not have a high score on any of these innovation principal components operate in the fourth and final stage of the product life cycle—the mature stage in which neither products nor process innovation occurs very frequently.

These components were used to group firms by innovation type. To do this, firms were ranked according to their scores on each of the three innovation principal components. Firms that scored in the top quartile—the top 25 percent—in any of the three principal components were deemed to be innovative. Firms that scored in the top quartile of one component only were assigned to that component. A small number of firms that scored high on more than one component were assigned to the component where their scores most resembled the average score of the uniquely assigned innovators. All other firms were classified as non-innovative.

Some 19% of the sample consisted of *product innovators*, 19% were *comprehensive innovators* and 20% were *process innovators*. Membership in a particular innovative group is not solely determined by broad industry groups. While manufacturing industries are slightly more likely to be found in the innovative groups relative to services industries, firms in each of the industries are distributed across each of the innovative groups (Figure 1).

Since it is the purpose of this paper to examine how other competencies vary with the innovation strategy chosen, the nature of the data that are used to gauge the emphasis placed on various functional areas (management, finance, human resources) is developed in the following sections.

Figure 1. Industry Breakdown by Firm Type



Investment and Production Costs

In order to both adopt new technologies, and maintain properly functioning equipment, firms must invest in new machinery, equipment, and production facilities. The extent to which firms maintain and enhance their production capabilities is measured by whether the firm incurred any investment expenditures in the 1991 reference year and the percent of sales that were devoted to investment expenditures.

Marketing

Several indicators of the marketing strategy of the firm are available from the survey. Firms rated (on a scale of 0 to 5) the importance of strategies related to maintaining current products in current markets and introducing current products in new markets. They also rated themselves in comparison to their competitors in terms of price, quality, customer service, and flexibility in responding to customer needs. The first principal component index constructed from these six variables, referred to here as the *comprehensive traditional marketer*, is used to summarize the importance that the firm attributes to marketing in general. The weights assigned to each variable (Table 3) were relatively similar, thereby indicating that the variables have about the same importance.

The above measures capture the broad marketing stance of the firm. In addition, the exporting behaviour is used here to represent a separate and specific market orientation of the firm. Developing a significant export market allows firms to reduce risks by diversifying across dissimilar markets and to prolong the marketability of their products. Therefore, in addition to measuring the broad marketing efforts of firms, the export activity of the firm is used here as a separate variable to represent this specific aspect of its sales orientation.

Table 3. *Weights for Comprehensive Marketing*

	Weight
Maintaining current products in current markets	0.27
Introducing current products in new markets	0.33
Price relative to competitors	0.39
Quality relative to competitors	0.50
Customer service relative to competitors	0.46
Flexibility in responding to customer needs	0.45

Human Resources

As increased skill levels become an increasingly important element in many economic activities, the importance the firm gives to enhancing its human resources becomes more critical to success. The survey provides evidence about several different facets of firms' competencies in this area. Firms rated (on a scale of 0 to 5) both their labour climate and their labour skills relative to their competitors. They also rated the importance of labour skills as a factor contributing to their past growth. Additional questions elicited the value that firms attribute to various human resources strategies: continuous staff training, innovative compensation packages, and other means of staff motivation. As was the case with marketing, the first principal component was used to generate a comprehensive labour index that captures the emphasis a firm gives to human resources. Once again, a relatively similar weighting is assigned to each of the six underlying variables (Table 4).

In addition to examining the emphasis on human resources in a broad sense, the activities that the firm undertakes to improve its human resources are of particular interest. Actions taken to either improve existing skills or teach new skills should result in workers either being able to perform their existing tasks better, or to perform new tasks. Both contribute to superior performance. To capture this, a binary variable indicating whether or not the firm engaged in training, as well as the expenditures on training per employee in the firm, are also included in the analysis.

Table 4. *Weights for Comprehensive Labour*

	Weight
Labour climate relative to competitors	0.23
Labour skills relative to competitors	0.29
Importance of labour skills to past growth	0.36
Importance of continuous training	0.50
Importance of innovative compensation packages	0.48
Importance of other staff motivation strategies	0.50

Financing

The structure of, and attention to, financing are also likely to be factors that affect the success of the firm. The structure of financing is defined by the types of financing instruments used and the sources of that financing. There are two types of financing instruments measured by the survey: debt and equity. Debt is divided into short- and long-term. Two types of equity are captured by the survey: share capital and retained earnings.

Three summary statistics are used to represent the capital structure of the firm—the percent of net assets (assets minus accounts payable) attributable to debt, share capital, and retained earnings. The omitted variables for the types of financing are deferred taxes, and other types of financing (i.e., contributed surplus, shareholder advances).

Firms are also distinguished by the sources of their financing—whether from retained earnings, accounts payable, financial institutions, venture capital firms, public equity markets, governments, affiliates, deferred taxes, or other individuals. Some of these are more traditional sources of financing, while others are more innovative sources of financing. Innovative firms are typically perceived to have greater problems in raising capital because of the difficulty in evaluating the prospects of the company and the lack of hard collateral to back knowledge-based assets. It is, therefore, hypothesized that sources that specialize in evaluating the special risks involved (venture capitalists, equity markets) will provide more capital to those innovators where the problems of evaluation require specialized intermediaries.

Financing sources are summarized here with two variables—the percentage of financing from financial institutions, and from innovative sources (venture capital, public equity, and affiliates). The omitted variables for the sources of financing are: accounts payable, government, individuals (not elsewhere specified) and other miscellaneous sources.

Principal component analysis is used to generate the financing types. Three typologies of financing structures are evident (Table 5).

The first financial structure typology is *high debt/diversified financing*. Firms that score high on this principal component typically have a high percentage of assets that is attributable to debt, little in the way of retained earnings and focus on both innovative and more traditional bank sources of financing.

The second principal component is *low debt/high share capital/innovative financing*. Firms here have relatively little debt, rely on share capital and derive a large portion of their financing from innovative sources of financing such as public equity, venture capital, and related firms. They draw little of their financing from traditional sources such as banks.

The third principal component is *low debt/high share capital/bank financed*. Firms that score high on this component have low debt/asset levels and hold large amounts of share capital. While this group has relatively less debt, most of it is derived from banks.

In addition to the structure of financing, the strategic emphasis given to financing is also included in the analysis. Firms rated (on a scale of 0 to 5) the importance of access to capital, and the cost of capital as a contributor to their growth. These two additional variables on the strategic orientation of the firm with respect to financing are used to complement the summary measures on financial structure that are derived from the principal component analysis.

Table 5. Weights for Financing Principal Components

	High debt/ diversified financing	Low debt/ innovative financing	Low debt/ bank financing
	Weight		
<i>Type of financing</i>			
Debt as a percent of net assets	0.66	-0.19	-0.24
Share capital as a percent of net assets	0.22	0.54	0.58
Retained earnings as a percent of net assets	-0.69	0.04	0.11
<i>Source of financing</i>			
Percent of financing from venture capital, public equity, affiliates	0.16	0.64	0.04
Percent of financing from financial institutions	0.13	-0.50	0.77

Management

Finally, the management strategy of the firm is likely to be associated with success. Several questions from the survey were used to gauge the importance of management. As the broadest indicator of the importance of management, firms rated the importance of management skills to the growth of the firm. They also rated the importance of several specific management strategies, including: improving management incentives through compensation schemes, innovative organizational structure, and total quality management (TQM). The first three responses were closely related, and thus were combined to form a comprehensive management variable using the first principal component (Table 6) of the management variables. The last, the importance of TQM, is a very specific management strategy, and is included as a separate variable.

Table 6. Weights for Management

	Weight
Importance of management skills to growth	0.40
Improving management incentives via compensation schemes	0.64
Innovative organizational structure	0.66

3. Analyzing the Factors Related to Success

Regression Analysis

This section establishes the importance of innovation to success. Accordingly, the general success index was regressed on the variables that summarize the firms' posture in the areas of innovation, human resources, management, marketing, and financing that were described above. All of the values of the components that were used in the regression analysis were standardized. The results of an OLS regression presented in Table 7 corroborate previous findings of Baldwin et al., (1994). It is clear that innovation is strongly related to success. Firms that adopt a comprehensive innovation strategy—that is, firms that strive to develop both new products and processes are more likely to be successful. Firms that focus on process innovation by introducing new technologies, new inputs and improving the efficiency of use of their existing inputs are also more likely to be successful. Conversely, firms that concentrate on product innovation, without giving sufficient attention to improving their production processes, are not likely to be more successful.

None of the measures relating to investment, production, human resources, or management that are positively related to success are significant. This does not imply that capabilities in these areas are unimportant. Rather, it indicates that once the effects of innovation on success are taken into account, additional emphasis in these areas is unrelated to success.

All three of the financing principal components are positively associated with success. The two low-debt components are most strongly associated with success. Each of these components weights share capital heavily. Successful firms are those that derive a significant amount of their net assets from share capital. These firms do not have to rely on retained earnings to finance their activities. The relationship between the measure of success and the value of the third principal component—*high debt/long-term debt/bank financed*—is positive though weaker and less significant than the other finance principal components. This component negatively weights retained earnings. Once again, firms that rely heavily on retained earnings do less well.

The importance that the firm attaches to financing also contributes to the success of the firm. Firms that value access to capital more highly are typically more successful than other firms. On the other hand, firms that are more concerned about the cost of capital (after having corrected for differences in the perceived importance of access to capital) are less successful. One explanation for this is that growth generally requires greater share capital, which is a more expensive form of capital, and firms that are overly concerned about the cost of capital are imposing restrictions on their abilities to obtain financing.

Table 7. A Regression Analysis of the Factors Relating to Success

Variable	Parameter estimate	Standard error	Probability value	
Intercept	-0.4443	0.2329	0.0569	*
<i>Innovation</i>				
Comprehensive innovator	0.2026	0.0899	0.0247	**
Process innovator	0.1441	0.0637	0.0241	**
Product innovator	-0.0962	0.0653	0.1414	
<i>Investment and production</i>				
Percent of firms incurring investment expenditures	-0.0580	0.1423	0.6835	
Percent of sales invested	-0.0007	0.0034	0.8453	
<i>Human resources</i>				
Comprehensive labour	-0.1182	0.0586	0.0439	**
Percent of firms offering formal training	0.0836	0.1381	0.5454	
Training expenditures per employee in the firm	-0.0001	0.0001	0.1464	
<i>Management</i>				
Comprehensive management	-0.0692	0.0661	0.2957	
Total quality management	0.0811	0.0499	0.1042	
<i>Marketing</i>				
Comprehensive traditional marketing	-0.0687	0.0475	0.1487	
Percent of sales exported	0.0096	0.0035	0.0057	***
<i>Financing</i>				
High debt/diversified financing	0.1007	0.0437	0.0215	**
Low debt/innovative financing	0.3002	0.0558	0.0001	***
Low debt/bank financing	0.2145	0.0668	0.0014	***
Importance of access to capital	0.1435	0.0653	0.0285	**
Importance of cost of capital	-0.1032	0.0627	0.1004	
<i>Size at start of period</i>				
Assets (\$ 000), 1984	0.0595	0.0214	0.0056	***
Sales (\$ 000), 1984	-0.0353	0.0151	0.0197	**
F statistic	5.723		0.0001	
adjusted R ²	0.1636			

*** Significant at the 10% level, ** significant at the 5% level, * significant at the 1% level.

Finally, firm size is related to success. Firms that have a strong asset base in the earlier part of the period used to derive performance data were significantly more successful than those with a weaker asset base. The relationship between sales and success in the multivariate model is the reverse (and statistically significant). If the model is recalculated omitting either sales or assets, the remaining variable is found to be insignificant, i.e. if the model is run without the asset variable, the sales variable is no longer significant. The positive and significant sign on assets, in combination with the negative and significant sign on sales, indicates that, while size contributes to success, firms that expand their sales base without a concurrent increase in their asset base are less likely to be successful.

Strategies by Innovation Type

Previous work with the GSME survey (Baldwin et al., 1994) has found that the success of firms in the sample was strongly related to the innovative stance that they adopted, but it did not distinguish the type of environment that firms faced. Some authors (i.e. Miller, 1988) have argued that the route to success is dependent on the environment in which the firm operates, the characteristics of the firm, and the particular strategic thrust of the firm. One of the major differences that firms face is the innovative environment (Gort and Klepper, 1982).

A regression analysis that examines the relationship between success and strategies for all firms in the sample represents an attempt to find common factors behind success, irrespective of the industry environment in which a firm finds itself or the package of strategies it adopts. The fact that some factors (i.e., the emphasis on human resources) are not strongly related to success at this level does not mean they are not important in specific situations.

One of the major differences that firms face is the innovative environment. The next section then uses the taxonomy, which is based on the innovation principal components, that groups firms by innovation type and examines the strategies that are pursued by firms in each group. The sections compare the innovative stance of each group, examine differences in performance of each innovative type, and investigate the nature of the complementary strategies that a particular innovation type adopts.

Product Innovators

Product innovators represent firms operating in the first stage of the product life cycle. These firms focus on continually introducing new products (Table 8). They do not pursue an aggressive technology or cost-reduction strategy. The *product innovators* are less successful, across a broad range of performance measures, than the other two groups of innovators (Table 9). Their product differentiation has paid off in terms of increases in their share of industry profits. However, their lack of emphasis on improving production efficiency has prevented them from realizing market-share gains comparable to *comprehensive innovators*, or the efficiency gains that have rewarded *process innovators* with strong growth in profit/sales margins relative to the industry average.

The commitment of *product innovators* to introducing new products is associated with intense investment activity. Almost half of *product innovators* incurred investment expenditures in 1991 (Table 10). While these firms were more likely to invest than *process innovators* and *non-innovators*, a large portion of investment expenditures went into investments in R&D product innovation.

Product innovators stress product innovation but place little value on strategies related to maintaining existing products in current markets. This is in marked contrast to the *comprehensive innovators* who place higher scores on both traditional strategies with respect to existing products as well as aggressive strategies with respect to new products, and the *process innovators* who

score higher in the traditional marketing areas. This difference in emphasis from the other groups substantiates the view that *product innovators* are at the head of the product life cycle where firms tend to mainly possess new products.

Table 8. Average Scores on Innovation Related Variables for Firms in Each of the Groups

	Product innovator	Comprehensive innovator	Process innovator	Non-innovator
Percent of investment devoted to product innovation	12.9%	7.7%	5.2%	1.2%
Percent of investment devoted to process innovation	2.4%	1.5%	2.8%	1.0%
Importance of R&D innovation capabilities as a factor in success	1.9	2.7	1.7	0.6
Importance of ability to adopt technology as a factor in success	2.4	3.5	3.0	2.4
R&D spending relative to competitors	1.8	2.4	1.6	0.8
Importance of strategies related to...				
Developing new technology	1.7	3.3	2.0	1.0
Refining others' technology	1.5	2.9	1.8	1.1
Using others' technology	1.8	3.1	2.4	1.9
Improving own technology	1.9	3.6	2.6	1.8
Using new materials	0.8	3.4	2.3	1.4
Using existing materials more efficiently	0.9	3.9	3.0	2.1
Cutting labour costs	1.4	4.1	3.8	3.0
Reducing energy costs	0.5	3.6	3.3	2.2
Introducing new products in existing markets	3.2	4.0	2.8	2.2
Introducing new products in new markets	2.9	3.8	2.2	1.8
Range of products relative to competitors	3.5	3.9	3.2	3.0
Frequency of introduction of new products relative to competitors	3.2	3.6	2.6	2.1
Importance of following factors as a source of innovation...				
R&D unit	1.3	2.2	0.4	0.3
Production unit	1.2	3.2	0.6	1.3
Marketing unit	1.9	3.7	0.6	1.8
Management	2.2	3.9	1.0	2.7
Related firms	0.8	1.3	0.1	0.4
Canadian patents	1.0	1.4	0.0	0.2
Foreign patents	1.0	1.2	0.0	0.1
Government contracts	0.8	2.1	0.1	1.3
Competitors	1.5	3.3	0.3	2.4
Customers	2.4	4.4	0.7	3.4
Suppliers	1.7	3.9	0.5	2.8

Their strategic emphases is reflected in their competitive stance. These firms score about the same as *process innovators* or *non-innovators* in traditional areas of price, quality, customer service, and flexibility in responding to customer needs. However, they significantly outperform the *process innovator* and *non-innovator* groups in terms of the range of products offered and frequency of introduction of new products.

As is the case for both *comprehensive* and *process innovators*, firms who are *product innovators* require employees who are both adaptable and highly skilled. Their investment activity and the originality of their products suggests that they will also require ongoing investments in training. This is the case. The incidence of training in this group is second only to that in the *comprehensive innovators*. Furthermore, these firms expend the highest amount on training per worker. While these firms are clearly committed to upgrading the skills of their employees, perhaps surprisingly, they lag the other firms in terms of their commitment generally to human resource strategies. The average score among firms in this group on the *comprehensive labour* is lowest among the three innovative groups, and only slightly higher than that of the *non-innovators*.

Table 9. Performance Measures of Firms

	Product innovator	Comprehensive innovator	Process innovator	Non-innovator
Score on success index	-0.054	0.266	0.050	-0.183
Number of employees, 1984	23	21	18	23
Number of employees, 1988	47	49	39	45
*Share change in employment, 1984 to 1988	0.34%	0.61%	0.35%	0.25%
Sales, 1984	\$ 2,231	\$ 2,656	\$ 1,817	\$ 2,434
Sales, 1988	\$ 5,581	\$ 6,322	\$ 4,405	\$ 5,590
*Share change in sales, 1984 and 1988	0.06%	0.11%	0.06%	0.05%
Assets, 1984	\$ 1,086	\$ 1,311	\$ 858	\$ 1,327
Assets, 1988	\$ 3,185	\$ 3,348	\$ 2,500	\$ 3,856
*Share change in assets, 1984 to 1988	0.05%	0.09%	0.05%	0.04%
Profits, 1984	\$ 107	\$ 106	\$ 65	\$ 86
Profits, 1988	\$ 147	\$ 304	\$ 213	\$ 180
*Share change in profits, 1984 to 1988	0.22%	0.07%	0.02%	0.19%
Labour productivity, 1984	\$ 116	\$ 123	\$ 116	\$ 127
Labour productivity, 1988	\$ 126	\$ 118	\$ 123	\$ 133
Change in profits/sales relative to industry, 1984 to 1988	185%	96%	370%	89%

* measured in percentage points

Product innovators give a higher score to the low-debt/high share capital/innovative financing prototype than they do to the other financing components. Examination of their financial structure reveals that they depend more heavily on share capital, innovative financing and financing from foreign sources than do firms in other groups. Product innovations require investments in marketing, research, and machinery and equipment, often for completely untried products that may be market failures. *Product innovators* exist at the first and perhaps riskiest stage in the product life cycle. *Product innovators*, due to their greater risk, require more share capital and tend to utilize innovative, less traditional, sources of financing, such as venture capitalists, public equity, and related firms.

Table 10. Strategies Across Types of Firms

	Product innovator	Comprehensive innovator	Process innovator	Non-Innovators
Investment and Production				
Percent of firms incurring investment expenditures	47.0%	52.0%	35.0%	32.0%
Percent of sales invested	5.0%	3.0%	7.0%	3.0%
Marketing				
Comprehensive traditional marketing	-0.05	0.73	-0.09	-0.26
<i>Maintaining current products in current markets</i>	2.8	4.0	3.6	3.2
<i>Introducing current products in new markets</i>	3.0	3.8	2.9	2.5
<i>Price relative to competitors</i>	3.2	3.3	3.0	3.1
<i>Quality relative to competitors</i>	4.0	4.3	3.9	3.8
<i>Customer service relative to competitors</i>	4.1	4.3	4.0	4.0
<i>Flexibility in responding to customer needs</i>	4.0	4.3	4.0	3.9
Percent of sales exported	13.0%	11.0%	7.0%	4.0%
Human resources				
Comprehensive labour	-0.26	0.98	-0.01	-0.32
<i>Labour climate relative to competitors</i>	2.4	3.2	2.9	2.7
<i>Labour skills relative to competitors</i>	3.5	3.7	3.5	3.5
<i>Importance of labour skills to past growth</i>	3.0	3.8	3.7	3.2
<i>Importance of continuous training</i>	2.8	3.6	2.9	2.7
<i>Importance of innovative compensation packages</i>	2.4	3.2	2.2	2.1
<i>Importance of other staff motivation strategies</i>	3.0	3.9	3.1	2.9
Percent of firms offering formal training	51.0%	60.0%	42.0%	45.0%
Training expenditures per employee in the firm	\$ 683	\$ 482	\$ 248	\$ 324
Financing				
High debt/diversified financing	0.20	0.26	-0.03	-0.19
Low debt/innovative financing	0.33	0.11	-0.18	-0.12
Low debt/bank financing	0.11	-0.04	0.03	-0.05
Financing instrument – as a percent of net assets				
<i>Total debt</i>	47%	59%	44%	34%
<i>Short-term debt</i>	23%	28%	20%	16%
<i>Long-term debt</i>	24%	31%	22%	19%
<i>Share capital</i>	14%	9%	5%	5%
<i>Retained earnings</i>	31%	22%	42%	53%
<i>Other types of financing instruments</i>	8%	10%	7%	7%
Sources of financing – as a percent of total financing				
<i>From financial institutions</i>	23%	25%	28%	26%
<i>From venture capital, public equity, affiliates</i>	10%	10%	5%	5%
<i>From other sources</i>	67%	65%	67%	69%
<i>Financing from foreign sources</i>	5%	2%	0%	1%
Importance of accessing financing	2.6	3.4	3.0	2.7
Importance of cost of financing	2.6	3.4	3.0	2.7
Management				
Comprehensive management	-0.13	0.92	-0.03	-0.34
<i>Importance of management skills to growth</i>	3.5	3.9	3.5	3.3
<i>Improving management incentives via compensation schemes</i>	2.2	3.1	2.1	2.0
<i>Innovative organizational structure</i>	2.2	3.5	2.5	2.1
Total quality management	2.63	4.25	3.33	2.84
Size at start of period				
Assets, 1984	\$ 1,086	\$ 1,311	\$ 858	\$ 1,327
Sales, 1984	\$ 2,231	\$ 2,656	\$ 1,817	\$ 2,434

Comprehensive Innovators

The second group of firms, the *comprehensive innovators*, adopt a broad approach to innovation (see Table 8 for the mean values and Table A.1 for the standard errors of the estimates). They score higher in each of the areas that measure the innovation stance of a firm (with the exception of the percent of investment devoted to R&D) than firms in each of the other groups.

Comprehensive innovators score highest on the general index that weights several different measures of performance (Table 9). *Comprehensive innovators* enjoyed stronger growth in their share of industry sales and assets over the 1984 to 1988 period than all other firms. This growth enabled these firms to expand their share of their industry's employment faster than firms in the other groups.

The ongoing change in these firms necessitates continual investments and, consequently, they are more likely to invest than other firms. Note, however, that these changes, while frequent, appear to be relatively incremental in nature—they devote a smaller share of their sales to investment than other firms.

Comprehensive innovators also place more emphasis on the innovative, more aggressive measures of market development, as indicated by their score on the product development measures included in the innovation index (Table 8). They also score higher than other firms on the traditional marketing strategies. Their score on the broad measure of emphasis on traditional marketing—the comprehensive traditional marketing—is significantly greater than that of any of the other three groups. They also score higher on each of the factors included in the broad marketing measure. They place more emphasis on both maintaining current products in current markets and introducing current products in new markets. As a result, they are more competitive with respect to price, quality, customer service, and flexibility in responding to customer needs, all traditional means of competing. Similarly, they are outmatched, in terms of percent of sales exported, only by the *product innovators*.

The ability to continually innovate—to implement new processes and produce new products—depends critically on a highly adaptable, skilled, and committed workforce. This is evidenced by the emphasis this group devotes to enhancing their human resources, both in terms of their general emphasis on human resources (as indicated by the value of the comprehensive labour), and their scores in each of the sub-categories that are unmatched by any of the other innovative groups. *Comprehensive innovators* credit their labour skills as being responsible for a greater portion of their success than do other firms. These firms give more emphasis than other innovator types to strategies related to enhancing their human resources—either through training, innovative compensation packages, or other means of motivating their staff. Firms in this group exhibit the highest incidence of formal training. While they spend less on training per employee than *product innovators*, they spend more than *process innovators* or *non-innovators*. Their training efforts are well rewarded—they boast a superior labour climate and set of labour skills relative to their competitors.

Financing is also critical for these firms. The inherent risk involved in continually implementing new processes and offering new products demands extra attention to financing. They place a greater emphasis on both access to capital and the cost of capital than firms in other groups.

Comprehensive innovators as a group score highest on the high-debt diversified financing prototype. In keeping with this, they have the highest debt/asset ratio and the lowest percentage of share capital and retained earnings.

The low debt/asset strategy that was weighted first by their predecessor in the product life cycle—the *product innovators*—comes second for the *comprehensive innovators*. Like their predecessors, they also make use of innovative sources of financing. Nevertheless, there is evidence of a transition since they have increased their reliance on debt and they have begun to increase the percentage of financing that comes from financial institutions. It may be argued that the second stage in the product life cycle that is represented by *comprehensive innovators* is less risky than the previous product innovation stage. The fact that there is some process innovation undertaken suggests that there has been some maturation beyond simple rapid product development. Hence, these firms are able to turn more to debt, a less expensive form of financing. Firms at this stage are also probably better able to signal their potential to financiers because they are more successful across a wide range of indicators.

In keeping with the balanced approach taken elsewhere, *comprehensive innovators* also pay more attention to management than other firms. They seek to improve their performance in every area. These firms place a higher value on innovative organizational structures, management incentive compensation packages, and adherence to total quality management. The relationship between attention to management strategies and innovation involves a complex feed-back loop—firms with good management choose to adopt successful strategies like introducing new products and processes, while introducing new products and processes requires good management to overcome organizational problems that invariably arise due to change.

In summary, *comprehensive innovators* also adopt a strategy that places a greater stress on all of the other functional areas. To succeed, these firms need to do everything well.

Process Innovators

The third group of firms consists of *process innovators*. These are firms that focus on developing new technologies and improving their input use (Table 8). These firms place little value on developing new products.

The emphasis on continually refining processes is well rewarded: this group of firms is the second most successful using the broad measure of success (Table 9). They not only gain market share but their focus on improving production efficiencies enables them to realize the highest gains in profit/sales ratios relative to those in their industry.² There is much to be said for “sticking to the knitting” and focusing solely on trying to improve production efficiencies.

² Note that caution should be exercised in interpreting the profit/sales variable since the standard error of the estimated is large—see Tables A.2.

Continual improvements in processes require investments on the part of the firm. *Process innovators* engage in investment less frequently than *comprehensive* or *product innovators*, but more frequently than *non-innovators* (Table 10). However, the investments that they do make are typically larger, and, on average, they expend a greater proportion of their sales on investment. This accords with the view that *process innovators* invest discontinuously in large, lumpy increments.

Given that these firms focus on improving their production process and introduce fewer new or improved products, it is not surprising to find that they lag behind both the *comprehensive* and *product innovators* in terms of the emphasis they place on aggressive, innovative market development strategies. In contrast, they place greater emphasis on the traditional marketing strategy of maintaining current products in current markets and score approximately the same as the *product innovators* and the *non-innovative* firms in the traditionally competitive areas of price, quality, customer service, and flexibility in responding to customer needs.

Process innovators attribute part of their success to the skill level of their workers. They score second only to *comprehensive innovators* on the *comprehensive labour*, and on most of the human resource sub-categories. However, their training efforts, as measured by expenditure per employee, fall short of those in other firms. These are firms that are able to acquire skilled labour without having to exert greater than normal efforts to train—probably because process innovation is more routinized. The technology skills required come from organized labour markets and universities.

Process Innovators do not have high scores on any of the three financing principal components. Indeed, they receive a large negative weight on the low debt/high share capital/innovative financing component, primarily because they possess the smallest amount of share capital and the least amount of innovative financing of any group except *non-innovators*. They rely more heavily on retained earnings than either of the other two innovative groups and turn more to banks for the remaining financing that they require. The established nature of their products is probably in part responsible for their greater reliance on traditional means of financing.

The *process innovators* come second only to the *comprehensive innovators* in terms of the importance that they attribute both to the cost of capital and access to financing as factors that contributed to their growth.

The TQM philosophy is built on the belief that the route to success involves continually improving quality and efficiency. This means continually searching out new inputs or better ways of using existing inputs, enhancing human resources, and utilizing information technologies to improve quality. The scores of *process innovators* in each of these areas are consistent with their purported emphasis on the TQM philosophy. These firms typically attribute (slightly) more importance to the other management strategies than *product innovators* and *non-innovators*—as is evidenced by their score on the comprehensive management.

Non-Innovators

The fourth group of firms is the traditional (*non-innovator*) firms (Table 8). These firms tend to devote little attention to either product or process innovation. These firms score the lowest on the general success index (Table 9). They also lag the innovators in each of the individual categories that went into the overall index. They are still successful—they are included in the survey sample, which means that they grew over the 1984 to 1988 period. However, their success is inferior to that of firms that are introducing new products or processes. As previously noted, these differences are not closely related to the industry where these firms are located.

Given their lack of emphasis on developing new or improved products or processes, *non-innovators* are the least likely to incur investment expenditures, and spend little on investment when they do invest (Table 10). They are the group that rely most on retained earnings as a source of funds and as a result score negatively on the three financing components. Their marketing strategy is a traditional one—their marketing efforts are concentrated more heavily on maintaining their existing products in their existing markets—than is the case in innovative firms. However, their overall emphasis on marketing is the weakest among the four groups of firms. Not surprisingly, they are not highly competitive in the traditional areas of competition, such as price, quality, customer service, and flexibility in responding to customer needs. As these firms essentially concentrate on performing traditional activities in an unchanged manner, they have less of a need for training than other firms, and are the least concerned about human resource strategies. Given the absence of change and their lack of emphasis on strategies in most areas, it is not surprising to find that *non-innovators* also place the least emphasis on management and are the least successful.

4. Conclusion

Utilizing a taxonomic approach that classifies firms by innovation type improves our understanding of the nature of innovation and its relationship to such measures of success as profitability, market-share growth and productivity gain.

While there are some similarities in that all innovation groups are successful, there are many differences in terms of strategic emphases. *Product innovators* represent firms operating in the first stage of the product life cycle. In this stage, the product is still new, and its characteristics and production techniques are unlikely to be settled. This is an inherently risky stage of the life cycle. This probably accounts for the fact that these firms are, on average, the least successful of all the innovators, especially when success is measured, as it is here, by market-share gains. Training is undertaken to impart the skills required to develop new or improved products. The inherent risk of product innovation requires attention to financing. These firms rely significantly more on equity and foreign financing. Finally, as is the case with other innovators, attention to management strategies is greater than is the case in non-innovating firms. Their emphasis on product differentiation generates superior profit gains for them. However, the lack of attention to production efficiencies is accompanied by lagging profit/sales performance relative to *process innovators* and weaker market-share gains than *comprehensive innovators*.

The second stage in the product life cycle may be characterized by one in which there is both product and process innovation. This stage is represented by *comprehensive innovators*. Continuous change in this group requires ongoing investment spending and training to upgrade both equipment and worker skills. The frequent introduction of new products requires emphasis on marketing strategies. The inherent risk involved in innovative activity demands attention to financing, in particular, long-term financing that allows firms to compensate for their relatively small size, while surviving a volatile environment. These firms, unlike *product innovators*, typically rely more on debt financing. One can argue that this is because firms operating in the first stage are typically more risky, or because *comprehensive innovators* are typically more successful. Finally, the inherent instability caused by these ongoing changes requires superior management capabilities. *Comprehensive innovators* tend to outperform other firms in each of these areas, and are rewarded with stronger growth in sales, market share, and employment size.

Process innovators focus on developing new technologies and improving their input use, while placing little value on developing new products or seeking out new markets. As such, they tend to invest more heavily in new equipment, value their human resources more than *non-innovators* and concentrate their marketing strategy solely on maintaining their current products in current markets. While their activities are subject to changes associated with process innovation, the degree of change is less than in *comprehensive innovators*. Consequently, they place more emphasis on management strategies than non-innovative firms, but less than *comprehensive innovators*. These firms are typically rewarded with stronger growth in sales, assets and profit/sales ratios than those in all but the *comprehensive-innovator* group.

The last group of firms, the *non-innovators*, place little value on strategies related to either product or process innovation. As they are not undergoing change, they are less likely to incur investment expenditures and they are less likely to devote resources to upgrading either their equipment or human resources. Similarly, the lack of change in this group requires less attention to marketing and management strategies. This group of firms lags the others in virtually all performance areas.

The innovator typologies tell two stories—that innovation is more successful than lack of innovation, and that *comprehensive (product/process) innovation* is more successful than either product or process innovation alone. The latter may simply occur because firms engaging in comprehensive innovation are always more successful than firms that master only half the innovation process—either just product or just process innovation. However, this interpretation of the survey's findings ignores the substantial literature that suggests the appropriate innovation strategy varies across the product life cycle and the empirical evidence that each of these innovation types is appropriate to a particular phase in the life cycle. If the product, product/process and process innovative groups are taken to represent the successive stages in the product life cycle, differences in strategies simply reflect differences in the required strategies at different points in the life cycle.

Perhaps the most interesting evidence on differences across the life cycle occurs in the financial strategies that are pursued. The three innovative stages demonstrate an evolution of the financial structure of the firm. In the first stage, which is quite risky, *product innovators* emphasize two strategies, which have in common a heavy reliance on share capital. Both also rely heavily on innovative sources of financing.

In the next phase of the product life cycle, *comprehensive innovators* continue to stress the low-debt strategy using innovative financing that was pursued by the previous *product innovator* stage. However, a new strategy emerges that reflects higher debt/asset ratios, as the nature of firms' activities in this stage becomes less risky and firms become more successful. Moreover, firms move from being highly reliant on just innovative sources of financing to using both innovative and more traditional sources of financing.

In the third stage of the product life cycle, *process innovators* no longer pursue innovative sources of financing. Their stage in the life cycle has enabled them to build retained earnings and this now becomes the most important financing instrument. They also move back to lower debt/asset ratios and increase their use of bank financing.

The final implication of the analysis pertains to the patterns of success that have been observed across firms by innovation type. While one index of success is used throughout, firms in the three innovative stages are each characterized by different aspects of success. Profit growth is highest for *product innovators* but these firms gain market share relatively slowly. Firms in the second stage—*comprehensive innovators*—show both profit growth and market-share growth, but they do not exhibit increases in productivity. Firms in the third stage show market-share growth and growth in profit/sales margins. Firms are, therefore, not only heterogeneous in terms of strategy but also in terms of outcomes. They provide different bundles of characteristics to investors who have different preferences for growth as opposed to profitability.

Appendix A

Table A.1
Standard Errors of Estimates of Mean Scores on the Innovation-Related Variables

	Product innovator	Comprehensive innovator	Process innovator	Non-innovator
	Standard error			
Percent of investment devoted to product innovation	2.71%	1.91%	1.64%	0.09%
Percent of investment devoted to process innovation	1.12%	0.42%	1.15%	0.05%
Importance of R&D innovation capabilities as a factor in success	0.16	0.13	0.15	0.07
Importance of ability to adopt technology as a factor in success	0.16	0.09	0.12	0.09
R&D spending relative to competitors	0.16	0.15	0.15	0.08
Importance of strategies related to...				
Developing new technology	0.17	0.11	0.15	0.09
Refining others' technology	0.15	0.14	0.14	0.09
Using others' technology	0.16	0.12	0.13	0.10
Improving own technology	0.17	0.12	0.14	0.10
Using new materials	0.12	0.10	0.14	0.09
Using existing materials more efficiently	0.13	0.08	0.13	0.11
Cutting labour costs	0.15	0.08	0.08	0.09
Reducing energy costs	0.09	0.11	0.12	0.10
Introducing new products in existing markets	0.13	0.07	0.14	0.10
Introducing new products in new markets	0.15	0.10	0.15	0.10
Range of products relative to competitors	0.14	0.11	0.12	0.09
Frequency of introduction of new products relative to competitors	0.15	0.11	0.14	0.10
Importance of following factors as a source of innovation...				
R&D unit	0.17	0.16	0.10	0.05
Production unit	0.14	0.14	0.11	0.10
Marketing unit	0.16	0.11	0.11	0.10
Management	0.16	0.09	0.14	0.10
Related firms	0.14	0.16	0.04	0.07
Canadian patents	0.14	0.15	0.01	0.04
Foreign patents	0.14	0.14	0.01	0.03
Government contracts	0.12	0.15	0.06	0.10
Competitors	0.14	0.10	0.07	0.09
Customers	0.17	0.06	0.12	0.09
Suppliers	0.15	0.10	0.09	0.09

Table A.2

Standard Errors of Estimates of Mean Scores on the Success Variables

	Product innovator	Comprehensive innovator	Process innovator	Non-innovator
	Standard error			
Score on success index	0.149	0.171	0.149	0.080
Number of employees, 1984	2.6	2.5	2.7	2.1
Number of employees, 1988	4.7	4.3	4.4	3.3
*Share change in employment, 1984 to 1988	0.09%	0.12%	0.07%	0.03%
Sales, 1984	\$ 325	\$ 713	\$ 362	\$ 291
Sales, 1988	\$ 705	\$ 1,356	\$ 581	\$ 615
*Share change in sales, 1984 and 1988	0.01%	0.02%	0.01%	0.01%
Assets, 1984	\$ 281	\$ 421	\$ 194	\$ 237
Assets, 1988	\$ 645	\$ 747	\$ 571	\$ 1,026
*Share change in assets, 1984 to 1988	0.02%	0.02%	0.01%	0.01%
Profits, 1984	\$ 26	\$ 17	\$ 10	\$ 18
Profits, 1988	\$ 54	\$ 53	\$ 25	\$ 42
*Share change in profits, 1984 to 1988	0.22%	0.10%	0.05%	0.15%
Labour productivity, 1984	\$ 11	\$ 15	\$ 13	\$ 12
Labour productivity, 1988	\$ 11	\$ 9	\$ 9	\$ 12
Change in profits/sales relative to industry, 1984 to 1988	144%	81%	350%	89%

* measured in percentage points

Table A.3

Standard Errors of Estimates of Mean Scores on the Strategy Variables

	Product innovator	Comprehensive innovator	Process innovator	Non-innovator
	Standard error			
Investment and Production				
Percent of firms incurring investment expenditures	4.5%	4.5%	4.1%	2.8%
Percent of sales invested	1.2%	0.7%	2.6%	1.0%
Marketing				
Comprehensive traditional marketing	0.12	0.09	0.14	0.09
<i>Maintaining current products in current markets</i>	0.17	0.09	0.11	0.11
<i>Introducing current products in new markets</i>	0.14	0.09	0.13	0.10
<i>Price relative to competitors</i>	0.09	0.10	0.08	0.06
<i>Quality relative to competitors</i>	0.08	0.07	0.10	0.06
<i>Customer service relative to competitors</i>	0.10	0.07	0.10	0.06
<i>Flexibility in responding to customer needs</i>	0.09	0.06	0.10	0.07
Percent of sales exported	2.4%	2.1%	1.7%	0.8%
Human resources				
Comprehensive labour	0.17	0.10	0.13	0.09
<i>Labour climate relative to competitors</i>	0.16	0.14	0.13	0.09
<i>Labour skills relative to competitors</i>	0.12	0.09	0.08	0.06
<i>Importance of labour skills to past growth</i>	0.14	0.09	0.11	0.08
<i>Importance of continuous training</i>	0.13	0.08	0.12	0.08
<i>Importance of innovative compensation packages</i>	0.14	0.10	0.14	0.08
<i>Importance of other staff motivation strategies</i>	0.13	0.08	0.12	0.08
Percent of firms offering formal training	4.5%	4.4%	4.3%	3.0%
Training expenditures per employee in the firm	\$ 258	\$ 91	\$ 50	\$ 71
Financing				
High debt/diversified financing	0.09	0.21	0.05	0.09
Low debt/innovative financing	0.14	0.12	0.10	0.06
Low debt/bank financing	0.11	0.10	0.08	0.05
Financing instrument – as a percent of net assets				
<i>Total debt</i>	4.3%	14.0%	3.0%	5.7%
<i>Short-term debt</i>	2.7%	7.9%	2.0%	2.6%
<i>Long-term debt</i>	3.2%	6.6%	2.6%	3.9%
<i>Share capital</i>	3.1%	2.4%	1.4%	1.0%
<i>Retained earnings</i>	5.9%	14.2%	3.2%	5.9%
<i>Other types of financing instruments</i>	1.8%	1.7%	1.4%	1.0%
Sources of financing – as a percent of total financing				
<i>From financial institutions</i>	2.8%	2.3%	2.6%	1.8%
<i>From venture capital, public equity, affiliates</i>	2.0%	2.0%	1.4%	0.9%
<i>From other sources</i>	3.1%	2.6%	2.7%	1.9%
<i>Financing from foreign sources</i>	1.6%	1.1%	0.1%	0.3%
Importance of accessing financing	0.14	0.11	0.13	0.09
Importance of cost of financing	0.14	0.11	0.14	0.09
Management				
Comprehensive management	0.12	0.09	0.12	0.08
<i>Importance of management skills to growth</i>	0.12	0.08	0.10	0.08
<i>Improving management incentives via compensation schemes</i>	0.13	0.11	0.14	0.09
<i>Innovative organizational structure</i>	0.14	0.10	0.14	0.09
Total quality management	0.17	0.08	0.14	0.10
Size at start of period				
Assets, 1984	\$ 281	\$ 421	\$ 194	\$ 237
Sales, 1984	\$ 325	\$ 713	\$ 362	\$ 291

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