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Innovation Capabilities: The Knowledge Capital Behind the Survival and Growth of Firms

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Abstract

This paper summarizes the findings of a research program aimed at outlining the importance, to the firm growth process, of competencies that arise from investments in intangible assets. The program has consisted of two parts. First, longitudinal databases have provided a rich set of studies on entry, exit, mergers and other aspects of dynamics related to growth and decline in firm populations. These studies have shown the pervasiveness of growth and decline in the firm population. By themselves, these studies do not demonstrate what strategies differentiate the most successful from the least successful. To do so, we have built a set of business surveys that allowed profiles to be developed of the type of competencies that stem from investments in organizational capital. In turn, these are linked to administrative data that allow us to classify firms as either growing or declining. We then asked how differences in competencies were related to the performance of firms.

This paper is the transcript of a lecture given to the Conference on the Use of Micro Business Data which took place at the University of Cardiff, Wales, in September 2005.

Keywords: firm growth, innovation, research and development, technology use.

Executive summary

Capital, both tangible and intangible, drives the growth process. The recent emphasis on the importance of knowledge capital stems in part from the recognition that intangible capital contributes as much as physical capital does to a firm's success. The competencies of a firm flow from its knowledge and organizational capital.

This paper summarizes the findings of a research program aimed at outlining the importance of this form of intangible asset to a firm's growth. The program has consisted of two parts.

First, longitudinal databases have provided a rich set of studies on entry, exit, mergers and other aspects of dynamics related to growth and decline in firm populations. These studies have shown the pervasiveness of growth and decline in the firm population. However, by themselves, these studies do not demonstrate what competencies differentiate the most successful from the least successful. To do so, we need more detailed profiles of the producers found in the longitudinal data bases.

This paper describes a research agenda developed at Statistics Canada that has constructed a set of surveys that allowed profiles to be developed of growing and declining firms and then asked how differences in these profiles were related to the performance of firms.

The population of small firms is varied. Many will decline and exit the market place shortly after entry. Others will survive and grow. Some will innovate and surge ahead of their competitors. This paper outlines the strategic foundations associated with the firm growth process writ large. General business skills—basic capabilities related to management, financing and marketing—are competencies that young firms need if they are to survive their early precarious years. They derive from the organizational capital of a firm.

But the studies also tell us that specialized competencies related to innovation and technology management form the core of intangible capital in most firms—often proving to be the key distinguishing factors between a firm's success or failure. They tell us that specialized competencies related to innovation and technology management are strongly correlated with this growth process. These are specialized competencies that set high-growth firms apart from low-growth firms; they also discriminate between more and less successful firms based on more comprehensive measures of business performance, including an amalgam of changes in productivity, profitability and market share. The research also tell us that firms support these innovation competencies by developing a network of supporting skills, including those related to human resource management, marketing, production and finance.

These findings emerge from studies that search for basic commonalities amongst small businesses, shared factors that help to explain differences in performance, or that serve to characterize large numbers of firms at a particular stage in their developmental process. Other studies shift the emphasis from generalities to specifics, focusing on the link between innovation and the competitive environment. Here our results show that innovative firms respond to different competitive pressures in terms of the set of strategies and activities that they pursue. The results show that there is no single path to innovation that transcends all market environments, as there is often a high degree of specificity that accompanies the innovation process.

Chapter 1. Introduction

Both tangible and intangible capital drive the growth process. Small firms grow to become large firms in large part because they learn how to make use of much more capital. The most common difference between small and large firms is their capital intensity—as measured by machinery, equipment, buildings and other engineering structures that supplement the skills of individual workers. These are part of tangible capital stock—assets that have long-lived applications to the production process.

The recent emphasis on the importance of knowledge capital is, in part, a recognition that there is another intangible aspect to capital employed by firms—the organizational capital of a firm that depends upon its various competencies. Knowledge capital is synonymous with intangible capital. Its existence is difficult to pinpoint precisely and to measure with any degree of accuracy. It comes from investments that firms make in their employees. These investments produce knowledge whose benefits extend beyond the years in which the expenditures occur. These investments are perhaps most frequently associated with expenditures on research and development (R&D). They also cover expenditures that develop technological and production know-how not covered by the common definition of R&D.[1] Both are types of innovation expenditures.

Other expenditures on training develop know-how that serves the firm for years. Software skills, human resource skills, organizational skills, marketing and financing techniques all provide multi-period benefits to a firm and build its knowledge base or its intangible capital stock.

As important as these skills are, finding hard evidence on their importance has proven to be elusive. Our research agenda set out to overcome this deficiency by delineating the type of skills that make up the useful knowledge capital of the firm.

Expenditures on assets that have a potential for multi-period benefits do not guarantee the existence of useful knowledge assets within a firm. Expenditures only take on value if they are useful. Expenditures that do not serve to enhance the value of the firm are, in effect, wasted. The same can be said of machines that cannot be profitably integrated into a firm's production process. But at least machines can be sold in second-hand markets. There is little chance of recovering the sunk costs involved in creating useless knowledge capital.

Successful investments, in contrast, boost the fortunes of the firms that make them. Our purpose has been to demonstrate that there is a core set of competencies that is developed by more successful firms. In doing so, we outline the competencies that are developed by firms that grow and prosper more than others. We argue that it is these competencies, flowing from their organizational and knowledge capital, that underpin their success. By developing a list of the skill sets chosen and how the environment conditions the set chosen by successful firms, we show how competitive market forces select the type of assets that determine the most successful firms.

To do so, we have had to develop two broad streams of results. The first focuses on the dynamics of markets. Here we have outlined the nature of growth and decline that is continuously taking place in markets. The second focuses on the nature of the strategic competencies that separates those firms that are growing from those that are declining. We argue that these differences reveal which competencies that are being built by investments in know-how are valuable and under which conditions different investments are rewarded.

Our research agenda has been pursued with two parallel research streams. In the first case, Statistics Canada has developed a number of longitudinal databases on industrial producers and the analytic capability to study firm dynamics (Baldwin, Penner and Dupuy, 1992; Baldwin, 1995; Baldwin, Beckstead and Girard, 2002). Applied research from these databases has investigated the importance of the entry and exit process, the extent of growth and decline in incumbent populations, the effect of mergers, and the impact of firm turnover on productivity.[2] As revealing as these studies were, they left unanswered a number of questions about the nature of the firms that are contributing to these industrial transitions.

Beginning in the early 1990s, Statistics Canada also began to make an investment in the development of special business surveys designed to support analyses of firm strategies. Research from these surveys has examined how the strategic profiles of firms differ across various segments of the industrial population—faster- versus slower-growing, successful versus unsuccessful, small versus large firms. These surveys focused *inter alia* on the capabilities of firms in the areas of marketing, management, financing, human resources, innovation, and in the use of advanced technologies.[3]

Applied research from these surveys has significantly advanced our knowledge of what could best be termed the microdynamics of industrial competition—the role that different business strategies, activities and demographics play in effecting shifts in competitive position, often evaluated in terms of productivity performance and changes in market share. These business surveys have allowed researchers to construct highly detailed strategic profiles of firms of the sort long seen in the strategic management literature, but less visible within the confines of industrial economics. In industrial economics, descriptions of the firm based on stylized production functions, defined in terms of primary factors, labour and capital, continue to predominate. The wealth of data on strategies and activities available from these business surveys allows us to study firms as 'collections of competencies,' classifiable in terms of the relative emphasis given to different core functional areas (production, management, marketing, financing, human resources) and/or more specialized activities

(innovation and technology management). Relating specific strategies and activities, or combinations thereof, to different performance outcomes (e.g., survival versus failure, fast growth versus slow growth) is the overarching purpose of these surveys, an objective that necessitates both sophisticated survey designs[4] and data development strategies that link survey data (on business strategies and activities) to administrative databases on business performance.

A substantial portion of this survey activity at Statistics Canada has focused on small firms. Small businesses have long garnered interest amongst academics and policy-makers.[5] In Canada and other developed countries, small firms have been widely described as 'engines of economic growth' on the grounds that they account for a sizable share of new job creation.[6] Their contributions to job creation aside, the prevalence of small business start-ups is viewed as a barometer of the level of entrepreneurial activity at work within an economy—with innovative, competitive economies playing host to large numbers of young small firms.[7] The close association between smallness and newness noted above is evident, either explicitly or tacitly, throughout much of the work described herein, as entry serves as the basic process by which small firms are continually injected in the competitive system.[8]

In describing the entry process, Audretsch (1995: 69) has remarked on the "startling size of most new firms" in that most exhibit considerable scale disadvantages in relation to established incumbents. These size disadvantages help to shape the way in which new small firms compete against other businesses. Data collected from business surveys have been useful in describing the nature of this competitive process. Quality, flexibility and customization are hallmarks of the competitive strategies favoured by small firms. Many of these businesses excel in their ability to provide quality products and flexibility of service (Baldwin, Chandler et al., 1994; Baldwin, Gellatly et al., 1998). Small firms are also adept at ascertaining changing consumer tastes with regards to the amount of services that are bundled with a product, or at being flexible with regards to other aspects of the product offering. It is these competitive strategies that help many young entrants overcome the twin liabilities of newness and smallness and grow into viable businesses.

In this paper, we discuss major findings in the areas of strategic capabilities, with a heavy, though not exclusive, emphasis on the performance of small firms because the sorting process is more intense in this group and therefore differences are more evident. We focus on general strategic competencies and more specifically on capabilities in the areas of innovation, technology use and firm performance.

We organize our discussion around two major themes. The first of these focuses on relationships between strategies, activities and market outcomes. This amounts, in effect, to a general exploration of the strategic foundations for success and failure. During this investigation, the key role played by innovation competencies emerges.

The second of these major themes explores the extent to which innovation strategies are context-bound—that is, conditional on the operating environments in which new young firms compete. Many of the data sources described herein support detailed comparative

analyses of innovation strategies in different competitive environments, or amongst firms at different stages of their growth and developmental life cycles. The former often involve industry differences (e.g., manufacturing versus services); the latter concentrate on performance distinctions (e.g., high-growth firms versus low-growth firms; businesses with superior track records in terms of productivity, profitability and market share versus other firms).

The organization of this paper is as follows. Chapter 2 provides a brief description of the work that outlines our basic findings on the nature of the dynamic process that governs growth in the industrial population. Chapter 3 is a brief description of the data sources on which our work on the relationship between the strategic stance taken by a firm and its success is based. These include a set of special surveys that together support the analysis of different small-firm populations, along with administrative data that have been used in conjunction with these surveys to obtain quantitative measures of performance. In this chapter, we discuss a range of methodological issues, ranging from the types of questions asked to the construction of analysis variables that have guided applied research from these surveys.

Chapter 4 explores how the strategic stance that new small firms adopt correlates with different market outcomes. Our discussion here focuses on business skills that distinguish viable entrants from failed entrants; strategies and activities in successful entrants that are associated with growth; and innovation profiles in small- and medium-sized enterprises (SMEs) that are correlated with high performance, as defined by changes in productivity, profitability and market share.

Many of the profiles discussed in Chapter 4 encompass a broad range of strategies and activities. Chapter 5 focuses more narrowly on one specific aspect of innovation policy, the adoption of advanced computer-based technologies, and examines how the use of these technologies correlates with changes in productivity performance and market share.

Chapter 6 investigates the relationship between innovation and the competitive environment. We report on differences in strategic behaviour across a variety of settings: industries with a strong scientific base; industries that are goods-based versus those that provide services; and industries at different stages in their growth cycle.

Chapter 7 concludes by drawing attention to a core theme apparent from research on these business surveys—the innovative firm as an active, purposeful and compleat firm.

Endnotes

1. See Baldwin, Beckstead and Gellatly (2005).
2. For a description of the research results, see http://www.statcan.ca/english/freepub/11-623-XIE/11-623-XIE2003001.htm.
3. Statistics Canada is not unique in this regard; many parallel developments occurred in other national statistical agencies. The Community Innovation Surveys carried out under the auspices of the Organisation for Economic Co-operation and Development (OECD) serve as a conceptual parallel for many of the Canadian data sources described herein.
4. In this context, sophisticated designs refer to those that stratify target populations (new small firms) by different performance categories (e.g., fast growers versus slow growers).
5. This interest follows, in part, from the important role that small firms are seen to play within the overall process of employment creation; for United States evidence, see Birch (1981, 1987). For data on European economies, see OECD (1985).
6. As Picot, Baldwin and Dupuy (1994) note, however, small firms also account for a sizable share of job destruction. Mortality rates are much higher in the small-firm sector than elsewhere (for Canadian evidence, see Baldwin, Bian et al., 2000).
7. The role that small firms play in innovation systems warrants particular emphasis. Small businesses overcome the inertia built into larger firms and capitalize on new technologies. They develop new products in the early stages of an industry's life cycle when product standards are fluid, when production processes are in flux, when turnover is high, and when competition is based on new features. For discussions on the manner in which new small firms provide an important stimulus to the industrial population, see Rothwell and Zegveld (1982) and Rothwell (1989).
8. We examine small firms and the entry process in detail in Baldwin and Gellatly (2003); see Chapter 2.

Chapter 2. Industry dynamics

In Canada, as elsewhere, micro databases have been used since the 1980s to study properties of the dynamic competitive process that leads some firms to replace others. Firms enter new markets trying to supplant others. Firms that exit are those that fail to provide customers with competitive products and prices. Firms grow by taking market share away from their competitors. Some firms take over others. This dynamic process drives productivity growth and removes excess profits.

An understanding of this process requires special longitudinal databases. There are several such databases within Statistics Canada. Using these data, our research program has pioneered new studies that allow for a better understanding of the competitive processes at work within the industrial population.

A compendium of studies (Baldwin, 1995) provides a comprehensive portrait of the nature of the dynamic change that takes place in firm populations as a result of competition.

Before this work, the standard descriptions of industry dynamics contained in textbooks focused on measures that are derived from static firm populations. These generally describe competition as a state of affairs rather than as a process. An example of this tendency occurs when concentration ratios are used to measure the likelihood that anti-competitive activities may occur within industries, since concentration measures are static measures of firm populations, not dynamic measures of the amount of change that is taking place within these populations.

The work on the dynamics of competition that has been carried out at Statistics Canada has challenged existing preconceptions of the competitive process that used measures like market concentration as a statistical summary of the state of competition in an industry. These studies of competitive dynamics (focusing primarily on the manufacturing sector) have shown that entry and exit are large; that large firms tend to lose market share and decline; and that small firms tend to gain market share and grow. They show that there is a substantial amount of firm turnover. Moreover, these studies demonstrated that standard proxies for competition (concentration ratios) do not capture the amount of competitive turnover that takes place in an industry. Key findings from this research on the dynamics of industrial competition are summarized below.

1. Greenfield entry (the entry of new firms via the building of new plants) and close down exit (the exit of firms via the close down of plants) have a significant cumulative impact when measured over time (Baldwin, 1995). While the immediate impact is primarily on smaller firms, the process is not unimportant in a quantitative sense. This is not a phenomenon that warrants the description of 'churning at the margin.' Firms may start small, and many may die during the maturation process, but the effect of successive cohorts cumulates to meaningful levels. Greenfield firms that entered from 1970 to 1979 accounted for, on average, 16.1% of 1979 industry shipments; in 1970, firms that were to close by 1979 accounted for 18.2% of industry shipments. The importance of entry cumulated over a twenty-year period increases to over 36%. Entry cannot be dismissed as being quantitatively unimportant, as some previous studies have done.

2. Our work on firm dynamics has shown that entry and exit are an important component of firm turnover. There is a connection between the two if most entrants fail quickly. Understanding the magnitude of this process and the factors that affect the rate of new-firm failure is important to industrial strategies that are aimed at helping young entrants gain a foothold in the market place.

   In a study of the failure rates for new Canadian firms (Baldwin et al., 2000), mortality rates for new firms in both goods and services industries were investigated. This study found that this group, as a whole, has very low survival rates. Only one in five new firms survives beyond its first decade of life. The median age of the sample was only about three years. While there were large differences in the initial hazard rates across industries, over 10 years these differences were substantially reduced.

   The study suggested that exit is part of an experimentation process. Where the costs of experimentation were low, entry is larger and the incidence of exit from any group of entrants is higher. New entrepreneurs appear to partially use the entry process to assess their competence. This means that high exit rates are not so much a manifestation of market imperfections associated with competition, but with rational choices that are influenced by the magnitude of experimentation costs.

3. Other work on entrants has investigated the maturation process of these firms. Baldwin and Rafiquzzaman (1994) and Baldwin and Gu (2003b) examined firms that entered the manufacturing sector by constructing a new plant over the period from 1971 to 1989. They investigated the extent to which improvements in the performance of any entry cohort are the result of a selection process that culls out the most inefficient entrants, or the result of a learning process that allows survivors to improve their performance relative to incumbent firms. Both selection and evolutionary learning were found to affect post-entry performance, but selection per se is a more important contributor to the overall growth of an entry cohort.

4. In evaluating the extent to which firm turnover is due to entry, the effect of entry via acquisition must not be ignored (Baldwin and Gorecki, 1987). In the manufacturing sector, its cumulative effect is just about the same as for greenfield entry. What is

equally important, acquisition entry brings new participants into different areas of the firm-size distribution and into industries where greenfield entry is less extensive. It is the joint effect of the two processes that has to be considered when evaluating the intensity of entry. The quantitative importance of acquisition entry emphasizes the importance of the market for corporate control in bringing new participants into industries.

5. Turnover also takes place within the continuing firm population. There is a continuous growth and decline process that results in small firms displacing large firms (Baldwin, 1995). Large firms are not immune to change. The largest firms in an industry are generally already in decline because of the inexorable process that replaces the old with the new. The rapidity of this process differs industry by industry.

6. While each of the turnover processes examined—greenfield entry and closedown exit, acquisition entry and divestiture exit, and continuing plant turnover—is respectable by itself, it is the joint effect of the three that is striking. In an average industry, almost 44% of all market share is shifted from decliners to growers over a decade (Baldwin, 1995; Baldwin, 1996b; Baldwin and Gu, 2003b). By itself, this testifies to the intensity of competition. The size of the turnover process increases inexorably with the period of time over which death and renewal via entry are measured. Over a decade, some 35% of jobs in manufacturing disappear because of either exit or decline in incumbents. Over a period of forty years, some 80% of jobs disappear (Baldwin and Brown, 2004). An equally high percentage of jobs appear because of the birth of new plants or because of the expansion of existing plants.

7. The importance of turnover does not have to be evaluated on the basis of size alone. Gains in productivity are associated with substantial shifts in market share (Baldwin, 1995; Baldwin, 1996b; Baldwin and Gu, 2003b). Greenfield entrants are more productive than the exiting plants that they replace (Baldwin and Gorecki, 1991a). Continuing plants that gain market share become substantially more productive than continuing plants in decline. And more importantly, the shift of market share from the less productive to the more productive accounts for a significant portion of aggregate productivity growth. Over half of productivity growth comes from shifting market share from the less productive to the more productive (Baldwin and Gorecki, 1991a; Baldwin, 1995; Baldwin, 1996b).

   A more recent study (Baldwin and Gu, 2003b) has examined differences in the impact of different types of entry—new plants of greenfield entry versus new plants of incumbents, domestic versus foreign-owned plants, single versus multi-establishment plants. It also asks whether the impact of these different forms of entry has changed over time. It finds that overall entry (the creation of new plants) has made about the same contribution to overall productivity growth in each of the last three decades. But the portion of the total contribution of entry that originates in foreign plants or multi-establishment units has increased. Conversely, the contribution that is made by small, single-establishment domestic plants has fallen.

Turnover makes a substantial contribution to productivity. This reinforces the admonitions of those who have argued that a dynamic population of firms is the key to industrial success, and that performance should be measured in terms of progress—not in terms of the static concept of inter-industry profitability differentials. The evidence from these Canadian studies demonstrates the linkage between turnover and progress. It also raises the question whether there are differences between firms that manage to succeed and those who are culled from the market by competition.

8. Most of the first studies in industrial dynamics focused on the nature of the dynamic process using longitudinal manufacturing data for the 1970s (Baldwin, 1995). These databases have now been extended to cover over forty years. The longer period has allowed the development of new studies that examine how the dynamic process has adapted to changes in the environment—for example, changes that have occurred in response to trade liberalization in the early 1990s between Canada and the United States. These studies have tested whether there have been any changes in the amount of turnover in those industries most affected by the trade liberalization.

   Increased trade liberalization was shown to have an impact on industrial structure—through entry and exit or changes in scale. Both enhance productivity. Several research studies examined the relationship between the degree of trade liberalization and changes in structure.

   Economies of scale that are associated with larger plants and longer production runs of specific product lines reduce unit costs and improve a plant's ability to compete in world markets. Proponents of the move to free trade argued that the change in trade regime would benefit Canada because it would permit Canadian plants and firms to exploit scale economies more fully. Several studies investigate how these adaptations were made.

   One study (Baldwin, Beckstead and Caves, 2002) found that there has been a general increase in specialization of both firms and plants. Firms have been continuously reducing the span of industries in which they operate, particularly when these industries are unrelated. Commodity specialization has also occurred at the plant level; however, in contrast to industry specialization, commodity specialization emerged late in the period, around the time of implementation of the Free Trade Agreement between Canada and the United States. Plant specialization increased most in those plants that moved more strongly into export markets.

   In a complementary vein, another study (Baldwin and Gu, 2003a) investigated whether there were direct links between exporting activity and productivity, based on a microeconomic panel data set that followed plants from 1973 through to the 1990s. Productivity (output per worker) and the export intensity of each plant was measured—along with other plant characteristics like size, age, nationality, and capital intensity. It was determined that a selection process operated that affected which plants entered export markets—more productive plants were more likely to become exporters. But

significantly, after these plants became exporters, they increased their productivity relative to those that did not enter export markets. There are productivity gains associated with entering export markets. It is also the case that plants that increased their export intensity also increased their relative productivity. Significantly, these gains were associated with the development of more innovative profiles by the exporters (Baldwin and Gu, 2004a). A changing environment required the development of new competencies in the firm.

9. The various dimensions of turnover perform different functions. They improve productivity (Baldwin and Gorecki, 1991a; Baldwin, 1995; Baldwin and Gu, 2006); they increase industry efficiency (Baldwin, 1992); and they serve as an equilibrating function for inter-industry profit differentials (Baldwin, 1995).

10. The effects of the various turnover components on the different aspects of performance are not the same.

    Greenfield entry has a particularly strong effect on progress. However, the effects of entry emerge only in the long run and studies that focus on the short run will underestimate the real impact of entry. The newborn require time to reach adolescence and only begin to make a substantial contribution as they mature.

    Merger entry has greater short-run effects because it is used essentially to rescue a mature firm that has temporarily gone astray. The long-run effects are less because there is less room for improvement for an adult that has already proven its mettle. Improvement comes here from returning slightly subnormal performance to the mean. Nevertheless, it has a substantial overall effect because the affected businesses are large (Baldwin and Caves, 1991; Baldwin and Gorecki, 1991a).

    The finding that there is a 'real' effect of mergers shows that mergers, like entrants, do not involve a meaningless churning of resources. Greenfield entrants bring new resources into an industry. Mergers bring in new actors. Both renew the industry, but they do so in different ways.

These studies on firm dynamics outline the amount of change and describe different market forces—focusing on entry as opposed to exit, incumbent producers versus entrants, small versus large firms, those with control or ownership changes (mergers) versus those who remained under the same ownership, and foreign-controlled versus domestically controlled producers. Throughout all of these studies, one central theme emerged—that of the magnitude of the total change that is continually taking place, when all the components were viewed together. And concomitantly, how important this change was to many aspects of performance.

Firms are continuously growing and declining. And this turnover has a dramatic effect on industry performance. Whether calculated for the 1970s, 1980s, or 1990s, our estimates show that without the shifts in market share occasioned by the competitive process, productivity growth would be halved.

These findings led us to develop a new research agenda that is summarized in Baldwin and Gellatly (2003). This agenda is devoted to one central question: Can we discern basic patterns in the different strategic stances that are associated with success and failure? We were interested in penetrating beneath the black boxes represented by the firms in our administrative databases that have formed the basis for our longitudinal studies. We wanted to know whether we could observe differences in the strategic competencies that distinguished firms that were increasing their market share and relative productivity from those who were less successful. And to do this, we had to develop new surveys that allowed us to obtain a richer profile of the producers in our longitudinal databases. We describe how we did this in the next chapter.

Chapter 3. The foundations for analysis: Data and measurement

3.1 Developing analytical capacity: Comparative and complementary data sources

Statistics Canada's research on firms' strategic profiles has been supported by an array of large-sample survey instruments and administrative databases. The products of data development strategies over many years, these data sources provide detailed information on business strategies and activities for firms at different stages of their growth and developmental cycle. Six special surveys conducted by Statistics Canada have contributed substantially to our research on firm profiles.[9] These include:

Survey of Growth Companies (1992)
Survey of Innovation and Advanced Technology (1993)
Survey on the Characteristics of Bankrupt Firms (1995)
Survey of Operating and Financing Practices (1996)
Survey of Innovation (1996)
Survey of Advanced Technology in Canadian Manufacturing (1998)

Two of these surveys, the Survey of Growth Companies (SGC) and the Survey of Operating and Financing Practices (SOFP), produced data on more successful small firms across a full spectrum of goods and service industries. The 1992 SGC focused on small- and medium-sized firms (those with less than 500 employees) that had grown their assets, revenues and employment over the 4-year period from 1984 to 1988. The 1996 SOFP collected information on new young firms that survived their first decade of operation. While the SOFP's sampling strategy was not predicated on growth history, its emphasis on post-entry duration constituted a noteworthy performance metric in its own regard, as only one in five new Canadian firms reaches its second decade of life.[10] The SOFP's design also placed more emphasis on smaller firms than did the SGC's design—as 75% of the SOFP respondents reported having fewer than 20 employees.

Their economic importance aside, firms in the small-firm sector are good candidates for studies that compare business strategies because there is a large amount of strategic variation within the small-firm community. This is largely a reflection of where small firms are in their life cycle—smaller firms tend to be younger, and the market is actively sorting these firms into those that are going to grow and those that are not. Larger firms, in contrast, are often older businesses that have acquired the capacity for growth; as a group, larger firms often exhibit less strategic variation, as much of the experimentation required for growth has already occurred.

Both the SGC and the SOFP were linked to administrative data sources at Statistics Canada in order to obtain quantitative measures of performance. Each allowed for a comparative analysis of firms based on their growth performance, while the SGC also classified respondents into more and less successful categories based on a combination of performance indicators, including changes in profitability, productivity and market share. These two surveys were designed to study high-performance business populations—where performance is evaluated broadly in terms of growth and/or duration. These are all small firms that, in varying degrees, had met the demands of the competitive process.

But decline and failure are as essential to competitive restructuring as growth and success, and a full analysis of business dynamics must deal with both positive and negative outcomes. We examined the latter via the 1995 Survey on the Characteristics of Bankrupt Firms (SCBF) which focused on businesses that decline and exit the market place. Smaller and younger businesses contribute disproportionately to this group. Conducted with the assistance of bankruptcy trustees, the SCBF allowed us to assess the relative importance of various internal deficiencies insofar as these contribute to business failure. Collecting data on business deficiencies is important, as they cannot be derived from surveys that focus on more successful firms (one cannot infer, for instance, that failure arose because of a lack of emphasis on those characteristics that are associated with success).

Three other surveys have also been used extensively in our analysis of business strategies. Two of these surveys—the 1993 Survey of Innovation and Advanced Technology (SIAT) and the 1998 Survey of Advanced Technology in Canadian Manufacturing (SATCM)—focused exclusively on the manufacturing sector. The SIAT allowed for detailed strategic comparisons of (1) innovative versus non-innovative manufacturers[11] and (2) plants that adopt advanced technology versus plants that do not. The second, the SATCM, provided a detailed portrait of technology use in Canadian manufacturing. Both of these surveys have been linked to administrative data on plant performance. This, in turn, has allowed us to evaluate the extent to which technology adoption is associated with changes in market share and labour productivity, after other industry and firm characteristics are taken into account.

Despite the sizeable contributions that firms in service industries make to the gross domestic product and employment growth, innovation in service firms has been understudied, largely as a result of data limitations. The final survey noted above, the 1996 Survey of Innovation, developed a profile of innovative firms in three dynamic service sectors—communications, financial services and business services. These data allowed for a comparative analysis of innovation strategies in different sectors of the service economy—focusing on the objectives, sources, outcomes and barriers that service firms face when developing new products and services.

One important characteristic of all the survey instruments noted above warrants emphasis when evaluating their efficacy as analytical tools—the scope and breadth of their coverage of firm populations. In all cases, substantial investments were made at pre-production stages to ensure that these surveys would yield accurate descriptions of their respective target

populations. All six surveys were developed after substantial pre-production testing and evaluation, and were based on random samples drawn from Statistics Canada's Business Register, a comprehensive list of all firms with employees in Canada. Also, all were well-received by their respondent communities; five of the six surveys had very high response rates, ranging from 70% to over 90%.[12]

In our view, the comprehensiveness of these data sources creates a strong statistical foundation for studies of the strategic profile in the small-firm sector. Empirical research in small firms has traditionally utilized case studies and/or small sample surveys. While these approaches yield valuable insights, they do raise the spectre of bias. In case-study research, there is the temptation to focus only on successful companies (as these are often the most visible) at the expense of less successful firms. In a similar vein, small-scale surveys are sometimes based on non-random samples drawn from unrepresentative populations (those that provide only a partial view of the target population in question). What is more, many of these samples are characterized by high rates of non-response, which is problematic if a firm's willingness to respond is at all correlated with its innovation stance or its performance characteristics. In such cases, it becomes difficult to 'generalize' research results to larger firm populations. One important role of our research program is to evaluate the results of case studies and small-sample research—by asking whether their findings are consistent with what one observes in larger, more representative business populations.

3.2 Evaluating differences in business competencies: Measurement issues

In Section 3.1, we described the set of surveys that form the core of our research program. In this section, we discuss the types of questions that are used from these surveys to generate reliable portraits of different populations. All of these surveys feature questions that allow us to compare differences in the emphasis that firms give to different strategies and activities that develop competencies (organizational capital) in various functional areas, such as management, marketing, financing, production, human resource development, as well as innovation and technology use.

Two broad types of questions were developed. The first dealt with general competencies in the firm. The second probed each general functional area (i.e., human resources) with specific questions in order to ascertain the direction of emphasis (training, hiring, etc.). In each case, firms were asked to report on the importance of these business strategies using a Likert scale of 1 to 5, with 1 corresponding to "not important," 2 to "slightly important," 3 to "important," 4 to "very important," and 5 to "crucial."

As a cross-reference, firms were also asked to provide an assessment of their position relative to their main competitors with respect to different competitive strategies. For example, questions might focus on the importance, amongst other issues, of price, cost, quality, customer service, labour climate, employee skills, flexibility in responding to customer needs, range of products offered, and the frequency of the introduction of new products—or on research and development (R&D) capacity, or on the use of advanced technologies. For each of these factors, respondents rank their position relative to their competitors, again using a Likert scale of 1 to 5 (with 1 corresponding to "behind," 2 to "somewhat behind," 3 to "about the same," 4 to "somewhat ahead," and 5 to "ahead").

Questions on the importance of different strategic factors are questions that business managers must constantly evaluate, and hence fall within the range of experience of the small-firm managers who respond to these surveys. These subjective evaluations are part of the reality of business, as the day-to-day demands of competition require firms to continually compare themselves to their competitors.[13] The challenge to researchers is to find ways to pose questions that will generate unbiased responses. These responses are used to assess the emphasis that firms assign to different strategic areas. This is a fundamental aspect of our research design and warrants emphasis. The analysis of these data is predicated on the idea (supported by the empirical testing) that observed differences in the emphasis that firms report placing on certain areas translates into actual differences in the competencies that firms develop in these areas. For example, firms that report a much larger emphasis on human resource strategies are more likely to exhibit superior competencies related to human resource management.

Testing the link between strategies and competencies thus necessitates the development of parallel questions on activities, as questions on strategies cannot by themselves provide a complete picture of the competencies of the firm. Activities are the tasks that are required to implement strategies. Our surveys examine activities in many areas, including financing, hiring and training personnel, purchasing technology and capital equipment, establishing R&D facilities, and coordinating and monitoring personnel. These activities reflect previous strategic choices, and provide evidence on the degree of expertise available in firms.

Evaluating the validity of the subjective scores that respondents report on their competencies in different functional areas was based on parallel questions regarding their activities. For instance, the responses that firms give to questions regarding the strategic importance of R&D are compared with responses to questions that enquire about the existence and nature of the R&D activities. Similarly, responses to questions on the strategic emphasis afforded to skill development are cross-tabulated with questions that enquire about actual training practices.

When these comparisons are made, we find firms that are assigned a higher strategic valuation to an activity are more likely to be performing this activity or performing it more intensively (Baldwin and Johnson, 1996a, 1996b; Johnson, Baldwin and Hinchley, 1997). For this reason, we regard the subjective scores that firms assign to different strategic areas to be good proxies for the intensity of resources devoted to these areas and for the level of competencies that firms develop therein.

These survey data on strategies and activities provide an integrated profile of the broad range of capabilities that must be mastered by a firm—management skills, marketing abilities, human resource development, financing capabilities, and innovation expertise. When combined with administrative data on performance, these data permit an evaluation of the factors that are correlated with growth, survival and success. In the next chapter, we explore how the strategic stance that small firms adopt is correlated with different performance outcomes.

Endnotes

9. For the sake of brevity, we focus here on the core group from which we have taken the results described herein.
10. See Baldwin and Gellatly (2003, Chapter 5) and Baldwin, Bian et al. (2000).
11. Strategic comparisons of innovators and non-innovators were also extensively conducted using data from the Survey of Operating and Financing Practices; see Johnson, Baldwin and Hinchley (1997).
12. The Survey on the Characteristics of Bankrupt Firms was the most difficult to conduct, as it required us to locate the owners of firms after the business had gone bankrupt. This survey had a response rate at 50%—still high by the standards of most business surveys.
13. The practice of benchmarking, for instance, has led many firms to continuously assess themselves against industry leaders.

Chapter 4. The link between strategic stance and performance: A synopsis of results

4.1 The challenge facing small firms

The life of a small firm is often short and uncertain. Most industries are characterized by a substantial amount of competitive turnover, with new startups continually replacing firms in decline. New small firms often bear the brunt of this competitive process, as young companies face very high failure rates. Indeed, for entrepreneurs working to gain a foothold in the market place, the odds of success are not encouraging. In Canada, roughly one-half of new startups exit the market place prior to their third anniversary. The average lifespan of an entrant, the mean survival time of a new firm, is about six years. And, as we noted earlier, only about one in five new firms reaches its second decade of operation (see Baldwin and Gellatly, 2003, Chapter 5).

The causal factors that underlie these statistics on new-firm failure are varied and complex. In Baldwin and Gellatly (2003), we reported that macroeconomic, industry-level and firm-specific factors were all correlated with failure rates. Nevertheless, differences in firm-specific factors have the largest impact on a new firm's likelihood of survival. In generating these results, we relied on a large administrative database developed and maintained at Statistics Canada for the purpose of studying business dynamics, and we examined differences in firm characteristics by relying on simple proxies for post-entry preparedness—the size of the new firm measured in relation to the average start-up size of its competitors, other new firms in its industry. Firms that entered the market place that were either much larger or much smaller than their other young competitors had, respectively, a much lower or a much higher incidence of failure, after controlling for other factors. In short, the investments that firms make in developing their size-related competencies will greatly influence their odds of survival—more than industry or macroeconomic factors.

One of the limitations of the above study is that, like many other studies of new-firm survival, it utilized a large administrative database that contained relatively little information on the operating strategies or the competencies of the individual firms themselves (beyond standard data on size and age). As a result, the underlying causes of firm dynamics were referred to as being driven by idiosyncratic forces—forces that seem vague and difficult to measure.

Studies that equate some observed firm characteristic, such as relative start-up size, to more abstract notions of 'post-entry preparedness' or the 'development of competencies' leave a vague state of malaise. One is left wondering what, in any meaningful strategic or activity-based sense, differences in 'post-entry preparedness' and 'developing competencies' can

be inferred from characteristics such as firm size. For more information on the strategic profiles of firms (entrants, exits, small and large firms), we looked to a set of special surveys and compared strategic profiles of small firms with different performance characteristics.

We organize the discussion of our analytical results around a core set of research questions. These include the following: (1) Are there a common set of strategic factors that differentiate viable enterprises from failed firms? (2) What strategies differentiate more successful firms—innovative firms, firms that exhibit strong growth performance, and firms that do well in terms of productivity, profitability and labour performance—from those further back in the pack? We examine these in turn below.

4.2 Strategies for survival versus strategies for success

The Survey on the Characteristics of Bankrupt Firms (SCBF) allows us to outline the strategic factors that are correlated with survival (Baldwin, Gray et al., 1997). Business failures can result from internal factors (factors over which firms have control) and external factors (those outside the control of firms, but that may be anticipated). One means of examining the requisites for survival is to ask managers[14] of non-viable firms—businesses that had exited the market place—to assess the major internal deficiencies that, in their view, had contributed significantly to the demise of their firm. The SCBF asked these managers to evaluate the role of different contributing factors, including general management, financial management, marketing capabilities, production or operations, innovation strategy, or human resource capabilities. Within each of these general areas, respondents were then asked about the importance of a more detailed set of strategic deficiencies. For example, under the category of financial management, firms reported on the role of "undercapitalization," "inability to manage working capital," "unbalanced capital structure" and "excessive cash withdrawals."

Results from the SCBF underscore the importance of what business managers refer to as 'focusing on the basics.' In Canada, many firms fail because they do not have the basic management skills and characteristics for success. Deficiencies in management are particularly consequential, with 71% of firms identifying deficiencies in both general and financial management as major causes of failure.[15] In over 50% of cases, these general management deficiencies centered on the depth and breadth of management knowledge. Deficiencies concerning financial management often involved an inability to manage working capital and undercapitalization; major shortcomings in over 60% of cases.

Marketing competencies are also important to business survival. Almost half (47%) of firms fail because of poor marketing capabilities. More critical deficiencies include poor pricing strategies and the failure to establish a market niche.

These results lead one to view managerial vision and the ability to manage capital as *necessary* conditions for business survival, skills that all firms must develop in order to remain viable. Firms that lack these basic abilities are not likely to last, and the strategic profile of successful entrants derived from the Survey of Operating and Financing Practices (SOFP)—a scientific

sample of new small firms that have survived their first decade of operation—bears this out. These firms often possess a broad array of skills. Many of these occur in core business areas such as management, financing and marketing. Also, many focus their competitive strategies on areas in which one expects new small firms to excel—they stress customer service and flexibility, and high-quality products. Over 40% of these entrants attribute their success, in part, to business strategies that stress quality, customer service, flexibility in responding to customer needs, and product customization.

4.3 Separating the more successful from the pack: Strategic foundations for growth and high performance

Applied research from the Survey of Growth Companies (SGC) and the SOFP demonstrated that viable firms are those that develop a core set of business skills. These are basic skills related to management, financing and marketing—skills that firms, to some degree, can be expected to master. The next question we addressed was whether these competencies were sufficient to guarantee success beyond the initial stages in life. Are these basic competencies also those that separate high-performance growing firms from their competitors?

We examined this issue by exploring the strategic characteristics of firms with different performance profiles. These comparisons are drawn from populations of small firms that have demonstrated their viability—such as small firms that survive the entry process or small- and medium-sized firms (SMEs) that have demonstrated a capacity for growth. Data on the first group are available from the SOFP; and on the second from the SGC. We separated data on successful entrants from the SOFP into faster- and slower-growing firms, and examined strategic differences between the two subgroups. We also divided data on growing small- and medium-sized enterprises (GSMEs) from the SGC into a more successful subgroup and a less successful subgroup based on changes in productivity, profitability and market share. Both of these exercises required us to link survey data to administrative data on performance.

When examining successful entrants, it becomes apparent that basic differences in growth performance are correlated with the level of strategic intensity exhibited by these firms. High-growth entrants tend to develop a sharper strategic stance in several areas: marketing, management, human resources and financing. These encompass many of the basic business skills noted earlier—skills that firms are required to master in order to remain viable. But high-growth entrants are also twice as likely to innovate, to invest in computer-controlled processes for production, and to train. Innovation and technology-based activities, and the investments in human capital that support these activities, are far more apparent in faster-growing firms than in slower-growing ones. Innovation and technology strategies are correlated with growth.

We observe similar findings when we examine strategic distinctions between more- and less-successful GSMEs. More successful firms—when the metric for success is based on an amalgam of performance indicators, including productivity, profitability and market share—are more likely to develop and implement research-based, technical innovation

strategies (see Baldwin and Gellatly, 2003, Chapter 6). These high-performance firms place greater weight on many elements of advanced innovation strategies: research and development (R&D), product development, export capabilities, advanced technology use, and aggressive marketing. More successful firms are also more likely to have higher R&D–sales and R&D–investment ratios, and attach more value to R&D tax incentives and export development programs.

One interesting result to emerge from the Survey on the Characteristics of Bankrupt Firms concerns the relatively unimportant weight that failed firms attached to innovation strategies. It is noteworthy that difficulties associated with innovation were viewed by only about one-quarter of failed firms as a major contributing factor to their bankruptcy, far fewer firms than those identifying basic skills such as management, financing and marketing as contributing factors. Innovation serves as an important statistical discriminator for firm performance—but within the group that has passed beyond the initial stages of life. Innovation is an important factor in setting successful mature firms apart from their competitors.

These findings underscore the relationship between core skills and specialized innovation capabilities: viable enterprises all share a commitment to developing a set of core business skills, many of which are absent or underdeveloped in failing firms; however, it is the development of specialized competencies in areas that support innovation (e.g., R&D and technology utilization) that often differentiates growth-oriented and high-performance firms from other businesses.

We should stress, however, that even amongst the subgroup of more successful GSMEs, the emphasis given to innovation is less than that accorded to other functional areas. There are a wide range of other competencies that are just as or more important to the firm. It is just that more of the successful firms attach an above-average importance to R&D. To some extent, many of these core business-skills competencies play a critical role in supporting innovation activities. For example, the firm cannot fully exploit the benefits of technology adoption without concomitant investments in its workers (i.e., skill development).

Complementarities between core business skills and innovation are apparent from many of the special surveys discussed herein. Data on SMEs from the SGC and on successful entrants from the SOFP are illustrative.[16] The latter have been used to investigate how innovative firms compare to non-innovative ones across a range of strategic areas (see Johnson, Baldwin and Hinchley, 1997). Innovative firms place more stress than do non-innovative ones on a broad range of business strategies, including technology management, marketing, human resources and production. Johnson, Baldwin and Hinchley (1997) also note that innovative businesses tend to exhibit financial structures that are geared towards flexibility and risk management—structures that are better-suited to the more uncertain market climate that many of these innovative firms report facing.

Many of the strategic profiles developed during the course of our research are multi-dimensional in that they integrate information on a broad set of strategies and activities.

This occurs by design—the result of deliberate decisions on how to best exploit the analytical capabilities of these surveys. Many of the innovation profiles that result from this research strategy are designed to convey information about the broad innovative stance, writ large, of different types of firms.

One difficulty with this approach is that it can become difficult to assess how specific competencies relate to firm performance, beyond their general importance within what we have characterized as a heightened strategic stance. For example, we noted earlier that faster-growing entrants assign more stress to many strategic areas than do slow-growers. These include marketing, management, financing, innovation and technology. But one cannot infer from this general descriptive profile what the exact relationship between innovation and growth is, net of all other specific competencies that are likely to exert some influence on growth performance.[17] Disentangling the contribution of individual factors requires, of course, more sophisticated analytical methods, well-developed surveys and linked panel data.

Our research program has addressed this issue by undertaking a set of complementary studies on the relationship between innovation, advanced technology use and business performance. These surveys develop a broader profile of a firm's innovation competencies than just R&D performance. Technology adoption represents a specific type of process innovation that has been widely posited to influence the competitiveness of firms. Our studies in this area rely on econometric methods to evaluate the impact of advanced technology use on changes in labour productivity and market share. We report on these studies in Chapter 5.

Endnotes

14. The survey was done in conjunction with bankruptcy practitioners who, for the most part, are also business or management consultants.
15. See Baldwin and Gellatly (2003, Chapter 7) and Baldwin, Gray et al. (1997).
16. These complementarities have also been studied using technology surveys, often via multivariate methods. For discussion, see Chapter 5.
17. We have sometimes relied upon multivariate techniques to integrate sets of information on strategies and activities in order to investigate the relationship between the firm's strategic stance and some activity of interest. For example, see the strategic analysis of more- and less-successful growing small and medium enterprises reported in Baldwin and Gellatly (2003, Chapter 8).

Chapter 5. Market outcomes associated with technology adoption

We have supplemented our descriptive studies of the innovation process with a series of econometric analyses that examine the impact of technology adoption on business performance (Baldwin and Sabourin 2000, 2002, 2004a, 2004b; Baldwin, Sabourin and Smith, 2003; Baldwin and Gu, 2004b). Our multivariate research on technology use has had several objectives. First, these studies examine the impact of advanced technology use on business performance, after controlling for the effect of research and development (R&D) and other firm competencies that support the innovation process. Second, several of these studies investigate, using more sophisticated methods, how technology use influences productivity and other aspects of performance, by tracing its sequential effect on changes in relative labour and market share. These studies have focused on the manufacturing sector and combine survey data on technology use and business practices with administrative sources that contain detailed data on plant performance.

These studies range from a comparison of simple tabulations of performance differences between advanced technology users and non-users (Baldwin, Diverty and Sabourin, 1995), to multivariate examinations relating differences in productivity performance over a time period to differences in technology use during that period (Baldwin, Sabourin and Smith, 2003), to studies relating changes in performance to changes in technology use (Baldwin and Sabourin, 2004a) using panel data on advanced technology use. In the latter case, we develop and estimate a dynamic structural model that postulates that technology choice affects productivity growth and that this, in turn, affects market share growth.

The first set of results demonstrated that technology users gained productivity relative to non-users. Results from the dynamic panel confirmed that increases in technology use at the plant level (measured over a five-year period) were positively associated with higher labour productivity growth. By contrast, initial levels of technology are far less consequential. In addition, plants that actively invested in technologies grew more rapidly than those that did not do so. Productivity growth and changes in market share were found to be related—plants that increased their productivity tended to realize market share gains.

Baldwin and Sabourin (2004a) investigate the different roles that technology use and R&D were shown to play within the plant's innovation strategy. R&D is only part of the innovation process and these studies investigate the effect of the adoption of advanced technologies as well as the effect of R&D. The growth in technology use was found to be more directly associated with improvements in labour productivity—improvements that stem from efficiency gains that occur on the process side. The impact of R&D, by contrast, was felt

more in terms of product innovation; R&D was hence an important determinant of growth in market share, but had no appreciable impact on changes in labour productivity.

Baldwin and Gu (2004b) examined the differential contributions that product and process innovation made to productivity growth. Using data from the 1993 Survey of Innovation and Advanced Technology, they found that process innovation is more closely associated with labour productivity growth than is product innovation. Process innovators had an annual productivity growth that was higher than non-process innovators. Product innovation, by contrast, had a positive but statistically insignificant effect on labour productivity growth. This analysis demonstrated that process innovation is related to market share growth through its positive effect on productivity growth—plants that introduce process innovations have faster productivity growth that, in turn, leads to increases in market share.

Baldwin and Sabourin (2001) used the 1998 Survey of Advanced Technology in Canadian Manufacturing to delve into the specific nature of technology use within manufacturing plants. Plants that were using advanced communications technologies or that combined technologies from several different technology classes realized the largest increases in relative productivity. Once again, gains in relative productivity were accompanied by gains in market share. And, as in Baldwin and Sabourin (2004a), R&D activities were also found to be associated with changes in market share but not with productivity growth.

These multivariate studies were also able to examine the extent to which other strategies complemented technology use. Baldwin, Sabourin and Smith (2003) found that firms adopting a set of business practices that enhanced quality management and innovation in products and processes were more likely to be adopting advanced technologies, and both advanced practices and advanced technologies were associated with higher productivity growth. This study also examined relationships between technology use, productivity growth and changes in a firm's market share. Complementarities in the innovation process were readily apparent. Plants that adopted advanced technologies tended to be more innovative along a number of dimensions other than just in their technological orientation. These plants adopted a number of advanced business production processes that made use of advanced technologies. These were plants that also developed a human resource strategy that focused on developing a skilled workforce and emphasized training.

Our studies (Baldwin, 1996a; Johnson, Baldwin and Hinchley, 1997; and Baldwin and Johnson, 1998) all found that firms that grow more quickly simultaneously develop certain innovation competencies that distinguish them from those growing less quickly. Our technology studies show that developing technological competencies have the same effect. That innovative and technological competencies are linked should not be surprising. Our surveys have shown that most firms that introduced advanced technologies did so in conjunction with the introduction of a product or process innovation.

Chapter 6. Innovation strategies in different competitive environments

6.1 From general to specific models of innovation

Several of the studies described herein have found that research and development (R&D) and technology-based innovation strategies are strongly associated with superior business performance. Export intensity is another factor that distinguishes high-performance firms from others. For those working to encourage the growth and development of small firms, the lessons from these studies may seem straightforward: businesses can improve their performance by gearing up their R&D–sales ratios by investing in advanced production technologies, and by becoming active in export markets. While these activities are associated with more successful outcomes, prescriptions of this sort—prescriptions that reduce the complexity of the innovation process down to a small set of highly visible activities such as R&D and technology use—may miss their mark.[18] One reason is that the innovation process rarely consists of just an R&D facility. It also involves technological capabilities and human resource strategies to make use of scientific professionals. Econometric studies that insert R&D expenditures that are highly correlated with these other factors will be unwittingly picking up the effect of many of these other factors in their R&D terms—and likely attributing more importance to R&D than it warrants.

Moreover, simple prescriptions related to the need for more R&D can obscure an important fact: the dimensionality of innovation is not invariant to basic differences in the operating environment. Our research has found that innovation strategies tend to be context-bound, that is, the sets of strategies and activities that firms rely on to develop and support innovation will depend, in substantive ways, on the competitive dynamics that define the market place in which these firms compete. Innovation profiles are not necessarily interchangeable from market to market.

We note that basic strategic differences amongst subpopulations of innovative firms have been well studied using innovation surveys. These differences are often used to demonstrate the breadth of innovation activities within populations—to illustrate that innovation is itself a varied and complex activity. In applied studies, innovation strategies are often categorized as product-based, process-based, or comprehensive in character. Our analysis of growing small- and medium-sized firms based on data collected from the Survey of Growth Companies relied extensively on these subgroups of innovative firms—in order to better ascertain the set of factors that are correlated with performance differences amongst more narrow groupings of firms that share a common innovation strategy. These broad classifications—products, process and comprehensive innovators—underscore very

substantial differences in competitive focus. For example, we found that product innovators are firms that place a high value on continually developing and offering new products, with little emphasis on improving their technological capability and production efficiency. Process innovators compete at the other extreme—they devote substantial resources to technology adoption and improving their production processes, and less effort to product development. The final group, comprehensive innovators, are businesses that pursue a broad mix of innovative activities. These are firms that emphasize both process technology and product development by drawing on a wide range of sources for innovative ideas (e.g., marketing, management, R&D and patents). Each of these groups has different needs—for example, drawing on different sources of financing.

Our research on the relationship between innovation and the competitive environment starts with the realization that innovation strategies are complex and varied—and asks whether the sorts of strategic differences that one observes amongst innovators are consistent with basic differences in the types of competitive pressures that these firms are facing. Many of the surveys that have been developed to study innovation were designed to support detailed comparisons of different operating environments. We have examined this notion of operating environment in several ways. First, we have focused on standard industry classifications that correspond to basic differences in the types of goods and services that firms provide (see Baldwin and Gellatly, 2003, Chapter 9).[19]

Second, we have explored a more nuanced view of the operating environment by comparing science-based industries—sectors that place more emphasis on intangible assets like R&D and skilled labour—to industries that assign less importance to the role of scientific knowledge (see Baldwin and Gellatly, 2003, Chapter 10)[20]. Last, we have examined a perspective of the operating environment that derives from basic differences in the life cycle of firms—by investigating differences between small firms and larger companies in the manufacturing sector. Smaller firms are often younger businesses that opt for different competitive strategies than larger, established incumbents (see Baldwin and Gellatly, 2003, Chapter 11). In what follows, we summarize select research in each of these areas.

6.2 Innovation in dynamic service industries: A comparative overview

Our research on innovation in services is based on detailed industry-to-industry comparisons. We focused on three major service industries—communications, financial services and business services.[21] All are examples of innovative services that share, in varying degrees an emphasis on advanced technology, an international orientation, and a critical role in supporting the production and distribution activities of other sectors. Two of these industries, communications and business services, are dominated by small firms. In each of these cases, we developed a profile of the competitive environment that faced firms—in terms of the threat of entry, brand loyalty, and threats from obsolescence.

On one level, innovation strategies in each of these service industries share a set of common characteristics, many of which are typically associated with small firms. Improving product quality, flexibility and catering to diverse tastes are important aspects of innovation in all

three industries. Customers are the most important source for innovative ideas. Beyond these characteristics, however, innovation strategies take different forms, in ways that are consistent with basic differences in the competitive environment that characterizes each industry.

For instance, communications firms operate in a market place where production technologies evolve rapidly and capital assets have low liquidation values. Here, innovative firms rely extensively on the use of advanced technologies and technology acquisition, often by developing networks with suppliers and outside firms. Less emphasis is placed on the development of in-house R&D capabilities.

Competition in financial services is driven by different competitive pressures. Price, flexibility, and customer service are seen by the firms in these industries to be key factors shaping their competitive environment. Innovation strategies are designed to yield new products that satisfy a diversity of customer wants and are price-competitive. Financial services firms often look to their competitors for ideas, and introduce innovations that are designed to reduce unit costs, an important objective in a price-competitive market place. These firms place a heavy emphasis on human resource strategies that are geared to improving labour productivity and service quality (e.g., worker incentives, acquiring skilled labour, and training).

Compared to firms in communications and financial services, firms in business services face a wider array of competitive pressures. Product obsolescence, difficulty in predicting competitor behaviour, and changes in consumer demand are all more significant forms of uncertainty here than elsewhere. In response to this more diverse mix of competitive pressures, business-service firms adopt a more varied mix of innovation strategies. They draw on more sources for innovation ideas, highlighting a broader range of objectives, and their innovations have a wider range of impacts—from improving quality, to reducing costs, to increasing reliability. Firms in business services face a less stringent regulatory regime than their counterparts in communications or financial services. Consequently, their innovation strategies are more outward-looking than in these other industries. Lastly, product standards in business services are evolving rapidly. Firms in this industry report substantial investments in developing their research capabilities, and make use of a more diversified set of intellectual property rights.

These findings stress that the type of knowledge capital that firms develop varies considerably across a wide range of industries, where we have defined our industries in accord with generally used industrial breakdowns. We also find these differences using a broad classification system that groups industries in accordance with the emphasis that they place on scientific knowledge. We turn to this below.

6.3 Innovation in science industries: Shifting the focus to research and development and human capital

Perceptions of industrial competitiveness are sometimes based on the extent to which an economy invests in knowledge-based assets, such as R&D and skilled workers. Accordingly, there has long been substantial interest in academic and policy circles on those sectors that place more stress on these and other high-tech inputs. Consequently, our analysis of the impact of industry environment on innovation has also utilized a general classification scheme that divides industries into two groups—science-based industries and all other industries.[22] Two types of external information were used to delineate industries as science-based—data on R&D intensity of industries and on the extent to which professionals like scientists and engineers make up a substantial proportion of the workforce.[23]

This classification exercise was useful because it yielded substantial insights into the extent to which new young firms participate in the innovation process.[24] Using survey data on successful entrants from the Survey of Operating and Financing Practices (SOFP), we found that those in science-based industries are more likely to innovate. In particular, firms in science industries are more likely to introduce product innovations.

This higher incidence of product innovation reflects larger investments in the innovation process—notably with regards to R&D and patent use. New young firms in science industries also pursue more aggressive marketing strategies to reach their customers. They target both new domestic and new foreign markets more than do firms in the other sectors, and turn more to export strategies.

Other relationships between innovation and the industrial environment emerge when viewed through the lens of an industry's science base—the emphasis given to R&D and scientific knowledge. Successful entrants in science-based industries place greater emphasis on enhancing their competencies in the areas of technology, human resources, production, and marketing. The relationship between human resource management strategies and innovation in science-based industries is particularly striking. New small firms in science-based environments require superior skills to acquire new technologies and to market new products.

Small-firm experiences in one core strategic area—financing—are worthy of emphasis. Financing strategies have to be adapted to different industry environments and are particularly sensitive to differences in risk. Respondents to the SOFP that were located in science industries reported facing more competitive uncertainty than those in non-science environments, evident in more volatile shifts in consumer demand, smaller customer bases and higher rates of technological obsolescence. In more uncertain environments, financing generally has to be found on the equity side. And in science-based industries, the same emphasis on equity financing, at least in the early stages of development, is reported. Retained earnings and share capital are better represented on the balance sheets of small firms in science industries than amongst those in non-science environments. A less predictable outcome emerges when comparing the emphasis given to financial strategies. While firms in science industries exhibit a wider array of strategic competencies than firms in other

sectors (e.g., skills related to technology, human resource management, production and marketing), they report giving less emphasis to financing. Yet these are industries in which small firms could be expected to devote more attention to financing—because of the importance of securing funds for less tangible investments in R&D and technology. However, firms in science industries place less emphasis on finding and maintaining capital than do firms elsewhere. And those in science environments are no more likely to stress other financial competencies than others—such as developing the flexibility to meet unforeseen circumstances and general financial management. This suggests that small firms in science industries may view the time and resource costs associated with the development of these financial competencies as prohibitive, leading these firms to look inward toward internal sources of funding.

The comparative analyses described in Section 6.2 and in this section tell us something about the nature of specificity within the innovation system. The studies of innovation in services (described in Section 6.2) report, in highly descriptive terms, how small-firm innovation strategies are tailored to meet the nuances of different industrial environments. Even within services, very substantial differences in the inputs and outputs of innovation are apparent. Comparisons between science and non-science industries highlight basic differences in the extent to which small firms in different operating environments engage in innovation. New young firms that enter more science-intensive environments place more emphasis on innovation and the visible manifestations of innovation strategies, such as R&D and intellectual property use. But these firms also support these investments by developing superior capabilities in other business areas, including human resources and marketing. In the next section, we explore an alternate view of the competitive environment—one based on the developmental life cycle exhibited by many firms as they grow from small entrants to large incumbents. Our research in this area focuses on how the strategic and innovative capabilities of small firms compare with those found in larger producers.

6.4 Life cycle differences amongst firms: Small versus large manufacturers

The literature has debated the relative contributions that small and large firms make to the innovation process. The Schumpeterian literature has long emphasized the importance of large firms. But new small firms are seen by many to be critical to the innovation process. The key role that new, small firms play in the innovation process has been described by Rothwell and Zegveld (1982), who argue that new small firms have been conspicuous in providing the lead for innovation in a number of industries—from electronics to biotechnology. In the same vein, Acs and Audretsch (1990) and Audretsch (1995) use United States data on innovations and argue that in many industries, small firms are relatively more innovative than large firms.

The survey evidence presented herein also paints a vibrant picture of innovation in the small-firm sector. A wide array of innovation strategies and innovation capabilities are at work within the small-firm population. More successful small firms—growing firms or

firms that improve their productivity, profitability and market share—are often those that invest in both specialized innovation capabilities, such as R&D and technology use, and core business skills. This finding is consistent with earlier studies by McGuiness and Little (1981), Utterback et al. (1988), Napolitano (1991), and Rosenbloom and Abernathy (1982) who found complementarities between firms' technical capabilities and a broad range of skills in such functional areas as human resources, management, marketing, production and financing. These complementarities are more apparent in some industrial environments than others. For example, small firms operating in science industries tend to place more emphasis on innovation, human resources and marketing. This occurs because science industries place a greater premium on innovation, and human resource and marketing strategies are essential if firms are to exploit the benefits of their innovation strategies.

Our research has examined the extent to which basic differences in the firm life cycle—the process by which many small firms grow into larger, established incumbents—influences the development of these complementary competencies related to innovation and core business skills. Differences in a firm's age as measured by its life cycle are not unrelated to the notions of competitive environment introduced in preceding sections. Small firms operate in different markets than large firms. They face a much higher risk of exit, and it may be much more important for new small firms to choose the right set of policies. Small firms may therefore find that different forms of organizational capital matter more to them than they do to large firms.

We investigated this issue using data from the 1993 Survey of Innovation and Advanced Technology, which sampled a representative cross-section of the manufacturing population. We divided these data in large- and small-firm groups and then compared differences between innovators and non-innovators. We were interested in learning whether the profile that makes an innovative firm different from a non-innovative one varies across small and large firms.

The results of this survey are consistent with those reported earlier—innovative firms place greater emphasis on a broad range of strategies than do non-innovative firms. Innovative firms not only develop superior capabilities related to R&D and technology, but their capabilities extend beyond a narrow scientific bent. All of this indicates that innovative firms must master a set of complementary skills. The importance of complementary strategies is particularly evident in the small-firm population. It is here that we find the largest and most significant distinctions between innovators and non-innovators. There are substantial differences between small innovators and non-innovators in terms of the importance that they give to strategies in a wide range of functional areas—from human resources, to marketing, to financial competencies. Of interest is that emphasizing the use of advanced technologies is a more important distinguishing factor in small firms than an R&D focus.

In comparison to small firms, there are fewer differences in the large-firm sector between innovators and non-innovators. We interpret this to mean that the advantage of making the correct investments in organization capital (getting policies right) matters more for small firms. In the small-firm sector, innovation is associated with growth. It is here that the natural selection process operates intensely, and it is here that critical differences in

capabilities are more closely related to the growth process. Larger firms have generally developed a range of competencies (competencies that have enabled them to grow) and fewer differences exist in the emphasis that innovators and non-innovators give to many strategies areas in this segment of the population.

Human resource strategies are illustrative. Small innovative firms are more likely to place more emphasis on human resource policies than are small non-innovative ones. Small innovators value their employees' skills more highly, exhibit a stronger commitment to enhancing those skills, to motivating their employees through a variety of means, and to involving their employees through collective agreements. They also boast a superior labour climate. Many of these differences are less apparent when comparing large innovators to large non-innovators. This occurs because small firms are still in the process of sorting themselves into those who are going to grow and those who are not. And here, differences in the emphasis given to skill development help to determine the growth prospects of a firm.

Endnotes

18. It has been argued that the standard statistical proxy for innovativeness, research and development (R&D) expenditures, is not particularly well suited to the analysis of innovation in small firms. For background, see Schmookler (1959) and Kleinknecht, Poot and Reijnen (1991). Baldwin and Gellatly (1998, 1999) demonstrated that there is a broad diversity of innovation practices in new small firms—different skills and activities related to innovation, technology adoption and human resource management. These practices are related, but imperfectly. New firms can consider themselves among the most technologically advanced without reporting that they are among the most innovative or that they place the heaviest emphasis on skilled workers.
19. See also Baldwin, Gellatly et al. (1998) and Gellatly and Peters (2000).
20. See also Baldwin and Johnson (1999).
21. Each of these three industry categories comprises a range of more detailed four-digit industries. Communications services includes radio broadcasting, television broadcasting, combined radio and television broadcasting, cable television services, and telecommunications carriers; the financial services category includes chartered banks, trust companies and life insurers; business services includes computer services, computer equipment and repair, engineering, and scientific and technical services. For discussion, see Baldwin, Gellatly et al. (1998).
22. While a dichotomous classification scheme is used here, it is important to remember that not all firms in science-based sectors are high-tech or high-R&D performers. Similarly, not all firms in other sectors are low-tech. Related work (Baldwin and Gellatly, 1999) discusses this issue at greater length. High-tech firms can be found in almost every industry—but to varying degrees.
23. The classification technique is basically that used by Lee and Haas (1996), who divide industries on the basis of three R&D measures—the R&D–sales ratios, the proportion of R&D personnel to total employment, and the proportion of professional R&D personnel to total employment; and three measures of human capital—the ratio of workers with post-secondary education to total employment, the ratio of knowledge workers to total employment, and the ratio of the number of employed scientists and engineers to total employment. Industries were then assigned to the R&D/scientific category if they fell in the top third on the basis of two of the R&D indices *and* two of the human-capital indices.
24. For a more extensive discussion of these findings, see Baldwin and Gellatly (2003, Chapter 10) and Baldwin and Johnson (1999).

Chapter 7. Conclusion

The population of small firms is varied. Many will decline and exit the market place shortly after entry. Others will survive and grow. Some will innovate and surge ahead of their competitors. This paper has summarized a large body of research on both small and large firms using survey and administrative data developed and maintained by Statistics Canada. The core objectives of this research are two-fold.

First, we have attempted to understand the strategic foundations associated with the growth process writ large. Business surveys can tell us much about different aspects of this process. They tell us that investments in developing general business skills—basic capabilities related to management, financing and marketing—provide the type of intangible capital related to business competencies that young firms need if they are to survive their early precarious years. They tell us that other investments related to the development of specialized competencies in the area of innovation and technology management are strongly correlated with the subsequent growth process. These are specialized competencies that set high-growth firms apart from low-growth firms; they also discriminate between more and less successful firms based on more comprehensive measures of business performance, including an amalgam of changes in productivity, profitability and market share. Our surveys also tell us that firms support these innovation competencies by developing a network of supporting skills, including those related to human resource management, marketing and production.

All of the findings noted above resulted from studies that search for basic commonalities amongst small businesses, shared factors that help to explain differences in performance or that serve to characterize large numbers of firms at a particular stage in their developmental process. Other of our studies have shifted the emphasis from generalities to specifics, focusing on the link between innovation and the competitive environment. Here we investigated how innovative firms respond to different competitive pressures in terms of the set of strategies and activities that they pursue. Work in this area has found that there is no single path to innovation that transcends all market environments, as there is often a high degree of specificity that accompanies the innovation process.

There is a core finding that runs through much of this research that warrants special emphasis. Innovation is active, not passive. New knowledge—whether embodied in new product designs, superior production methods or organizational forms—is borne out of purposive action. The sharper, more developed, strategic stance that serves to differentiate innovators from non-innovators, apparent in all of the surveys noted herein, is evidence of this.

Innovators place more weight on a host of strategies and activities in order to better their performance. They not only focus on developing new products and processes, but they also invest in training programs to develop the skilled personnel required, along with their marketing and production skills to successfully bring innovations to market. They spend more on acquiring technological know-how. More often that not, the innovative firm is also a compleat firm. This type of firm has developed firm-specific knowledge capital that pays dividends in the form of enhanced growth.

Successfully investing in skills—combining a diverse yet complementary set of business competencies—goes to the heart of dynamic entrepreneurship. Developing the intangible capital that is manifest in competencies across many functional areas often translates into greater success. To many observers, this may seem obvious; however, it is sometimes argued that firms stumble across new ideas serendipitously. While this most certainly occurs, it is difficult, in light of the evidence, to see this passive approach to innovation as the norm, as it is equally difficult to see success as simply the product of random chance. Granted, the outcomes of innovation strategies are far from deterministic—there is nothing to guarantee, for instance, that by spending money on research and development, firms will actually develop useful knowledge capital. This said, a more intensive commitment to innovation and all the concomitant competencies can, in the main, improve a firm's chances for success.

This core finding—the innovative firm as a compleat firm actively developing its knowledge capital—shapes our understanding of industrial competition. Our research shows that populations divide up into firms that have adopted an aggressive innovation strategy and those that have not done so. Aggressive and non-aggressive innovation strategies have different risks and different payoffs. Most do not pursue an aggressive strategy, but are doing something that can be construed as involving newness. A relatively small percentage of firms are aggressive innovators, introducing radically new products that involve patent protection or dramatically different new technologies. These activities are difficult and risky. But these firms reap greater rewards.

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