

Understanding the Innovation Process: Innovation in Dynamic Service Industries

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Abstract

In studies of business innovation, the term *innovation process* is used to describe (i) the array of sources and objectives that culminate in the act of innovation, (ii) the set of market effects that result from innovation, and (iii) the obstacles that firms encounter when pursuing innovation strategies. An examination of the innovation process is thus designed to bring about a more comprehensive understanding of the characteristics that innovative firms share, as well as of those characteristics that set innovators apart from other businesses. The *Survey of Innovation, 1996* examined innovation in three dynamic service industries: communications, financial services, and technical business services.

This article explores the principal findings to emerge from the *Survey of Innovation, 1996*. Two themes are apparent. In the first instance, many elements of the innovation process are common to all the service industries studied, such as an emphasis on product innovation, a strong customer orientation, and a commitment to service quality. Beyond these common elements, however, differences in competitive pressures across these industries serve to engender important differences in innovation strategies. Accordingly, much of what we can ultimately learn about the innovation process occurs at the industry level.

Keywords: innovation, service industries

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1. Introduction

Innovation is at the heart of economic growth and development. Much of our empirical knowledge of the innovation process, however, derives solely from studies of manufacturing firms. This report draws on Statistics Canada's *Survey of Innovation, 1996* to develop a profile of innovative firms in three dynamic service industries: communications, financial services, and technical business services.¹ It finds that innovation is extensive in these service industries—comparable to many of the more innovative industries in the manufacturing sector. It further demonstrates that differences in the competitive pressures facing service firms are associated with real differences in the innovation strategies that these firms pursue.

This paper explores elements of the innovation process in dynamic services. Innovation in communications, financial services, and technical business services is important. New products and methods of service provision developed in these industries serve as the impetus for innovation and growth in other sectors of the economy. Of this, examples abound. New data transmission and carrier technologies developed in the telecommunications sector have greatly improved the efficiency of business transactions. Communications technologies such as local area and inter-company computer networks have been widely integrated in all sectors—technologies that depend on software products developed in the computer services industry. New financial products have radically altered the scope of savings and investment behaviour, creating new opportunities for wealth creation through more sophisticated forms of financial management. The impact of each of these examples on business activity is, in the main, difficult to overstate.

The term *innovation process* refers to the key features of—inputs to, and outputs from—an innovation strategy. It is comprised of several elements: the set of objectives that new products, processes or business routines are designed to address, along with the array of sources, both external and internal, that contribute to their development. Other elements include the benefits that innovation brings to the firm, along with factors that hamper innovative activities.

Firms pursue innovation strategies in order to meet a variety of objectives. New products may be developed in order to reach new markets, or simply to maintain existing markets. Improving production routines may lead to price advantages over competitors as the firm reduces unit costs. Organizational restructuring may lead to higher productivity. In general, innovation objectives often take the form of production, product, or market strategies, or some combination thereof. Elements of a production strategy may focus on improving production flexibility, reducing lead times, improving working conditions, or reducing labour costs. Elements of a product strategy may centre on improving product quality, replacing products that are being phased out, or extending the product range. A market strategy may focus on opening new domestic or foreign markets, or simply on maintaining current market share.

¹ The survey included 895 firms from broadcasting and telecommunications industries, 160 banks, trust companies and life insurers, and 3,830 businesses in computer or related services, engineering, or in other scientific and technical services. For a discussion of survey coverage, see Appendix A.

The success of an innovation depends fundamentally on its commercial value. Innovation is market-driven. Firms innovate in order to gain an advantage over competitors, perhaps by becoming more cost-efficient, by tailoring products to meet unique customer requirements, or by improving access to service in remote areas. It may be the case that the impacts of an innovation accord directly with its objectives. For example, a firm may implement product development teams to bring to market a new product line. Its successful commercialization is both the primary objective and outcome of an innovation strategy. Innovations may also give rise to unintended consequences. For example, the act of constituting development teams (itself an organizational innovation) may improve worker morale and lead to higher productivity.

In developing innovation strategies, firms draw on a variety of sources. These may be internal to the firm: R&D units, production, management, and marketing departments are all potential sources of new ideas. The importance of certain factors, such as R&D, will depend on the scientific and technological characteristics of the industry, as well as on the provisions for protecting investments in intellectual capital. In certain sectors, a firm's competitive strategy may focus on developing novel products that embody high levels of technological sophistication. A substantial investment in R&D may thus be required to bring these products to market. If the firm is able to protect new products with intellectual property rights, then it has an incentive to invest in R&D. If, however, competitors are readily able to appropriate the gains from this investment in R&D—by offering comparable products to consumers with little delay—the benefits from this investment are substantially diminished. In this case, firms may look to other sources for innovative ideas.

Many such sources are found outside the firm. Customers, suppliers and competitors all contribute to the development of an innovation strategy. Customers, particularly those in downstream businesses, may call on the firm to offer new products, or re-engineer existing products. In the same way, suppliers can affect how the firm innovates. Products and technologies that are supplied to firms may, in turn, enhance their potential for innovation (as these inputs may lead to new products or more efficient production methods). Other sources for innovative ideas are of a more general character, often taking the form of public goods. Research institutes and government agencies make information widely available that can be utilized by firms when developing new products and processes. All firms can avail themselves of these 'institutional' supports. Indeed, substantial public investments in national innovation systems focus on developing research networks that act as drivers of innovation by providing new technologies directly to business.

While various sources encourage the innovation process, other problems arise that impede it. Innovation strategies are risky. New products may fail to meet consumer expectations and provide little financial return. New processes may be costly to integrate and involve substantial investments in labour training. New organizational routines may impede well-established lines of communication. The risks involved in introducing innovations are substantial; it is because of these risks that many firms choose not to pursue innovation strategies, instead focusing on the status quo. Impediments to innovation fall into several categories.

In the first instance, financial barriers may prove limiting. The costs of innovative projects may be excessively high. Moreover, they may be difficult to predict *a priori*. Many firms may not have sufficient access to equity capital to finance innovations. Once brought to market, the amortization period associated with an innovation may be unduly long: long-run revenues may not be sufficient to offset short-run costs.

A second group of impediments centres on the market and technical risks of innovation. After substantial investments in R&D, a new product may not be feasible, or may have only limited market appeal. Moreover, unless protected by an intellectual property right (itself a costly investment), innovative products may be easily imitated by competitors.

A final group of impediments are non-financial in nature. These focus on the idiosyncratic characteristics of the firm. Existing labour skills may not be sufficient to implement an innovation strategy. Management may resist change, or provide little incentive for risk taking. Other factors, such as legislative barriers, may also diminish the return on innovation.

The interplay between all the above components—sources, objectives, impacts and impediments—constitutes the innovation process. The objectives and impacts influence the benefits that a firm anticipates from innovation. The sources and impediments will determine the costs. Together, then, the objectives, impacts, sources and impediments affect the net benefits (benefits less costs) that firms can anticipate from innovation.

Far from a singular act, innovation embodies a continuum of decisions taken by the firm—decisions on information sources, objectives, risk management and project assessment. Developing successful innovation strategies is often difficult, which explains why many firms choose not to do so, even though the benefits of innovating are widely understood. A successful innovation strategy relies on developing ongoing linkages—such as production units collaborating with R&D divisions; purchasing departments acquiring new technologies from suppliers; and management teams interacting with customers.

In what follows, we investigate the innovation process within communications, financial services, and technical business services. We begin in Section 2 by examining the scope of innovation in these industries, followed by an overview of the characteristics of innovation that firms within each of these industries share. Many of these characteristics are consistent with the specialization, customization and product strategies typically associated with small firms.

While commonalities can be found in the innovation process, their importance should not be overstated. Innovation strategies are often tailored to individual market circumstances. Section 3 highlights intersectoral differences in innovation regimes by focusing on differences in competitive pressures, business strategies and the innovation process.

A final section reviews some basic lessons from the study of innovation in services. Each of these has important implications for innovation policy.

2. Innovation in Dynamic Services

2.1 Incidence of Innovation

Innovation in communications, financial services, and technical business services is extensive. Sixty-two percent of financial service firms reported introducing either a product, process or organizational innovation, as did 45% of communications firms, and 43% of businesses in technical business services.² These rates compare favourably with many of the more innovative manufacturing industries often considered to be innovation leaders (Table 2.1.1).³

Table 2.1.1 Innovation Rates, Select Industries*

| <i>Industry</i> | <i>Percentage of businesses introducing innovations</i> |
|-----------------------------------|---|
| <i>Service Industries:</i> | |
| Communications | 45.0 |
| Financial services | 61.8 |
| Technical business services | 42.6 (1.3) |
| <i>Goods Industries:</i> | |
| Machinery | 43.5 (5.5) |
| Electric equipment | 52.5 (6.7) |
| Petroleum refining and coal | 53.7 (9.9) |
| Chemicals | 41.4 (6.9) |
| Pharmaceuticals | 56.8 (15.1) |

*See Baldwin et al. (1998) and Baldwin and Hanel (1999).
Standard errors are in parentheses.

² Innovation rates are based on the percentage of businesses that self-identify as innovators—either by indicating the introduction of new and/or improved products, processes, or organizational forms, or some combination thereof. This concept of innovation is meant to exclude all modifications of a purely aesthetic nature. Estimates of sampling error are not provided for communications and financial services as these innovation rates are calculated directly from population data. Note also that the innovation rates and standard errors for manufacturing industries are preliminary. For a discussion of data quality, see Appendix A.

³ The goods industries listed in Table 2.1.1 represent a group of ‘core industries’ within the manufacturing sector. This designation was developed by Robson, Townsend and Pavitt (1988), who examined important innovations in UK manufacturing industries over the period 1945-83, and refers to industries that are highly innovative and that produce products that are widely used in other sectors. Note that the rates reported for these industries are based solely on product and process innovations—they do not account for changes in organizational structure or internal business routines. To evaluate whether our more comprehensive definition of innovation in service industries overestimates their relative innovativeness vis-à-vis the goods sector, we recalculated the innovation rates for services based solely on this more restrictive product and process definition. The results do not change substantively. Sixty percent of firms in financial services report product or process innovations, followed by 41% of firms in communications and 40% of businesses in technical business services. Even under this more restrictive concept of innovation, these service industries fare reasonably well against those in the ‘core’ manufacturing sector. What is more, they perform very well relative to manufacturing in general, as the *overall* innovation rate in the manufacturing sector (based on all industries, not simply those in the ‘core’ group) is 33% (Baldwin and Hanel, 1999).

That these service industries should exhibit high rates of innovation is not surprising. In many ways, the *potential* for innovation is greater in services than in traditional goods-producing sectors. Innovation involves doing business differently—such as offering new or improved products to customers. Services are constantly being differentiated in terms of characteristics involving time and space in order to better meet the preferences of individual consumers.⁴

What are some common examples of innovation in these service industries? In the communications sector, product innovations often consisted of new channels, cable packages and specialty programs, as well as internet-based services. Process innovations focused on the conversion from analog to digital-based processes, the adoption of fibre-optic technology, and the general incorporation of computer-based technologies. In financial services, product innovations consisted of new insurance policies and new investment instruments; process innovation focused on computer-based automation. In technical business services, product innovations included highly specialized software, task-orientated computer products, data management tools, and internet-based services; process innovations ranged from computerized networking in the development of software, the adoption of ISO standards, and the development of new project standards and methodologies dealing with evaluation methods and quality testing (Baldwin et al., 1998).

In each of these dynamic service industries, product innovation is more common than either process or organizational innovation (Table 2.1.2). This illustrates that service firms do not simply focus on process innovations that incorporate products developed in other sectors; rather, they develop new and improved products that are consumed elsewhere. Product innovations in communications and technical business services are excellent examples of this. Communications infrastructure and the software products developed to support this infrastructure are essential ‘inputs’ in most business operations. Among business services firms, telecommunication services were identified as important factors in improving overall firm productivity and the ability to respond to customer needs (Mozes and Sciadas, 1995). Recent work on Canadian manufacturing has demonstrated that the use of information and communications technologies is associated with superior performance (Baldwin et al., 1996).

⁴ This argument is explored in considerable detail in Baldwin et al. (1998). The basic idea is that the delivery of services to the consumer can be tailored across a number of time and space dimensions, in ways that satisfy a great variety of consumer preferences. Wireless communications technology, for instance, has afforded consumers more flexibility in terms of where they can access services—differentiating services along the lines of geographic location. Automation in financial service delivery is an illuminating example of differentiation in both time and space. In the not too distant past, consumers conducted the majority of their financial transactions at their home institution during certain ‘business hours’. With the advent of computer networks linking financial institutions and ATMs, consumers can now access their accounts at any time, and from a vast array of geographic locations (from different branches of the same institution and from competitor institutions). Moreover, with the advent of tele-banking and internet-based services, consumers no longer need to be present at financial institutions in order to conduct financial transactions.

Table 2.1.2 Incidence of Innovation by Type (% of businesses)*

| | <i>Communications</i> | <i>Financial Services</i> | <i>Technical Business Services</i> |
|----------------|-----------------------|---------------------------|------------------------------------|
| Product | 34.5 | 55.6 | 35.2 (1.2) |
| Process | 25.0 | 38.4 | 20.7 (1.0) |
| Organizational | 18.3 | 29.9 | 16.6 (0.9) |

*Standard errors are in parentheses.

This emphasis on product innovation among service firms does not imply, however, that the provision of new goods and services need be ‘market-firsts’—innovation can range from original to imitative. The latter variety is indeed more common. Less than 10% of innovators in communications and financial services indicated that their most important innovation was a ‘world-first’ innovation. Only slightly more innovators in technical business services, 17%, reported this to be the case. This low degree of novelty underscores the high degree of differentiation in service markets. Small continual changes in product design or in methods of service delivery—based often on the actions of competitors—may prove just as important to a firm’s competitive strategy as major market-first innovations.

In the service industries studied, the incidence of innovation and the complexity of innovation strategies are associated with firm size. The highest rate of innovation occurs in financial services—also the industry with the greatest concentration of large firms.⁵ Businesses in financial services are more likely to pursue complex innovation strategies that rely on combinations of product, process and organizational change. Here, 33% of innovators combine all three of these elements in their innovation strategy, compared to only 19% and 18% of innovators in technical business services and communications, respectively.

Innovation activity in each of these service industries is also intensive—a substantial percentage of innovators in all three sectors report introducing one or more innovations over the course of an average year (Table 2.1.3). Over four in ten innovators in financial services and technical business services introduce multiple innovations per year.

The profile of the business population in each of these industries reveals two broad groups: (1) a core of firms that pursue innovation strategies (i.e., that innovate frequently with varying degrees of success), and (2) firms that forego innovation strategies altogether. Indeed, a considerable percentage of innovative firms (ranging from 21% in communications to 38% in technical business services) report additional innovation activity that did not lead to the introduction of new products or processes; for non-innovative firms, only 5% (or fewer) report such activities. Innovators are thus both innovating and trying to innovate, while non-innovators engage in very little innovation activity.

⁵ Forty-five percent of businesses in financial services have 100 or more employees, compared to only 11% in communications and 5% in technical business services.

Table 2.1.3 Frequency of Innovation (% of innovators)*

| | <i>Communications</i> | <i>Financial Services</i> | <i>Technical Business Services</i> |
|-----------------------|-----------------------|---------------------------|--|
| More than once a year | 23.2 | 44.7 | 44.4 (1.9) |
| Once a year | 26.2 | 31.6 | 25.2 (1.7) |
| Every second year | 13.8 | 7.4 | 9.6 (1.1) |
| Every third year | 8.0 | 3.2 | 5.2 (0.8) |
| Less frequently | 28.7 | 13.1 | 15.5 (1.4) |

*Standard errors are in parentheses.

2.2 Common Elements of the Innovation Process

The innovation regimes in all three service industries share a set of core characteristics. We review these below.⁶

First, innovators in all three sectors stress the need to maintain or increase market share by focusing on existing customers and improving product quality.⁷ This emphasis on product strategies serves to distinguish innovative service firms from their counterparts in manufacturing, where innovation strategies generally place more emphasis on production methods (Baldwin and Da Pont, 1996). In dynamic services, innovation often leads to improvements in service quality—indicative of competitive strategies with strong product/customer orientations.

Second, customers often play a central role in the development of innovations. In each of the service industries studied, customers constitute the single most important source of information for innovative ideas. Once again, this stems from a general emphasis on product innovation, and reflects the fact that services can be highly differentiated in order to meet individualized needs. A strong customer orientation follows from a highly competitive marketplace where customers are readily able to substitute among competitor firms—an important source of uncertainty in each of these industries. Given this strong customer orientation, it is not surprising that an improvement in some aspect of service quality represented the primary benefit of innovation in each industry.

Third, innovators in all three service industries stress the use of copyrights and trademarks over other formal intellectual property instruments. Trademarks are significant because of the importance of brand recognition in markets where consumers can easily switch from one producer to another, and where competition hinges on product recognition and brand loyalty. This reliance on copyrights and trademarks distinguishes service firms from manufacturers who place more weight on patent use (Baldwin and Da Pont, 1996). Innovators in each service

⁶ The majority of comparisons in this section are based on responses to scale-based questions in which businesses were asked to rate the importance of individual factors on a five-point scale ranging from 1 (not significant) to 5 (crucial). Respondents were also given the option of identifying an element as ‘not applicable’. Our metric is the *extreme score*—the percentage of innovative businesses in each industry that characterized a particular element as ‘very significant’ or ‘crucial’ (a score of 4 or 5). For discussion of extreme scores, see Baldwin et al. (1998). Note that ‘not applicable’ responses are included in the calculation of extreme scores.

⁷ Henceforth we use the terms ‘innovator’, ‘innovative firm’ and ‘firm’ interchangeably. For example, the term ‘financial services firms’ refers specifically to innovators in the financial services sector.

industry also stress informal methods of protecting investments in innovation, such as being first in the marketplace or using complex product designs.

Fourth, key innovations in these industries tend not to bring about changes in labour demand or skill requirements. This result is compatible with an innovation process that focuses primarily on products that serve via differentiation to maintain the customer base. A solid majority of innovators in each industry (ranging from 61% in financial services to 64% in communications) reported that their most important innovation had no effect on the firm's demand for labour. Similar numbers of firms indicated that their most important innovation did not affect skill requirements. Among firms that did not regard the effects of innovations as neutral, a greater number reported an expansionary effect—an increased need for both labour and worker skills—than saw their innovation as labour or skill reducing, respectively.

The characteristics outlined above indicate that the service sector innovators studied here have a profile that is generally consistent with the archetypal innovative small firm—one that focuses on quality, flexibility and catering to diverse customer tastes. Early work on innovation, which focused predominately on large firms, emphasized the importance of business characteristics that often flow from scale economies—sophisticated production processes, research units, financial arrangements and organizational structures. Small firms, often lacking such characteristics, opt for innovation strategies that rely on specialization, customization, product flexibility, all of which result from a collaborative interaction with clients, more so than from internal sources like R&D (Baldwin et al., 1994). Service firms fit this mold given the importance of customer interaction, product specialization and service flexibility to their innovation activities. At first blush, this reflects the fact that many of these firms are small, particularly in the case of communications and technical business services. To this extent, small-firm characteristics are simply that, irrespective of whether a firm is a service-provider or goods-producer. More to the point, these small-firm characteristics are accentuated in service firms, due largely to greater rewards stemming from product differentiation across time and space. Service provision lends itself to more 'bundling' and 'product customization' than is evident in goods industries, and a greater emphasis on external sources for innovative ideas results from this.

While a general emphasis on bolstering market share and enhancing product quality is central to the innovation strategy in each of these service industries, there are substantial differences that emerge at the industry level. These differences are relevant to the policy process because they illustrate, firstly, the extent to which barriers to innovation differ, and, secondly, how specific policies designed to encourage innovation may be more effective in certain industries than in others. In our view, the majority of these intersectoral differences in the innovation process have a logical basis—they stem from relative differences in the competitive pressures that firms in each industry face.

3. *Intersectoral Differences in Innovation Regimes*

Innovators in each of these industries fashion strategies that are consistent with prevailing market pressures. That this should occur is not surprising—business strategies are responses to the competitive forces that shape the marketplace in which the firm operates. For example, in a price competitive marketplace, a firm’s competitive position will depend largely on its ability to develop innovative production technologies that reduce unit costs. In this context, innovation will be geared towards realizing efficiency gains. In other settings, where a firm’s competitive position depends more on its ability to bring new products to market, more resources may be directed into R&D in order to offer a differentiated product line to the consumer. Differences in the nature of competition engender differences in the type of innovation that is pursued.

Table 3.1.1 Key Elements: Competitive Environment, Strategic Orientation, and Innovation Characteristics

| | <i>Competitive Environment</i> | <i>Strategic Orientation</i> | <i>Innovation Characteristics</i> |
|------------------------------------|---|--|--|
| Communications | <ul style="list-style-type: none"> • Changing production technologies and low liquidation values for machinery and equipment are key sources of uncertainty • Regulatory restrictions are more pronounced than in other sectors | <ul style="list-style-type: none"> • Greater relative emphasis placed on using high quality suppliers and purchasing technology | <ul style="list-style-type: none"> • Improving product quality is a major objective of innovation • Improving product/service reliability is the dominant impact of innovation • Suppliers and technology acquisition are major sources for innovative ideas • Legislation is seen as an obstacle to innovation |
| Financial Services | <ul style="list-style-type: none"> • Consumer substitutability and threat of entry are dominate sources of uncertainty • Flexibility in responding to customer needs, as well as product development and customization strategies are relatively more intense areas of competition • Price competition is more intense | <ul style="list-style-type: none"> • Incentive compensation plans, recruiting skilled labour and training are more important strategies | <ul style="list-style-type: none"> • Reducing unit labour costs is a relatively more important objective • Speed of delivery and adapting to customer requirements are dominant outcomes of innovation • Competitors are a primary source of ideas for innovation • Use of trademarks is extensive |
| Technical Business Services | <ul style="list-style-type: none"> • Many important secondary sources of market uncertainty: product obsolescence, difficulty in predicting consumer and competitors’ actions • Product quality and customer service are key competitive areas | <ul style="list-style-type: none"> • More emphasis on R&D and developing/refining technology | <ul style="list-style-type: none"> • Customer diversification and production flexibility are more significant innovation objectives • Impacts of innovation are varied and intense: product reliability, adaptability, user friendliness, speed of delivery and accessibility • R&D is a major source of ideas for innovation • More diverse use of intellectual property instruments • Financing restrictions and labour shortages are key obstacles |

The relation between innovation and competition in these dynamic service industries is examined using Table 3.1.1. It lists, for each sector, salient features of the competitive environment, elements of business strategies that distinguish these service firms from those in other sectors, as well as important characteristics of innovation strategies.

3.1 Innovators in Communications

Innovators in communications rely extensively on new advanced technologies. Firms in this sector operate in a marketplace where production technologies change rapidly and machinery and equipment have low liquidation values. Innovators focus on improving product quality by networking with high quality suppliers and emphasizing, more so than other service firms, technology purchase—key elements of their production and technology strategies. Not surprisingly, suppliers, and to a lesser extent, technology acquisition, play key roles in the development of innovations.

Communications firms improve product quality by integrating new technologies into their production processes. These innovations lead to improved service reliability. For many firms, the conversion to fiber-optic and digital-based technologies—both key technological innovations—is accomplished via linkages with outside firms. Establishing and maintaining these supply networks is thus an important dimension of their business and innovation strategies. Innovators in communications place less weight on in-house R&D than do innovators in financial services or technical business services. It is not surprising, then, that the overwhelming majority of innovations are imitative, and that communications firms place less emphasis on formal intellectual property rights than do innovators in other dynamic services.

Firms in communications also differ from those in other service industries in that they identify legislative rules as important obstacles to developing innovations. A more restrictive regulatory framework—one that, in varying degrees, places limits on the nature and content of the services that firms offer—may also explain why these firms generally view competition as less intense than do innovators in financial services or technical business services.

3.2 Innovators in Financial Services

Competition in financial services is driven by price, service flexibility and customer service. The ability of consumers to substitute among competitive products, and the threat of entry, are especially important sources of market uncertainty in this industry.

Innovation is often designed to provide financial products that both satisfy a diversity of consumer wants and are price-competitive. Innovators stress trademarks, essential to brand recognition, when bringing products to market. When developing new financial products, innovators report that they look to competitors for ideas. As a part of their business strategy, financial services innovators emphasize human resource practices that focus on worker incentives, acquiring skilled labour and training—all designed to increase labour productivity and improve the quality of services offered to their customers. In a complementary vein, innovations are often designed to reduce unit costs. This reflects a price-competitive marketplace that is

characteristic of a mature industry—one in which process and organizational innovations, often designed to lower unit costs, become more consequential.

3.3 Innovators in Technical Business Services

Technical business services innovators react to a diverse set of market pressures. Product obsolescence, competitor behaviour, and consumer demand are all more significant forms of market uncertainty in this industry than in either communications or financial services.

A marketplace characterized by numerous forms of uncertainty gives rise to a diverse set of innovation strategies. Technical business service innovators draw on a great number of sources, pursue a wide range of objectives, and realize a diverse set of benefits. While firms in all industries focus on improving market position, innovation strategies in technical service firms place more emphasis on customer diversification, and look to foreign markets as a source of expansion. This reflects a less restrictive regulatory environment than in communications or financial services.

Innovation brings a variety of benefits to technical business services firms. Improvements in product and service reliability, speed of delivery, accessibility, user friendliness, and adapting to customer requirements are all important outcomes of innovation strategies. A greater variety of innovation outcomes among these firms suggests a more diversified innovation effort.

In developing general business strategies, technical business services firms place more emphasis on in-house R&D and on the importance of using intellectual property strategies—consistent with the development of specialized, task-oriented products. R&D and intellectual property thus emerge as more important elements of the innovation process for these firms. R&D serves as a significant source of innovative ideas, and greater numbers of intellectual property instruments are used to protect these ideas. Innovators in this industry also face more difficulties financing their innovation activities and acquiring skilled labour. These both stem from a greater relative emphasis on R&D. Innovation in technical business services is associated with high levels of market and technical risk—risk pertaining to market success and feasibility. Acquiring the financing resources to support innovation strategies that depend heavily on R&D is likely to be more difficult, particularly for smaller firms in this industry. Concerns over a lack of skilled labour are consistent with the emphasis on human capital often found in R&D-intensive firms (Baldwin and Johnson, 1996).

4. Some Key Impressions

The previous sections have illustrated that (1) innovation in dynamic service industries is intensive, (2) an emphasis on product innovation in these industries gives rise to certain common elements in the innovation process, and (3) differences in competitive pressures across industries lead to concomitant differences in innovation strategies. These findings have important implications for innovation policy. We examine these below.

4.1 Competition Conditions Innovation

Many of the intersectoral differences outlined in Section 3 support the view that innovation strategies are consistent with, if not direct responses to, the competitive forces that shape an industry. This reinforces a central point—innovation is a complex and varied activity. Where an industry is characterized by high rates of technological obsolescence and capital depreciation—as in communications—innovation strategies stress *inter alia* the adoption of new technologies designed to improve product reliability. When consumers can switch between competitors with considerable ease and the number of firms is increasing—key sources of market uncertainty in the financial services industry—innovation is geared towards providing flexible, individualized products and better methods of service delivery. Where firms face many different sources of market uncertainty, as in technical business services, innovation strategies are concomitantly diverse.

The implication of this is not trivial. It means that innovation should not be studied apart from the workings of markets. The competitive environment facing the firm affects all of its business strategies, of which innovation is one. Innovation is pursued for different reasons, in different ways, to meet different objectives.

4.2 Innovation Inputs are Diverse

There are many different paths to innovation. Traditional studies have emphasized R&D as the hallmark of a successful innovation strategy. On this view, innovation is seen as a linear process, originating in R&D labs, and culminating in the introduction of new products and processes. Even among those who focus on the manufacturing sector, this linear view of innovation has been questioned (Mowery and Rosenberg, 1989). Production departments, engineering teams, and management groups all make valuable contributions to the development of innovations. R&D interacts with other ‘innovation inputs’ in a number of different, and often, complex ways—ways that, in many cases, do not conform with the linear ‘R&D-to-innovation’ model. It is not the sole input into the innovation process.

This is not to suggest that R&D is unimportant, or that its role should be downplayed. Numerous studies have demonstrated the importance of R&D to the innovation process (e.g.) Baldwin (1997); Baldwin, Hanel and Sabourin (1999). Many firms, even those that place relatively little emphasis on formal R&D, often benefit from R&D performed elsewhere.⁸

The characteristics of innovation in these service industries go some way towards demonstrating these points. Cross-industry variation in R&D intensity is substantial. At first blush, innovators in technical business services most conform to the ‘linear model’. These firms are more likely to perform R&D (59% of innovators in this sector engage in R&D, compared to 43% in financial services and 24% in communications).⁹ What is more, a high percentage of innovators in technical business services (57%) report that in-house R&D constitutes an important source of information for innovation. This said, much of the *impetus* for innovation, both in this and in the other service industries studied, originates directly with customers. Three out of four innovators in technical business services report that customers are a very significant or crucial source of information for innovation. Interaction with customers, then, plays a critical role in guiding the research and development process, and in shaping its eventual commercialization.

The interplay between R&D and customers is an example of a simple innovation network—the combination of actors that come together to create commercialized change. Other inputs also play a substantive role. In communications, firms look to suppliers as a key source of information for innovation. Firms here are able to access, through their interaction with supplier businesses, the ‘gains’ from research and development in other sectors, in ways that lead to improvements in service delivery. Suppliers bring advanced technologies to the firm, which, when integrated into its production process, allow for product and process enhancements. These acts—the creation, delivery and utilization of technology—are at the heart of the innovation process, and constitute, in effect, a vertically-integrated form of research and development. These vertical linkages between communications firms and their suppliers thus compensate for the lack of more formal R&D arrangements in communications firms. It is not surprising that, of those communication firms that do engage in formal R&D, relatively more emphasis is placed (than in other dynamic services) on establishing cooperative agreements or alliances with other organizations.

Pressures from competitor firms also play a direct role in the creation of innovations—particularly in financial services. Innovators in this industry make significant investments in R&D. They also draw heavily on external actors, such as competitors, when designing new products and methods of service delivery. This interplay between external actors and internal capabilities is once again illuminating—as the former play a key role in ‘shaping’ or ‘directing’ innovation activities. It also illustrates that imitation can spur on innovation—it, like collaboration, serves an important role in the creation of new knowledge. It also calls into focus the provisions for protecting investments in intellectual capital.

⁸ Baldwin (1997) makes a similar point when examining differences in the R&D intensities of large and small manufacturing firms. R&D spillovers from large firms often aid small firms directly or indirectly.

⁹ That innovative firms in technical business services place more weight on internal R&D capabilities is, in and of itself, illuminating, given that, relative to their counterparts in financial services, innovators in this sector tend on average to be small. Large firms often make greater investments in developing R&D capabilities than do small firms (Baldwin, 1997).

In the main, innovation inputs are diverse. In technical business services, firms stress the development of internal R&D competencies. In communications, firms tend to forego traditional R&D strategies in favour of vertical linkages with suppliers. These firms introduce advanced technologies into their production process to create innovation. In financial services, firms draw heavily on the actions of competitors when developing new products and services. These firms re-engineer ideas developed elsewhere, combine them with internal research units, and bring to market new products. These firms also rely heavily on trademarks to distinguish their own innovations from those of competitors.

What can one take from these examples? In our view, the framework required to support innovation should be mindful of these distinctions, mindful of the manner in which diverse inputs are combined in order to create new products and processes. Encouraging innovation is about more than simply supporting R&D—it is about encouraging the development of horizontal and vertical linkages, designing optimal rules for competition and intellectual property use, promoting risk-taking that leads to the creation of new knowledge, and facilitating access to physical, intellectual and financial resources.

4.3 Obstacles to Innovation are Industry-Specific

All of the service industries studied identified high costs as the primary impediment to innovation. This is what would be expected in a world where resources are limited and opportunity costs must be considered when making investment decisions. General concerns over the costs of innovation aside, many of the obstacles that firms face differ across industries. For example, the act of securing financing for innovation is more daunting in certain industries than in others. Compared to other dynamic services, more innovators in technical business services reported that access to equity and external capital constituted limiting factors in the development of innovations. This reflects differences in both business demographics and innovation regimes. First, the firm-size distribution in these industries differs dramatically. There are far greater numbers of small firms in technical business services than in financial services. Second, businesses in the former are more likely to stress R&D creation. These differences mean that financial impediments will be more problematic in technical business services since small firms that engage in R&D-intensive activities have substantial difficulty in acquiring financing (Hall, 1992; Himmelberg and Peters, 1994).

Other obstacles that innovative firms face reflect input restrictions of a non-financial nature. A successful innovation strategy may require skilled labour—to develop new products, or to integrate advanced technologies. The availability of skilled labour may vary dramatically depending on the type of business activity. In technical business services, where many firms produce highly-specialized software products, the lack of skilled workers represents more of a problem than in financial services.

Still other obstacles may be of a more institutional nature. Regulatory constraints are rules that govern how firms can behave—what sort of products they can produce and when they can offer these products to consumers. Innovators in communications are more likely to cite legislation as an important obstacle to the development of innovations than are firms in the other service industries.

4.4 A Service Economy is Not Necessarily a Less Innovative Economy

The secular trend towards a service-based economy is often greeted with consternation. Service industries are sometimes characterized as low-value, low-skill sectors that do little to advance the economy's competitive position. Such impressions do little to alter the fact that the Canadian economy (as well as those of its industrialized trading partners) is fundamentally service-based. Services constitute roughly two-thirds of Gross Domestic Product. They also account for roughly 75% of total employment and the majority of new job creation. Manufacturing industries, by contrast, employ less than 20% of the total workforce (Baldwin et al., 1998; Baldwin and Gellatly, 1998).

The service sector, of course, encompasses a broad range of highly diversified activities. Recent work on industry classification has demonstrated that advanced firms—those that, in some combination, innovate, use advanced technologies, and invest in human capital—are found in all sectors of the economy, not just in certain industries (Baldwin and Gellatly, 1998 and 1999). Many industries that do not garner headlines, such as farm services and recreation services, contain substantial numbers of advanced firms. The fact that an industry is service-based does not make it intrinsically 'less advanced' than one that manufactures goods. Nor is it necessarily less innovative. The dynamic services profiled herein are in fact highly innovative. What is more, they are likely to remain so as firms continue to capitalize on new opportunities for product differentiation.

While many service-sector innovations are incremental in nature, their cumulative effects on users are often substantial. One facet of innovation in dynamic services—communications, financial services, and technical business services—warrants special emphasis: product innovations developed in these industries serve as 'inputs' into other businesses. Manufacturing firms have benefited greatly from the integration of information and communications technologies developed in telecommunications and technical business services. Financing plays a central role in conditioning innovative behaviour in all businesses—particularly among small, young firms in technology-intensive sectors. Dynamic, innovative services are an intrinsic element of a healthy, modern economy.

Appendix A: Notes on Survey Strategy and Data Reliability

In this appendix, we present a brief overview of the survey strategy, followed by some comments on data reliability. For a more comprehensive discussion of these topics, see Baldwin et al. (1998).

A.1 Survey Strategy

Three broad industry groups were targeted for the *Survey of Innovation, 1996*. We outline the composition of these groups in Table A.1.1.

Table A.1.1 Target Industry Groups and Sub-groups

| <i>Industry Group</i> | <i>SIC</i> | <i>Industry</i> |
|------------------------------|-------------------|--|
| Communications | 4811 | Radio Broadcasting |
| | 4812 | Television Broadcasting |
| | 4813 | Combined Radio and Television Broadcasting |
| | 4814 | Cable Television |
| | 4821 | Telecommunication Carriers |
| | 4839 | Other Telecommunication Carriers |
| Financial Services | 7021 | Chartered Banks |
| | 7031 | Trust Companies |
| | 7311 | Life Insurers |
| Technical Business Services | 7721 | Computer Services |
| | 7722 | Computer Equipment Maintenance and Repair |
| | 7752 | Offices of Engineers |
| | 7759 | Other Scientific and Technical Services |

We present population, sample and respondent counts for each of these industry groups in Table A.1.2. Different sample frames were used for each group, leading to substantial differences in sample design. We describe each below.

- For communications, a census was taken of all business organizations licensed to operate in Canada by the Canadian Radio-television and Telecommunications Commission (CRTC). The sampling unit was the firm.
- For financial services, a list of chartered banks, trust companies and life insurers, developed by Statistics Canada's Industrial Organization and Finance Division, constituted the frame. This amounted to a census of banks and trust companies, and a near-census of life insurers. (In addition to its 'take all' or census component, the survey strategy for life insurers also included a very small sample of smaller units). The sampling unit was the firm.
- For technical business services, a sample was drawn from Statistics Canada's Business Register—a comprehensive database of all businesses operating in Canada. The sampling unit was the establishment.

Table A.1.2 Population, Sample and Respondent Counts

| <i>Industry Group</i> | <i>Population</i> | <i>Sample</i> | <i># of completed responses</i> | <i>Response rate (%)</i> |
|-----------------------------|-------------------|---------------|---------------------------------|--------------------------|
| Communications | 895 | 895 | 755 | 84 |
| Financial Services | 168 | 160 | 143 | 89 |
| Technical Business Services | 21,053 | 3,830 | 3,363 | 88 |

A.2 Data Reliability

A.2.1 Weighting

All of the tabulations reported herein have been weighted to reflect the characteristics of the populations under study. For units in the communications sector, these weights simply adjust for non-response (as the survey strategy was based on a census of all units within this sector). For units in technical business services, these weights reflect both survey non-response and the stratified random sample design. For units in financial services, survey weights again account for both non-response and a sample component (although it should be emphasized that the coverage attributable to this sample component—relevant to only a small number of units in the life insurance industry—is extremely minor).

Non-response bias was minimal in each of the three sectors (Table A.1.2). This is particularly true among the innovative subpopulations—our current focus, and that of Baldwin et al. (1998).

A.2.2 Sampling Error

As the survey design in communications and financial services was based on a census of units (as opposed to a probability sample), estimates of data reliability are not presented. This is the convention adopted by Baldwin et al. (1998) in their initial analysis of the survey results. This convention, while certainly appropriate to the communications group, warrants some minor qualification in the case of financial services—as here the survey strategy, while census-based, also included a minor sampling component. On practical grounds, the decision to (analytically) treat this sector as a census is sensible, as 95% of the units in the target population were included directly in the sample. Accordingly, the results presented herein are treated as direct population estimates.

The survey results for technical business services derive from a probability sample, and are thus subject to sampling error. In Table A.2.2 we present standard errors for statistics that are not reported in tabular form in Section 2.

Table A.2.2 Reported Statistics and Associated Standard Errors, Section 2

| | <i>Technical Business Services</i> |
|---|--|
| % of innovators with complex innovation strategies (product, process and organizational) | 19.0 (1.4) |
| % of innovators who report world-first innovations | 16.8 (1.3) |
| % of innovators with non-commercialized innovation activities | 38.4 (1.8) |
| % of non-innovators with non-commercialized innovation activities | 5.4 (0.8) |
| % of innovators whose most important innovation had no effect on the firm's demand for labour | 63.3 (1.8) |

In Sections 2.2 and 3, we have structured much our argumentation without any direct reference to statistical tables—a presentation style which does not lend itself to a straightforward review of data reliability. Readers who wish to examine the statistical evidence that forms the basis for our interpretations (along with the corresponding estimates of data reliability for the technical business services sector) are encouraged to consult the initial analysis of the survey results: Baldwin et al., (1998). All of the interpretations presented herein draw from these initial findings.

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