

Broadband, ICTs, and the Expansion of Ontario SMEs: Towards a Research Agenda

Charles H. Davis, Ph.D.
Faculty of Communication and Design and Ted Rogers School of Management
Rogers Communications Centre
Ryerson University
c5davis@ryerson.ca

10 August 2007

Prepared for the Ministry of Government Services, Ontario

Abstract

Internet technologies and e-business solutions are applications of Information and Communication Technologies (ICTs) that offer unprecedented opportunities for business innovation and improvements in productivity and profitability. Broadband enables affordable, always-on, media-rich, interactive communication with customers, suppliers, business partners, employees, and stakeholders, making possible new value propositions and new business models. However, it can be challenging to create value from the networked interactivity made possible by advances in ICTs. Although the simplest ICTs are today within easy reach of practically every small and mid-sized enterprise (SME), these firms face obstacles to adoption and exploitation of more complex or advanced broadband and ICT applications. ICTs are pervasive in the business environment, and the historic goal of connectivity is now largely attained in the business community. Over 80% of Canadian firms that connect to the Internet do so via high speed connections. At this juncture, three needs must be addressed: 1) it is necessary to ensure that broadband is rapidly deployed to the remaining unserved communities; 2) it is necessary to ensure that present and future broadband services remain accessible, affordable, interoperable, and reliable; 3) it is necessary to develop a post-connectivity approach to ICT access, adoption, and value creation among SMEs. This paper develops a proposed research agenda regarding value creation with broadband and associated Internet technologies and e-business solutions among Ontario SMEs. The paper first describes the Ontario SME community and identifies its characteristic features. It then discusses current patterns of adoption and use of these ICTs among SMEs and briefly examines current thinking about the ways that broadband and associated ICTs can be used for business value creation. The paper also examines challenges and obstacles faced by SMEs in the adoption and exploitation of ICTs, and reviews policies and policy instruments from Canada and elsewhere that are designed to assist SMEs in their uptake and exploitation of ICTs. The final part of the paper proposes a research agenda on broadband and ICTs for the expansion of Ontario SMEs.

1. Introduction

The economic and social importance of SMEs (Small and Medium-sized Enterprises) cannot be overstated. SMEs constitute the vast majority of firms – about 99.8% of firms in Ontario, as well as in Canada and in many other countries (CFIB, 2006; MSBE, 2006; Storey, 1994). In Ontario, more than 340,000 “employer SMEs” (firms with one or more employees) provide more than half of all employment for Ontarians. If unregistered firms and self-employed individuals are included, SMEs in Ontario number well over a million.

The convergence of the previously distinct domains of computing, telecommunications, and broadcasting is creating revolutionary change in the information, communication, and media industries.¹ Information and communication processes are now centrally important in the production of goods and services. A growing range of industries produces content in digital form (for example: books, news, business and scientific periodicals, software, audio and video industries, business and financial services, and social, cultural, and public services). In a knowledge- and information-intensive society, high-speed communication networks are essential infrastructure. According to the OECD, “broadband is becoming the dominant telecommunication medium” (OECD, 2007). Network access, affordability, speed, quality, security, and reliability are of paramount importance.

In this report, the term “broadband” refers to high speed, two-way connection to the Internet, a publicly accessible network of networks. In Canada today, a speed of 1.5 Mbps is considered a high speed connection, although much higher speeds - 10 Gbps or more - are available commercially. Of course, the minimum speed that qualifies as “high speed” will increase with time. Typically, faster network and computing technologies are available to universities, governments, and technology companies before they become widely available commercially, and it is also typical that the cost of computing power and bandwidth decline over time.

¹ OECD (2005a, 2006) provides useful overviews of the telecommunications and information technology industries.

Speed conventionally refers to download speed. In the two most prevalent broadband technologies in use today, DSL and cable modems, upload speed is considerably slower than download speed. This could become an issue with the spread of internetworked, data-intensive business applications. Other available broadband technologies include satellite, fixed wireless, and broadband delivered over power lines. Examples of the many data- and computation-intensive applications enabled by broadband include video on demand, video streaming, mobile computing and location-based services, simulation and gaming, Internet telephony (VoIP), peer-to-peer applications, and a growing range of hosted applications on remote servers.

For SMEs, broadband enables ubiquitous networked interactivity: affordable, always-on, media-rich, interactive data and voice communication with customers, suppliers, business partners, employees, and stakeholders (Austin and Bradley, 2005). This high degree of connectivity and interactivity opens the door to development of new value propositions and new business models, as well as improvements in productivity, flexibility, and profitability.

Over the past decade, much of the policy debate about the deployment of broadband has focused on connectivity issues. Broadband access has been a sensitive issue because economic forces caused broadband to become available in Canada's more densely populated urban areas long before being offered in less densely populated towns and rural and isolated areas. In 2001, the report of the National Broadband Task Force recommended that broadband services be made available to all Canadian communities by 2004. In Canada's 2002 innovation strategy statement *Achieving Excellence*, the Federal government committed to ensuring that broadband would be available in most Canadian communities by 2005. In 2003, around 75% of Canadian communities were not served by broadband (Canada Gazette, 12 Feb. 2003). In 2007, access to broadband remains uneven in Canada, but reliable statistics are not readily available.² Judging from the maps on Industry Canada's broadband site (<http://broadband.gc.ca/maps/index.html>) around 40% of named Canadian communities are presently served by broadband. But more than 85% of Canadian firms currently use high-speed connections to access the Internet (Statistics Canada, Table 358-0016).

² The definition of "community" needs to be standardized before entirely accurate estimates of broadband availability can be produced.

With broadband now available to most Canadian households and firms – but not most Canadian communities – three sets of policy issues are surfacing. One set of issues has to do with regulation and regulatory processes to ensure continued access, fair competition, service quality, and ongoing innovation and improvement across the range of telecommunications services, as described in the recent final report of the Telecommunications Policy Review Panel (2006). These are important issues because the current arrangements that make broadband available are not necessarily those that will prevail in the future. Wireless broadband, for example, enables mobile applications of video and other data-intensive applications that are presently not widely available in Canada. Although Canada has been a front runner in deployment of broadband via DSL and cable, it is not a front runner in the deployment of wireless broadband. Also, the emerging issues of net neutrality and interoperability raise important questions of access to fixed and wireless broadband networks.

The second set of issues has to do with the deployment of broadband services to remaining unserved and isolated communities in Canada. Broadband has become an essential service. Communities without affordable access to broadband face serious disadvantages in education, delivery of public and private not-for-profit services, and business. As an essential service, broadband must be made universally available across the national territory, and therefore broadband access remains a critically important issue for unserved rural, remote, and isolated communities. In countries such as South Korea where broadband penetration is very high, a compact national territory and a highly urbanized population have facilitated the work of governments to promote broadband deployment. The situation is different in Canada, with its vast national territory. Canadian governments have had to face challenges when addressing the issue of what interventions are necessary to complete the deployment of broadband infrastructure to unserved, rural, or isolated communities. Typical alternatives include 1) decrease the cost of deploying broadband infrastructure by facilitating access to rights-of-way or lowering the cost of borrowing; 2) stimulate the emergence of community-level broadband service providers; and 3) reduce the costs of data transmission through the creation of rural broadband utilities, through expansion of government-owned broadband networks, or through incentives to aggregate demand for local broadband services (Zilber, 2003). Recent economic

analysis suggests that emerging distribution technologies such as fixed wireless broadband and satellite broadband are changing the market situation such that private service providers may viably supply affordable broadband services over most of the national territory by the end of the decade (Secor, 2005), although policy intervention could accelerate this process.

The third set of issues may be called “post-connectivity” policy issues that go beyond ensuring broadband availability. These have to do with the uptake and use of ICTs (information and communication technologies) by business, government, and consumers/citizens. ICTs increasingly make use of high speed connectivity for production, distribution, and consumption of goods and services. Business, government, and individuals (as consumers, citizens, and not-for-profit social actors) are the three principal groups of users of broadband connectivity. Limited availability of high speed connections is no longer the principal bottleneck to the deployment of internetworked products and services among most Canadian users. Now, users’ limited ability or willingness to adopt and exploit ICT applications and services is being flagged as the bottleneck.

The present paper does not address the issue of how to complete the deployment of broadband to remaining Ontario communities. This important policy issue is being discussed and dealt with elsewhere. Furthermore, the paper touches only briefly on the regulatory issues surrounding telecommunications services, including interoperability, the deployment of wireless broadband, and the issue of net neutrality. These issues fall under Federal jurisdiction and so cannot be dealt with directly by Ontario. The paper focuses instead on a key post-connectivity broadband issue: the adoption and use of ICTs by Small and Mid-sized Enterprises (SMEs) in Ontario. SMEs’ adoption and use of ICTs are problematic for three reasons.

In the first place, low levels of ICT investment and skills deficits among Canadian SMEs (compared to American SMEs) are believed to be a root cause of productivity gaps, pointing to possible problems of competitiveness and limited growth potential (Sharpe, 2006). In the second place, the market among Canadian SMEs for broadband access services is practically saturated. Broadband access providers are therefore seeking ways to become value-added

service providers to SMEs. Most SMEs already subscribe to broadband in preference over dialup services, and surveys indicate that SMEs without broadband access would subscribe if it were available. Greater uptake of ICTs among SMEs will drive demand for value-added (sometimes called managed) services.³ In addition to introduction of value-added services, some broadband access providers are quietly exploring ways to monetize IP traffic over their networks. One option under consideration is to establish tiered service levels by charging tolls on data traffic. In the third place, Canada's strong concern with issues of fixed broadband supply and demand may have deflected attention from equally important issues of access to other telecommunications services. For example, in cellular and mobile telephony, a few years ago Canada was in third-to-last place among OECD countries. An emerging issue is whether forthcoming wireless broadband services will be generally affordable and will permit interoperability of interface devices, as fixed broadband does. Public policy needs to ensure reliable, affordable, interoperable access to the entire range of telecommunications services (voice, data, mobile, and wireless).

This paper proposes a research agenda regarding value creation with broadband and associated Internet technologies and e-business solutions among Ontario SMEs. The paper first describes the Ontario SME community and identifies its characteristics and unique features. It then discusses current patterns of adoption and use of ICTs among SMEs and briefly examines current thinking about the ways that broadband and associated ICTs support business value creation. It also examines challenges and obstacles faced by SMEs in the adoption and exploitation of ICTs, and reviews policies and policy instruments from Canada and elsewhere that are designed to assist SMEs in their uptake and exploitation of ICTs. The final part of the paper summarizes gaps in knowledge and proposes a research agenda about broadband and ICTs for the expansion of Ontario SMEs.

³ Examples of such services include web hosting, applications hosting, voice over IP (VoIP), IP virtual private networks (VPNs), security services, data storage and backup, desktop management, web conferencing, and surveillance services.

2. The Dimensions of the Ontario SME sector

Within every population of Small and Mid-size Enterprises a vast amount of diversity exists (a fact that has significance in understanding processes of adoption and use of ICTs in the SME sector). Given this diversity, it is not surprising that definitions of SMEs vary from from country to country and from industry to industry. This creates confusion when collecting, analyzing, and comparing data from several sources. International statistical agencies are presently working to harmonize definitions of SMEs, and the European Commission (EC) has recently published a standardized definition of SME intended to regularize access to EC support services (EC, 2005; OECD, 2005b).

The simplest definition of SMEs refers to number of employees. A widely used definition of SME is any firm with fewer than 500 employees, including zero employees. This is the definition employed by Statistics Canada's Small Business and Special Surveys Division. Sometimes various size thresholds are used for firms in specific industries. For example, in the service and cultural sectors, the median size of firms is generally smaller than in other sectors. Three hundred employees may be taken as an upper limit for SMEs in the cultural sector (Nordicity, 2004).

It is also important to distinguish among size classes of SMEs. Typically, distinctions are made among microenterprises, small firms, and mid-sized firms. In Canada and the U.S., microenterprises are defined as firms with fewer than five employees (in Europe, the threshold is ten employees). Sometimes microenterprises are called SOHOs – small offices/home offices. “Small firms” are defined as firms with fewer than 100 employees. Some research on SMEs (CFIB, 2006; Davis and Vladica, 2007) distinguishes “very small” firms (5-19 employees) from small firms.

Most of the key dimensions of Ontario’s SME community are well known and are described in the Ministry of Small Business and Entrepreneurship’s *Pocket Guide to Small Business in Ontario, Canada* (MSBE, 2006) and in the Canadian Federation of Independent Business’ *Ontario Small Business Profile* (CFIB, 2006). It is useful to quickly summarize these

dimensions and highlight distinctive features of the Ontario SME community that are germane to the uptake and exploitation of ICTs by SMEs in the province.

- Of the 872,725 business establishments in Ontario, 99.8% are SMEs. Of these, three percent are mid-sized firms, 4% are small firms, 12% are very small firms, and 81% are microenterprises (CFIB, 2006). Around one million self-employed business owners are active in Ontario (MSBE, 2006).
- Over five million Ontarians are employed by firms. Most employees work for large firms (47%) and mid-sized firms (24%) (CFIB, 2006).
- Self-employment is growing much faster than paid employment in Ontario (CFIB, 2006). Entrepreneurship is more highly valued as a career path by Ontarians than professions, employment in the public sector, or employment with a large company (CFIB, 2006).
- Two-thirds of Ontario business owners have more than 10 years of experience (MSBE, 2006).
- Ontario firms generate nearly half of Canadian exports. Fifty-nine percent of Ontario's exports are generated by SMEs (CFIB, 2006). SMEs account for 93% of Ontario's exporters (MSBE, 2006). Ontario has 14,400 exporters with fewer than 50 employees (MSBE, 2006).
- Thirty-nine percent of all head offices in Canada are located in Ontario (MSBE, 2006).
- Education is a predictor of propensity to use ICTs in firms, and Ontario workers are highly educated. Nearly 60% of Ontario adults have post-secondary degrees, the highest rate among G-7 countries of post-secondary education of the labour force (MSBE, 2006). Ontario has 48 colleges and universities.
- More than half of Canadian industrial R&D takes place in Ontario (MSBE, 2006). Ontario SMEs that undertake R&D invest a higher proportion of their revenues in research than larger R&D performers. Small R&D performers (50-99 employees) invest over 10% of their revenues in R&D. The average for all enterprises is 2% (CFIB, 2006).
- Ontario is the principal centre of information technology innovation in Canada. Over 40% of venture capital investments in Canada go to Ontario firms. Of the \$759M in venture investments in Ontario in 2005, nearly three-quarters went to information

technology firms (MSBE, 2006). ICT firms are clustered in Kitchener-Waterloo, GTA, Kingston, and Ottawa.

- Nearly half of Canada's population growth of 1.6m people between 2001 and 2006 took place in Ontario. Of the 750,000 new residents of Ontario, about 600,000 were immigrants. More than half of all immigrants to Canada settle in Ontario. The largest immigrant populations in Ontario are European (44.1%) and Asian (35%). Most recent immigrants come from China, India, the Philippines, and Pakistan. Over one hundred languages are spoken in Ontario (MSBE, 2006; Statistics Canada, 2007).

The sectoral distribution of Ontario's SMEs is shown in Table 1. The fastest growing sectors are business services, F.I.R.E (finance, insurance, real estate, rental and leasing), construction, health care and social assistance, and retail and wholesale trade (MSBE, 2006). It is to be noted that the fastest growing sectors include industries that rely extensively on networked interactivity for the organization and delivery of products and services (for example, finance), as well as industries with very low intensity of investment in ICTs (for example, construction).

The geographical distribution of Ontario's SMEs is an important consideration from an ICT adoption standpoint. Firms are distributed more or less along the lines of the province's population – that is, most firms are in the urbanized Southern part of the province, where access to communications and transportation infrastructure, business services, human resources, capital, and markets is greater than in the North or in the rural or small town South. Firms in communities which are remote, isolated, or unserved by broadband face much more complex challenges of ICT access, adoption, and value creation than firms that are closer to the principal population centers.

To summarize this section: Ontario benefits from its central location, its transportation system, and its relative cost advantages (MSBE, 2006). Moreover, Ontario has developed several distinctive features that confer business advantages – a highly educated, multicultural, entrepreneurial population; a diversified, export-oriented economy; a fast-growing service sector; considerable R&D capabilities; a broad and deep higher education infrastructure; and a

vigorous ICT supplier sector, along with a risk investment community that is experienced in ICT ventures. However, an estimated 10% of Ontario's population remains unserved by broadband.

3. Internet technologies and e-business solutions: current patterns and rates of adoption and use among Canadian SMEs

The subject of how SMEs adopt ICTs and create value from them is, of course, not recent. Sizeable scholarly, policy, and management literatures have been published on this subject.⁴ Although good longitudinal data on ICT use among SMEs in Canada are available thanks to Statistics Canada's annual Survey of Electronic Commerce and Technologies (SECT), very little current or systematic information is available specifically about ICT adoption and use among Ontario SMEs. Unfortunately, SECT data cannot be disaggregated geographically, not even to the provincial level. This is why the discussion that follows usually refers to SMEs in Canada, not SMEs in Ontario. To streamline the discussion, nine salient features of ICT adoption and value creation among SMEs in Canada are summarized in Table 2.

Canada has a relatively high broadband penetration rate, compared to other OECD countries (OECD, 2006). In late 2005 Canada had about 22 broadband subscribers per hundred inhabitants. This puts Canada in eighth place among OECD countries, following Luxemburg, Iceland, Korea, Netherlands, Denmark, Switzerland, and Norway (OECD, 2006). The OECD average is about thirteen broadband subscribers per hundred inhabitants. The relatively high penetration rate of broadband provides potential benefits in terms of delivery of digital products and services to households and businesses. In Canada, broadband access services are provided by cable companies to a much higher degree than in most other countries.

Wireless broadband is a different story. Although improving in recent years, uptake of cellular telephones has lagged significantly in Canada. In 2003, Canada had about 42 mobile subscribers per 100 inhabitants, an adoption rate comparable to that of Poland, Turkey, and Mexico. The OECD average is about 85. The leading countries (Luxemburg, Sweden, Italy,

⁴ For reviews of literature on ICT adoption and use by SMEs, see Al-Qirim, 2004; Davis and Vladica, 2007; Davis, Lin, and Vladica, 2006; Lefebvre and Lefebvre, 1996; Trites and Pugsley, 2003, and Van der Veen, 2004.

and Iceland) have close to 100% penetration rate of cellular mobile phones (OECD, 2005a). Currently, the adoption rate of cell phones in Canada is about 60 per hundred inhabitants (higher in urban areas). Pricing of services is comparable to the U.S. for low-volume (voice) users, but high-volume (data) use is relatively expensive in Canada. This impedes the introduction to the Canadian market of hand-held web-enabled appliances such as the iPhone and represents a bottleneck to the development and diffusion of mobile and location-based services in Canada.

Most Canadian SMEs are connected to the Internet and most SME Internet connections are high speed. According to Statistics Canada's annual Survey of Electronic Commerce and Technology, in 2006 nearly 83% of Canadian firms used the Internet. Furthermore, when broadband is available, most businesses subscribe to it in preference to slower dial-up services. In 2006, 85% of Canadian firms that connected to the Internet used high speed connections (Statistics Canada, Table 358-0016; cf. Illuminas, 2006). In some sectors such as information and cultural industries or professional services, practically all firms use a high speed connection (see Figure 1). In Ontario in 2005, 74% of urban businesses used broadband access to the Internet, while 54% of rural businesses used broadband (MEDT, 2006). Half of Ontario firms that do not use broadband cite lack of availability as the reason (MEDT, 2006).

SMEs would seem to be particularly suited to reap benefits from Internet technologies and e-business solutions. It was once widely hoped that ICTs would provide major advantages to SMEs by "leveling the playing field" and allowing these firms to compete against much larger firms. However, many studies have demonstrated that larger firms adopt improved ICTs more rapidly than smaller firms (Burke, 2005; CEBI, 2004; Charles, Ivis and Leduc, 2002; Davis and Vladica, 2007). Slower rate of adoption is partly due to differences in firm-level business resources and capabilities between larger and smaller firms, and also partly due to differences in ICT needs between larger and smaller firms. For example, smaller firms do not require extensive software-based cross-functional business process integration. Nevertheless, some small firms are distinguished by their adoption of business models that are entirely

predicated on online commerce. These tend to be export-oriented microenterprises and very small firms (i.e. firms with fewer than 20 employees) (Davis and Vladica, 2007).

Adoption rates of the simplest Internet technologies and e-business solutions are very high among Canadian firms of all sizes. The least complex technologies and applications such as personal computers and e-mail have become nearly ubiquitous among Canadian SMEs. For example, in 2005, over 89% of Canadian firms used personal computers, 76% used e-mail, and 59% used wireless communication (Statistics Canada, Table 358-007). Network security solutions are also in widespread use. Although complex integrated enterprise-wide ICT applications are not as widely used, Canadian SMEs are adopting enterprise software for specific functional areas in the firm, especially finance and accounting, inventory management, customer relationship management, and human resource management (Illuminas, 2006). Use of structured IT-enabled linkages between trading partners is less common. Between 10% and 13% of firms use Electronic Data Interchange (EDI) for exchanging messages in a supply chain. Nineteen percent of firms use intranets and 7% use extranets (Statistics Canada, Table 358-007). Fewer than 20% of SMEs use hosted applications (Davis, Lin, and Vladica, 2006), and fewer than 40% of firms have a website (Statistics Canada 358-008).

Online transactions have grown steadily in Canada over the past five years. In 2006 private firms in Canada conducted about \$46B in sales, the bulk of which was business-to-business (B2B) commerce. Around 44% of Canadian firms presently purchase over the Internet, and around 8% of Canadian firms sell online (Statistics Canada, series 358-010 and 358-011).

4. Creating value with ICTs

Canada lags the US in intensity of investment in ICTs, and this lag may be attributed in part to the relatively greater preponderance of SMEs in the Canadian economy (Sharpe, 2006). This investment lag is of concern because technological change is the principal driver of long-term economic growth. The core technologies of contemporary knowledge-based economies are information and communication technologies. ICTs and previous core technologies such as

steam, internal combustion engines, or electricity, are regarded as “general purpose technologies” (GPTs), widely applicable technologies that represent a discontinuous or radical innovation relative to the technologies that they replace.⁵ General Purpose Technologies have three generic features that amplify their economic impacts:

1. GPTs are general because they affect a wide range of industries. They are produced by one specialized industry or group of industries, and they are adopted by a wide range of user industries, which capture the embodied technological progress in the form of improved machinery, equipment, or software. ICT user industries have benefited from exponential improvements in microelectronics and computing performance over the past four decades. Improvements in network bandwidth and software are less dramatic but nevertheless substantial. But patterns of adoption and exploitation of ICTs vary enormously from industry to industry. In Canada in 2005, the information and cultural industries had invested over \$91,000 per worker in total ICT capital stock, compared to \$271 in accommodation and food services and \$680 in construction (Sharpe, 2006). Policies to promote deepening of ICT investments need to take into account the wide sectoral differences in ICT capabilities as well as the differences in ICT-based value creation potential in different industries. For example, the information and cultural industries produce digital products and distribute them through digital channels, making these industries highly suitable for extensive ICT-enablement. Industries that do not distribute digital products over digital channels, such as the accommodation and food service industries, have different potentials for ICT-enabled value creation because of the nature of their products and services. These firms will find many opportunities to use highly interactive mobile applications with customers, employees, and suppliers.
2. The adoption and exploitation of ICTs require complementary innovation (customization and co-invention) on the part of users. Complementary innovation takes the form of modifications, new configurations, add-ons, firm-specific tweaks, organizational innovation, and development of complementary skillsets, for example.

⁵ Innovation is radical if it replaces a prior technology, rather than incrementally extends an existing technology.

The greater the degree of co-invention required by the adopter, the greater the costs of ICT implementation. Many studies of information system implementations in firms have suggested that failure or partial failure to realize anticipated benefits is attributable to inadequate investment in tangible and intangible complementary factors such as new production systems, business process redesign, and training.

Brynjolfsson and Hitt (2000) estimate that the cost ratio is approximately 1:10 between ICT hardware and software and the tangible and intangible complementary factors that allow the firm to produce expected value from ICT investments. That is, for every dollar invested in ICT equipment and software, ten must be invested in training, process design, and organizational development. Usability of business computer systems has improved considerably in the past decade. This reduces the costs of adoption of ICTs by businesses but also reduces the competitive advantages that may be expected as plug-and-play ICTs become part of the conventional business infrastructure. Development of competitive advantage through use of ICTs still requires thought and effort on the part of adopter firms.

3. Improvements through embodied technological progress and pervasive customization and co-invention accumulate to generate significant aggregate productivity improvements in the economy. However, these aggregate productivity improvements lag the initial introduction of the technology by years or decades because of the time that users take to learn to use the technology effectively and efficiently.

Compared to previous GPTs, ICTs appear more complex in their economic effects at the firm level and at the broader macroeconomic level. It has proven especially challenging to accurately conceptualize and measure the macroeconomic effects of ICTs on productivity. While economists generally agree that ICTs are a key driver of productivity gains, they don't agree what to include among the inputs, outputs, and broader outcomes when measuring ICTs' contributions to productivity gains. Even when the firm-level effects of ICT adoption and exploitation on performance and productivity are accurately measured, it is not

straightforward to move the analysis from the micro level to the macro level (Carlaw and Lipsey, 2002; Tuomi, 2004).⁶

Substantial evidence is available concerning ICT-based productivity gains at the firm level and at macroeconomic levels in Canada (for details see Martin and Milway, 2007, and Sharpe, 2006). At the same time, it must be emphasized that firm-level performance outcomes of ICT enablement go beyond narrowly defined productivity or efficiency gains. Profitability improvement, quality improvement, brand improvement, improved customer service, greater agility, and better product or service offerings due to more accurate business intelligence are other possible performance outcomes that can be enabled by ICTs (Bresnahan and Greenstein, 2001; Hitt and Brynjolfsson, 1996; Tuomi, 2004). Top-line performance improvements may appear before improvements in production efficiency occur. The latter may take time to appear, especially at the macroeconomic level (Sharpe, 2006).

Firms can use ICTs to create value in many different ways, from increasing operational efficiency to improving service quality, and from providing a basis for new products or services to engaging new customers or entering new markets. Three examples of useful frameworks with which to conceptualize value creation with ICTs are discussed here. Many other frameworks have been proposed, often focusing on internal business process redesign or IT alignment with corporate strategy. The diversity of thinking about how ICTs can support value creation should be taken as a reflection of the remarkable adaptability of these technologies to diverse business situations in support of all business functions. The diversity of thinking also reflects the fact that there are many ways to exploit these technologies beyond the most apparent cookie-cutter solutions.

Figure 2 shows the three dimensions of business that can be transformed by ICTs to create electronic commerce, defined as online transactions (i.e. payment for a good or service) (Choi, Stahl, and Whinston, 1997). The three dimensions are the product, the transaction process, and the agent, each of which can be physical or virtual. An example of commerce when all three dimensions are physical is a bricks-and-mortar store that sells physical

⁶ For a review of the literature on ICTs and productivity see Draca, Sadun, and Van Reenen (2007).

products to walk-in customers. An example of purely digital commerce is an online venue that automatically delivers an electronic product to a distant customer, as for example when software updates are delivered to registered customers automatically. When a firm modifies a dimension of an existing business model from physical to digital, it threatens other business models with disruption. For example, in the book industry, online delivery of books threatens brick-and-mortar retail channels. Books and periodicals in digital format undermine the business models of printers, publishers, and distributors. Search technologies, recommending systems that use artificial intelligence, online social networks, and online auctions guide customers' purchasing decisions in a growing range of domains, undermining conventional marketing, advertising, selling, and customer retention strategies. The Choi-Stahl-Whinston model of e-commerce provides a useful way of thinking about the ways in which physical and digital processes and products can be combined in particular industries.

Most industries do not have digital products that lend themselves to online distribution, and many kinds of physical products do not lend themselves to online purchasing. For example, very high value products such as real estate require physical inspection before a purchasing decision can be made. It is impossible for restaurants to deliver meals online. Furthermore, many services require physical performance and so cannot be delivered online. Nevertheless, analysis of the ways in which a firm interacts with its customers provides a fruitful way of thinking about how applications of Internet technologies and e-business solutions can create value for customers. Figure 3 depicts a customer transaction cycle (Bloch, Pigneur, and Segev, 1996). At the beginning of the cycle, potential buyers identify needs. If sellers can learn about these needs or help to shape them, they have the beginnings of a business opportunity. Market intelligence and transaction data are increasingly available to potential sellers, who however require a certain level of analytical capability to exploit this resource. In the next step of the cycle, buyers look for suppliers and suppliers look for buyers. Business practices in this step of the cycle are evolving very quickly. In the business-to-consumer sphere, search technologies, social network applications, and location-based mobile communications permit delivery of commercial messages with much greater accuracy than previously. In the business-to-business sphere, online sourcing has become highly structured in many industries through extranets and industry portals.

The third step of the customer transaction cycle, arrangement of terms, is the least e-enabled except in segments of industries in which purchasing decisions are determined largely by price differences among highly comparable products. Online auctions and electronic markets are examples of venues in which negotiation can be automated or semi-automated. SMEs in Canada and elsewhere often do not welcome e-markets that favour pure price competition, because of concern about commodification of products (Rosson and Davis, 2004). However, the spread of e-markets increases this threat.

The fourth step of the customer transaction cycle, purchasing and order fulfillment, can be very straightforward. For a variety of reasons many smaller firms are unwilling to conduct electronic transactions, although the costs, complexity, and risks of so doing are very manageable. Transaction processing and order fulfillment services are not difficult to arrange through specialized service providers.

In the fifth step in the transaction cycle, the customer uses the product and the supplier provides support and service. It is at this step that the customer's experience with the product and with the quality of interaction and post-sale services determine whether the customer returns to begin the transaction cycle anew, or instead seeks another supplier. Businesses know that it is usually much less costly (and usually more profitable) to retain a current customer than to recruit a new one. ICT-enabled customer relationship management capabilities, coupled with business processes that support a customer orientation, can provide the operational and analytical basis for optimal customer service quality. A further compelling reason to interact intelligently with customers is that customers are the most effective source of new product and service ideas (von Hippel, 2005). Customers and users are increasingly invited to participate in product design and content generation.

Several studies of business impacts of ICT use among Canadian SMEs provide strong evidence that adoption of e-business solutions with online transaction capabilities underpins top- and bottom-line improvement in business performance (CEBI, 2004; Davis, Lin, and Vladica, 2006; Martin and Milway, 2007). A study of impacts of ICT adoption among SMEs

in 2005 shows that the strongest impacts were qualitative as well as quantitative (Davis, Lin, and Vladica, 2006). Qualitative improvements in business performance include brand improvement, improved positioning vis-à-vis competitors, improvement of relationships with customers, improvement in coordination with suppliers, and responsiveness to changing customer requirements (see Figure 4). Quantitative improvements include an increase in the clock speed of the firm, increase in productivity, and improvement in profitability. The least important impacts had to do with improvements in production efficiency and international market development. Regarding the latter, it is to be noted that e-business capability is not in itself an enabler of export capability.

Figure 5 portrays an influential model of value creation with e-business (Amit and Zott, 2001). The model has four components, each with several elements:

- Efficiency, including reduction of information search and selection costs.
- Novelty, including new business processes, new customers, and new content.
- Complementarities, including value-creating complementarities between products and services, and between online and offline business activities.
- Lock-in through network externalities and switching costs.

Of the four components of e-business value creation, lock-in is the least accessible to SMEs because of their relatively small share of any market or network in which they participate. ICT users are, of course, increasingly cognizant of lock-in strategies, as the growing use of open source software attests.

SMEs face numerous obstacles to the adoption and successful exploitation of the more powerful ICT applications. The first obstacle is size. ICTs are not straightforwardly scale neutral. Ability to adopt and exploit ICTs for business purposes is sensitive to the size of the firm.

[S]maller sized firms are less likely to report Internet use, website use, and non-Internet-related computer use than even incrementally larger businesses. Additionally,

[...] size accounts for significantly more predictive power in [small business information system] adoption than CEO or industry factors (Burke, 2005).

By definition, smaller firms have limited internal resources and capabilities with respect to production, finance, management, marketing, and information technology. Their relatively weaker abilities to adopt and learn to effectively exploit Internet technologies and e-business solutions put them at a certain disadvantage when it comes to lowering operating costs, improving productivity and the quality of products and services, and responding to requirements of customers and other business partners (Raymond, Bergeron and Blili, 2005).

Furthermore, many of the smallest firms do not necessarily want to grow. Among the smallest firms, absence of a growth orientation represents a significant deterrent to performance improvement. As we saw earlier, about 81% of Ontario SMEs are microenterprises. Among the microenterprises described by Industry Canada (2001) and Papadaki and Chami (2002), only about one-third are “growth-oriented,” and two-thirds have no expansion plans. Only one percent of microenterprises grow to the next size category of SMEs in ten years (Industry Canada, 2001). Many microenterprises do not seek to grow because they are lifestyle firms, unregistered owner-operator firms, family firms, firms without resources that are established in distressed environments as vehicles to escape from poverty, or firms operated on a part-time basis to generate supplementary income. Growth-oriented microenterprise ventures are identifiable by enterprising behaviour, entrepreneurial intent (explicit growth objectives), and by certain characteristics of the entrepreneurs and their business plans (Friar and Meyer, 2003). Characteristics of Canadian microenterprises or their owners that are related to growth include: educational level of the entrepreneur, entrepreneurial intensity of the firm, informal networking with customers and suppliers, business partnering activities, extent of product innovation, adoption of e-business technologies, managerial delegation, focus on the local market, and age (Papadaki and Chami, 2002; Perren, 1999). Growth in very small firms is positively influenced by the competencies and orientation of the owner-manager, the owner’s perception of opportunity and value, and the implications of risk aversion for small firm engagement in e-business (De Berranger, Tucker, and Jones (2001); Fillis, Johansson, and Wagner (2004)). Low competencies of managers are also a barrier to ICT adoption among larger SMEs (Martin and Milway, 2007).

Statistics Canada's Survey of Electronic Commerce and Technology asks firms to evaluate the importance of ten barriers to electronic commerce. Analyzing SECT data, Noce and Peters (n.d.) find that, between 2000 and 2003, the most important barriers were "goods and services do not lend themselves to Internet transactions" (indicated by 44% of firms in 2003) and "prefer to maintain current business model" (36% of firms in 2003) (see Table 3). Fewer than 20% of firms cited costs, security concerns, uncertainty about benefits of e-commerce, lack of skilled workers, concerns about transparency to competitors, speed of Internet connection, or low readiness of customers or suppliers as barriers to adoption of electronic commerce. These findings seem to point in different directions than those reported in CEBI (2004), which indicate that cost, lack of time, and lack of skilled staff are barriers to adoption of ICTs by SMEs.

A recent survey of 300 Canadian SMEs by IDC Canada found a cautious attitude toward investing in ICTs. Firms report that they are aware of the benefits of ICTs and hold positive views about the value of investing in ICTs, but many say that absence of visible quantifiable benefits is a barrier to adoption. Non-ICT investments, especially in labour training, are currently priorities (IDC, 2006). Business growth and internal business needs are the top drivers of investment in ICTs. In other words, Canadian SMEs prefer to invest in ICTs in order to solve specific business problems or when the firms can reasonably anticipate growth.

6. Policies and programs to promote SME adoption and use of ICTs

The basic policy questions, with respect to SMEs and ICTs, are: what are the objectives for promoting accelerated adoption of technology, what is the rationale for selecting these objectives, and which public policy measures and instruments will best ensure that the objectives are attained? In the debate in Canada about public policy for ICT adoption by SMEs, the players and their positions are as follows:

- Macroeconomist advisors to public policy makers report that lagging productivity in Canada is partially due to relatively lower investment rates in ICTs in Canada, which

in turn is due in part to lower intensity of ICT adoption and use by Canadian SMEs. The Telecommunications Policy Review Panel, in its final report (2006), cited declining Canadian productivity and investment lags in ICT in firms, and advocated making “smart ICT adoption a national priority.”

- The domestic IT supplier industry would like to see measures introduced to strengthen domestic demand for ICT products and services. This interest is shared by the broadband access supplier industry, which sees increased adoption of ICTs as a way to improve demand for value added services.
- Canadian SMEs express interest and confidence in ICTs but would rather not proceed to purchasing until the business case for investment is clearly visible.
- Consumer advocacy groups contribute concerns about access, cost, competition, interoperability, and privacy to telecommunications policy fora.
- Federal and Provincial public policy makers in various ministries are charting policy with respect to telecommunications, the ICT supplier industry, e-business, industrial development, and economic development. For example, the interests of Ontario with respect to telecommunications policy and the Ontario business sector are 1) to improve productivity and business competitiveness “through the adoption of innovative and cost-effective technologies and services across the entire telecommunications spectrum (e.g. voice, data, broadband, mobile, wireless);” 2) to “ensure that the information and communications technology (ICT) industry in Ontario continues to thrive and remain globally competitive;” and 3) to ensure “the provision of innovative, low-cost and reliable telecommunications services [as] a key element in attracting and retaining investment in the province” (MEDT, 2006).

In its final report, the Telecommunications Policy Review Panel put forward recommendations for vigorous action to promote ICT adoption by business, government, and communities under the auspices of a national ICT adoption strategy to be led by the Prime Minister (Telecommunications Policy Review Panel, 2006: chapter 7). In particular, the Telecommunications Policy Review Panel recommended a policy agenda to promote ICT adoption by SMEs that encompasses active leadership, benchmarking, policy research, advocacy, policy advice, tax incentives, awareness measures, public investments in ICT

R&D, improvements in the legal and security infrastructure, and literacy. The recommendations of the Telecommunications Policy Review Panel that are germane to encouragement of ICT adoption among SMEs are summarized in Table 4.⁷

Many factors impinge on SMEs' decisions to adopt and implement ICTs. Some of these factors are more sensitive to public policy intervention than others. For example, Canadian SMEs report through responses to surveys that internal business needs, growth, and customer requirements are the principal motivators of investment in ICTs. These factors are more sensitive to the general business environment than to specific policy interventions that seek to improve access to highly qualified human resources or access to broadband services, for example. On the other hand, access to highly qualified human resources and access to broadband services are not major issues within the larger Canadian SME community at present because numerous public and private actors did not allow these factors to become bottlenecks in Canada, as they have become in other countries. In the 1990s Canada was recognized as an e-business leader, and many of the infrastructure initiatives and programs that we benefit from now were put in place then. But ICTs have faded from the public policy agenda in Canada. At present, according to the World Economic Forum, Canada ranks 42th of 104 countries in making ICTs a national priority (as cited in Telecommunications Review Panel, 2006: 7-17).

A comprehensive ICT policy framework for SMEs is complex to develop and implement for several reasons. In the first place, telecommunications infrastructure is shared among a range of users (business, government, consumers, and the not for profit civil sector) who have differing needs and expectations. Regulators and policymakers must take these different needs and expectations into account. Second, the SME sector is very heterogeneous. Firms' ICT needs and capabilities differ considerably by firm size, industrial sector, and geographic location. A one-size-fits-all ICT adoption policy would be too general to be particularly effective. Third, the policy instruments that can be used to influence firms' ICT adoption

⁷ Except for recognition that lagging Canadian productivity is related to an ICT investment shortfall in Canada, the new national science and technology strategy that was released in May 2007 by the Government of Canada says little about ICT adoption among SMEs (Government of Canada, 2007).

decisions are distributed across a variety of jurisdictions, from national to municipal, and across a variety of functional agencies (for example S&T, industry, economic development, regional development, finance, education, international trade, small business and entrepreneurship, and human resources). This makes synchronization of policy initiatives a constant challenge.

It is helpful to examine the full range of policy instruments that apply to ICT adoption by SMEs. Table 5 presents a taxonomy of such policy instruments, and provides examples of use of each kind of instrument in various jurisdictions. The most useful high-level overviews of ICT policies are published by the OECD on the basis of information provided by member countries (i.e. OECD 2007; 2006; 2005a). Detailed investigations of the use and impacts of particular ICT policy instruments are scarce. The most useful example is Warda's research on ICT investment tax incentives (Warda, 2005).

7. A proposed research agenda on Ontario SMEs, broadband, and ICTs

In this section, eight research themes on Ontario SMEs, broadband, and ICTs are proposed.

1) Information is lacking regarding the extent and variety of adoption and use of ICTs among Ontario SMEs. Ideally, either a survey would be undertaken at regular intervals, or Statistics Canada's SECT would be modified to allow geographical analysis. Information should be collected on firm size, sector, and location within the province; distribution of sales by geographic area; ICTs in use; investments in ICT equipment, software, connectivity, training, and externally supplied support services; perceived obstacles to adoption; perceived benefits of adoption; and the business capabilities that the firm most wishes to develop. Care must be taken to represent, at an acceptable degree of accuracy, Ontario's specific regions, sectors, and size distribution of firms. In recent years, surveys with relatively small samples (<300 firms) of Canadian SMEs' use of ICT have been undertaken by IDC and Illuminas, the latter as part of an ongoing Net Impact project sponsored by Cisco. These are useful contributions but they cannot be expected to clarify regional or sectoral ICT adoption issues in Ontario.

- 2) Research needs to be undertaken on the status of adoption and use of all telecommunications services in all regions of the province. Wireless broadband is of particular significance because it is beginning to trigger a wave of innovation in mobile business and consumer applications.

- 3) Regional economies must export in order to sustain their growth. Although information is not available regarding Ontario SMEs, evidence exists from surveys of SMEs elsewhere in Canada that use of ICTs supports export capability. Among SMEs in Atlantic Canada connectivity *per se* is not correlated with export activity, but use of e-business applications, engagement in e-commerce transactions, and enhanced website functionality are correlated with exports to the United States and other international destinations (Davis, Lin, and Vladica, 2006). SMEs that export report higher growth rates despite the greater competition in international markets (Ibid.). It would be of value to understand how Ontario's community of SME exporters uses ICTs and to develop a research agenda that focuses specifically on this group of firms.

- 4) Cities are generators and attractors of firms because in many industries, urban environments provide advantages to firms that are less available in rural or small town environments. However, concentration of economic activity in larger cities poses threats to smaller communities that are distant from urban centres. It is of considerable interest to understand whether ICTs can help to mitigate the disadvantages of rural or small town business location or distance from urban centres. Unfortunately, there exists no adequate information about Ontario SMEs' use of ICTs to permit an understanding of the situation in this province. It would be useful to better understand how the urban-rural digital divide in Ontario affects business practices and outcomes. A research agenda needs to be developed on this theme.

- 5) Research on dynamics of ICT use in specific industrial sectors in Ontario (for example tourism, business services, cultural industries, manufacturing, transportation, construction) would be helpful in understanding the specific needs and challenges of each sector with respect to ICT adoption support, and to develop policy initiatives in response to those needs.

Surveys and background studies at the sectoral level lend themselves to partnerships with sectoral trade associations, the Ontario ICT supplier industry, and institutions of higher education. They can be used to provide benchmarks, case studies, and other materials for workshops, management development initiatives, training programs, and collaborative projects to develop sector-specific ICT applications.

6) Irrespective of the situation regarding ICT adoption among Ontario SMEs, it is necessary to constantly monitor the growth and development of the Ontario ICT supplier industry. This is mainly an export-oriented industry, although smaller ICT service providers are often oriented toward local or regional markets. The Ontario ICT supplier industry is sensitive to provincial and federal tax, HR, education, commercialization, trade and investment, and S&T policies, to overall business costs, and especially to changing patterns of opportunity in international markets. It is also sensitive, in ways that are not well understood, to demand by domestic user industries. Research on the growth and development of this industry needs to be undertaken on an ongoing basis, preferably in partnership with the relevant stakeholders such as trade associations, provincial and federal ministries, institutions of higher education, local technology cluster development agencies such as ICT Toronto or OCRI, or investment associations.

7) ICT firms need complex business development capabilities that are mainly learned through experience (Davis and Sun, 2006). In the current business environment, potential SME customers indicate that they wish to more clearly define the business case for an investment in ICT than in the past. This may call for new approaches to business development, marketing, and selling on the part of ICT suppliers in which costs and likely benefits are clearly identified and configuration, implementation, and partnership options compared. It may be of interest to the Ontario ICT supplier community or some of its members to collaborate to strengthen their business development capabilities by sharing good practices, curriculum development and training sessions, mentoring, development of illustrative case studies, methodologies and practices for business case development, and approaches to value-based marketing and selling practices.

8) In view of the importance of microenterprises in Ontario, it would be useful to understand the origins and characteristics of these tiny firms, how they use ICTs to create value, the specific ICT support needs of microenterprises that seek growth, provision of sustainable self-employment opportunities, or routes out of poverty, as well as the ability of the Ontario ICT service industry to respond to these needs.

8. Conclusions

After reviewing the available scholarly, trade, and policy literature on broadband, ICTs, and SMEs in Ontario and in Canada, we can draw several conclusions with a good degree of reliability.

In Ontario, fixed broadband deployment to SMEs is largely complete. Most SMEs prefer to adopt broadband whenever it is available. Attention is shifting to issues of availability, reliability, and quality of the full range of telecommunications services, especially wireless broadband.

Connectivity *per se* is not the driver of improved business performance. Complementary investments in ICT hardware, software, skills development, and organizational development are usually required. Lags in investment in ICTs among Canadian SMEs are believed to be an important source of productivity differences between the U.S. and Canada. Opinions differ as to the best way to induce further investment in ICTs among SMEs. Some favour an ICT investment tax. Others favour a general reduction in taxes. A wide range of policy instruments is already in place to promote ICT development and use in Canada. However, neither Canada nor Ontario presently has a strategic plan with respect to ICT adoption by SMEs.

Little information is available specifically on Ontario SMEs' use of broadband, other telecommunications services, and ICTs. A research agenda encompassing eight themes is proposed to help fill the gaps in knowledge: 1) surveys on ICT adoption and use among Ontario SMEs; 2) research on the availability and adoption of the full range of

telecommunication services in Ontario; 3) the use of ICTs by the Ontario SME export community; 4) the implications and impacts on business performance of the urban-rural digital divide in Ontario; 5) sectoral dynamics of ICT adoption in Ontario; 6) the evolution of the Ontario ICT supplier industry and the role of its domestic market linkages; 7) business development capabilities among Ontario ICT supplier firms; and 8) patterns of adoption and business impacts of ICT among microenterprises and home businesses in Ontario, including the specific ICT support needs of microenterprises with growth or sustainable self-employment objectives. The proposed research agenda on these themes would help to remove the gaps in knowledge that currently exist regarding the ways that the ICTs can support the expansion of the Ontario SME community.

Table 1: sectoral distribution of SMEs in Ontario

Wholesale and retail trade	19.8%
Transportation and warehousing	3.3%
Goods and manufacturing	20.6%
Healthcare and social assistance	8.0%
Business services	19.2%
Finance, insurance, real estate, rental and leasing (F.I.R.E)	9.3%
Accommodation and food	7.1%
Other	13.6%

Source: MSBE, 2006

Table 2 – salient features of ICT adoption and use among Canadian SMEs

1. Canada has a relatively high broadband penetration rate (and a relatively low cellular mobile penetration rates) among OECD countries.
2. Most Canadian SMEs are connected to the Internet and most SME Internet connections are high speed.
3. The simplest ICTs are in widespread use among Canadian SMEs.
4. Smaller firms lag larger firms in adoption of more complex Internet technologies and e-business solutions.
5. Online transactions are growing steadily in Canada.
6. Business-to-business (B2B) is the largest component of online commerce in Canada.
7. Patterns of ICT adoption and value creation vary by sector.
8. Intensity of ICT use increases with export behaviour.
9. Rural firms engage less intensively in e-business than urban firms and report lower benefits of ICT adoption.

Source: this report.

Table 3: barriers to e-Commerce adoption among Canadian firms

Barrier	2000	2001	2002	2003
Goods and services do not lend themselves to Internet transactions	56	52	48	44
Prefer to maintain current business model	36	36	37	36
Security concerns	14	13	18	17
Development and maintenance costs too high	12	11	14	14
Customers not ready	10	9	11	11
Lack of skilled employees	10	9	11	10
Concerns about competitors analysing company	6	6	7	7
Uncertain about the benefits	10	8	9	7
Internet available to us is too slow	4	5	5	5
Suppliers not ready	6	5	6	5

Source: Noce and Peters (n.d.).

Table 4: recommendations of the Telecommunications Policy Review Panel to encourage ICT adoption among SMEs

- The Prime Minister should mandate the Minister of Industry to develop a national ICT adoption strategy. Two of its objectives would be “strengthening ICT adoption by Canadian businesses, particularly small and medium-sized enterprise” and “strengthening the links between ICT sector research and development and ICT adoption”
- Industry Canada should establish a National ICT Adoption Centre with the following responsibilities:
 - “benchmark Canada’s performance in the adoption and effective use of ICTs”
 - “conduct policy research and analysis on issues related to ICT adoption in the private and public sectors...”
 - “be a lead advocate for the effective use of ICTs, particularly among small and medium-sized enterprises”
- Establish a National ICT Advisory Council
- Introduce an ICT adoption tax credit encompassing investment in computers, communications equipment, software, computerized manufacturing, ICT training, business process re-engineering, and organizational change.
- Develop other measures to improve ICT adoption by SMEs, including awareness measures.
- Strengthen ICT R&D, particularly within Federal programs and institutions.
- Other recommendations concern a smart infrastructure, ICT adoption by government, promotion of ICT adoption skills and e-literacy, and measures to promote security, confidence, and trust in the online environment.

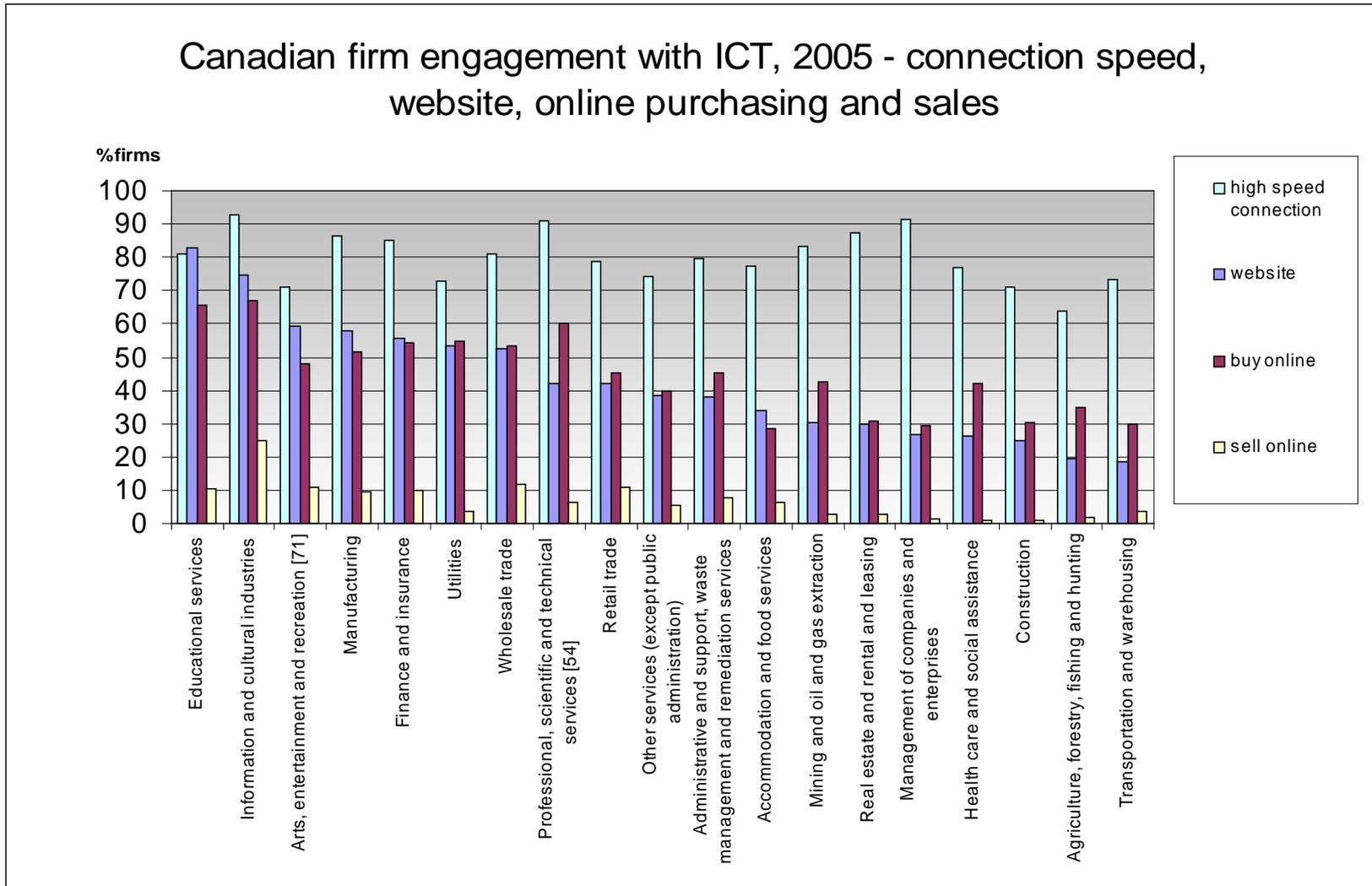
Source: Telecommunications Policy Review Panel *Final Report* (2006).

Table 5. taxonomy of policy instruments in support of ICT adoption by SMEs

High level policy development	<ul style="list-style-type: none"> • Most national and many subnational governments have the equivalent of ministries of industry, with responsibility for ICTs. • Some countries such as Japan have ICT policy organizations under the chairmanship of the prime minister or equivalent.
Articulated strategic agenda	<ul style="list-style-type: none"> • The European Union, Ireland, the United Kingdom, Japan, Australia, South Korea, India, and the U.S have articulated strategic agendas with respect to ICT (Telecommunications Policy Review Panel 2006: 7-18 – 7-20).
Mechanisms to promote advocacy and collective action among stakeholders	<ul style="list-style-type: none"> • The most common organizational forms to promote advocacy and collective action are trade associations (for sectoral collective action) and cluster associations (for collective action at the local and regional level). Each usually receives some public support. They may offer services such as training, project development, and policy advocacy to members. • The Canadian e-Business Initiative (CEBI), a multistakeholder initiative sponsored by Industry Canada, is no longer active. • In Canada, sector councils such as the Information and Communications Technology Council focus on human resource issues.
External policy advice	<ul style="list-style-type: none"> • In Canada, trade associations often seek to shape the policy agenda through delivery of policy advice. • National or subnational S&T advisory councils sometimes cover ICT issues. • In Canada, the proposed National ICT Advisory Council would be a peak, multi-stakeholder external provider of policy advice.
Industry regulation	<ul style="list-style-type: none"> • The basic rationale that underlies regulation of the telecommunications industry is the need to ensure competition, access, and quality. Most countries regulate the telecommunications industry in national territory.
Education	<ul style="list-style-type: none"> • Post-secondary educational institutions in every province provide courses of instruction in various ICT disciplines. • Sector councils such as the Information and Communications Technology Council in Canada provide advice and facilitate collaboration between post-secondary institutions and industry around HR issues. • Post-secondary education socializes students into use of ICTs and creates expectations regarding use of ICTs in their work environment. • In-firm technical training is usually provided by the private sector. Governments need intervene only in the case of market failure.
Legal infrastructure	<ul style="list-style-type: none"> • National IP and information privacy legislation are critical enablers of e-business. • Governments need to ensure protection against online fraud.
Technical infrastructure	<ul style="list-style-type: none"> • Governments may mandate use of new or upgraded technical standards, as in the case of HDTV, thus obliging industry and consumers to adopt new technologies.
Lead user	<ul style="list-style-type: none"> • When a public organization acts as a lead user, it can affect firms in three ways: as a demonstration of ICT capabilities, as a partner in the development of new products or services, and as a service provider itself. • Acting as a lead user of e-business solutions was a strategic objective of the Federal government in the 1990s.
Tax incentives	<ul style="list-style-type: none"> • Many countries offer ICT investment incentives (see Warda, 2005). • A broad ICT Adoption Tax credit is proposed by the Telecommunication Policy Review Panel. • The SME community favours an overall reduction of business tax over specific investment incentives (CFIB, 2007).
Technical assistance	<ul style="list-style-type: none"> • Technical assistance is provided by many public and private actors. • Generally, public providers of technical assistance concentrate on areas in which

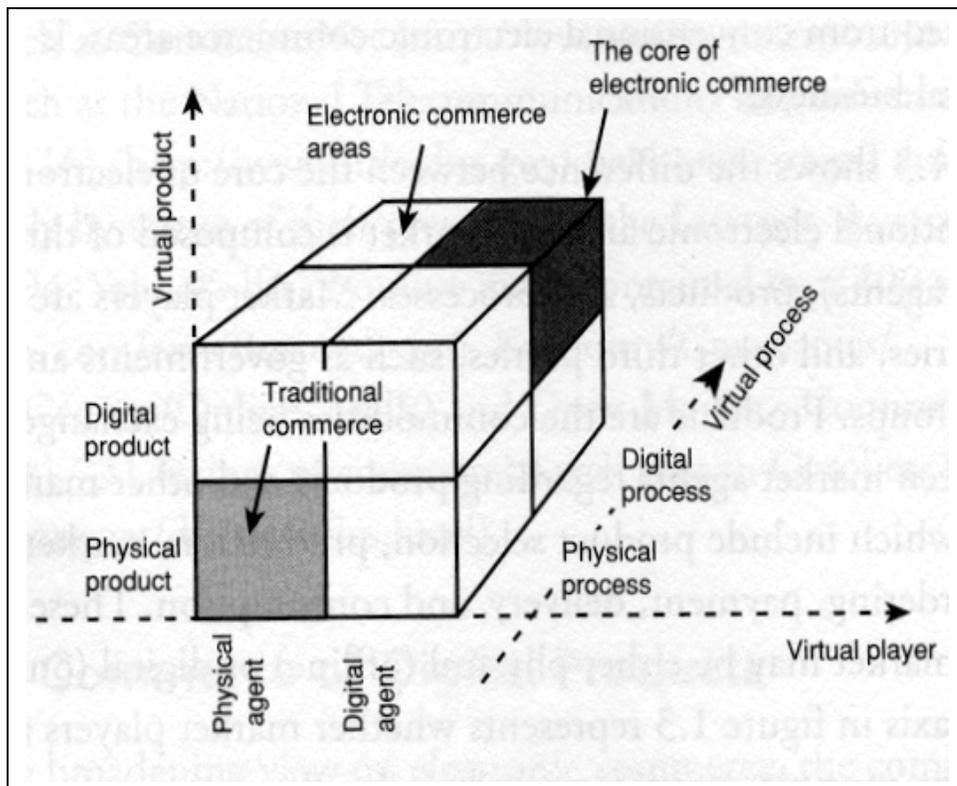
	<p>the market clearly fails to deliver business services to firms. This includes applied R&D and technology transfer services, such as those provided by NRC's Industrial Research Assistance Program (IRAP), entry-level business services to entrepreneurs that may include a technical component, and technical and business support services in rural, remote, or distressed regions. For an example of the latter, see the Tasmanian Electronic Commerce Centre (http://www.tecc.com.au/tecc/).</p> <ul style="list-style-type: none"> • Many online sites provide information on e-business to SMEs. See example the resources for SMEs on the Canadian e-Business Initiative site at http://www.cebi.ca/Page_e.asp?PageID=6 • Many private suppliers of ICT services to business customers are active in Ontario.
Awareness	<ul style="list-style-type: none"> • Awareness-raising activities are practiced by public actors as well as by private actors who may be playing a public service role. • Awareness activities are of interest because they can target different needs – entry level, executives, sector-specific, regional, linguistic, etc. • Examples of awareness activities are the “Netherlands’ Government Action Line for Raising ICT Awareness among Small and Medium-Sized Enterprises” (as described in Telecommunications Policy Review Panel 2006: 7-38) and the e-Business Awareness Program that is delivered in Atlantic Canada by the Electronic Commerce Centre in Saint John, New Brunswick. This program, developed with ACOA and Business New Brunswick support, offers an online e-business readiness test, training, modules, a strategy template, short case studies, a directory of service providers, and workshops (see http://www.ebusinessinnb.com/english/services.jsp).
Incentives and support for commercialization and technology venturing	<ul style="list-style-type: none"> • Initiatives under this rubric are primarily of interest to the ICT supplier industry and to domestic lead user firms. • The list of instruments to promote commercialization and venturing includes: targeted public investments in ICT R&D and training in post-secondary and public R&D institutions; university technology transfer offices and institutional IP rules; small business incubators; fiscal measures that encourage risk investing; and encouragement of entrepreneurship through recognition, education, and mentoring.
Public procurement	<ul style="list-style-type: none"> • Public procurement is presently under consideration in the European Union as an instrument to support ICT innovation. • In Canada, public procurement is only occasionally used to promote ICT innovation. Transparency in tendering and contracting has been the principal objective of public procurement initiatives.
Policy intelligence	<ul style="list-style-type: none"> • Statistics Canada undertakes an annual national survey of electronic commerce (SECT). Other surveys are produced occasionally under contract, under sponsorship of CEBI, or by individual researchers. Apparently no Ontario-wide surveys of ICT adoption have been undertaken. • No agency or body in Canada is presently collecting or sponsoring the production of comprehensive e-business policy intelligence, which encompasses information about the state of e-business in various countries as well as information about ICT policies. This situation contrasts with that in Europe, which has mounted e-Business W@tch, a program to monitor, analyze, and promote the progress of e-business in industry (see http://www.ebusiness-watch.org/). • OECD members regularly contribute information on ICTs and ICT policy, which is summarized and published in OECD reports.

Figure 1: sectoral patterns of ICT use among Canadian firms, 2005



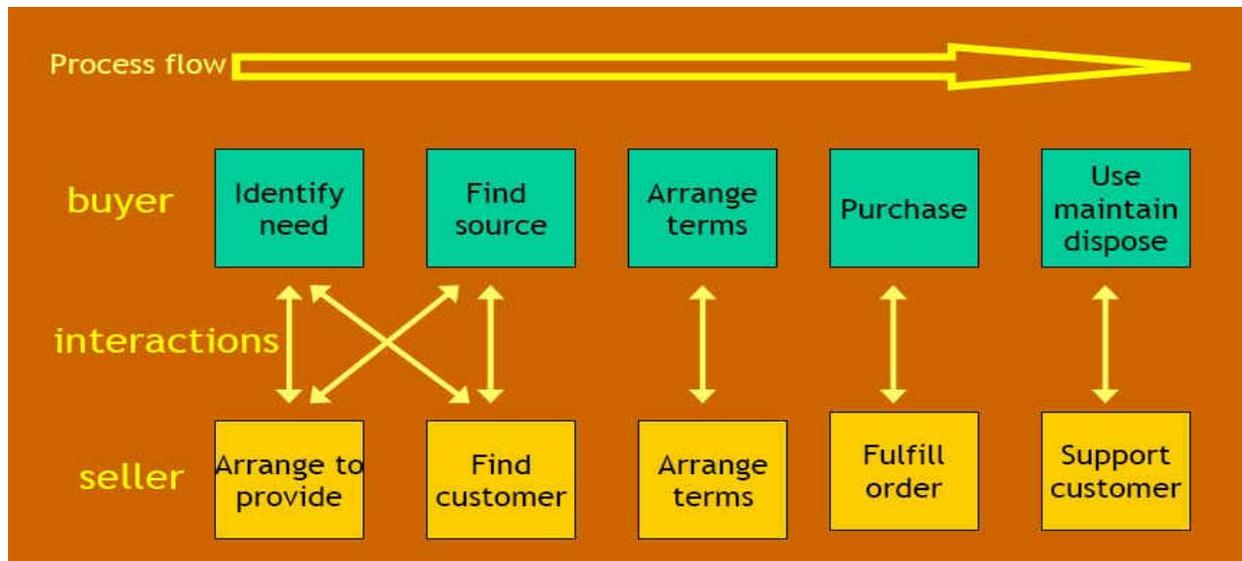
Source: Statistics Canada tables 358-0008, 358-0010, 358-0011, and 358-0016

Figure 2. dimensions of electronic commerce



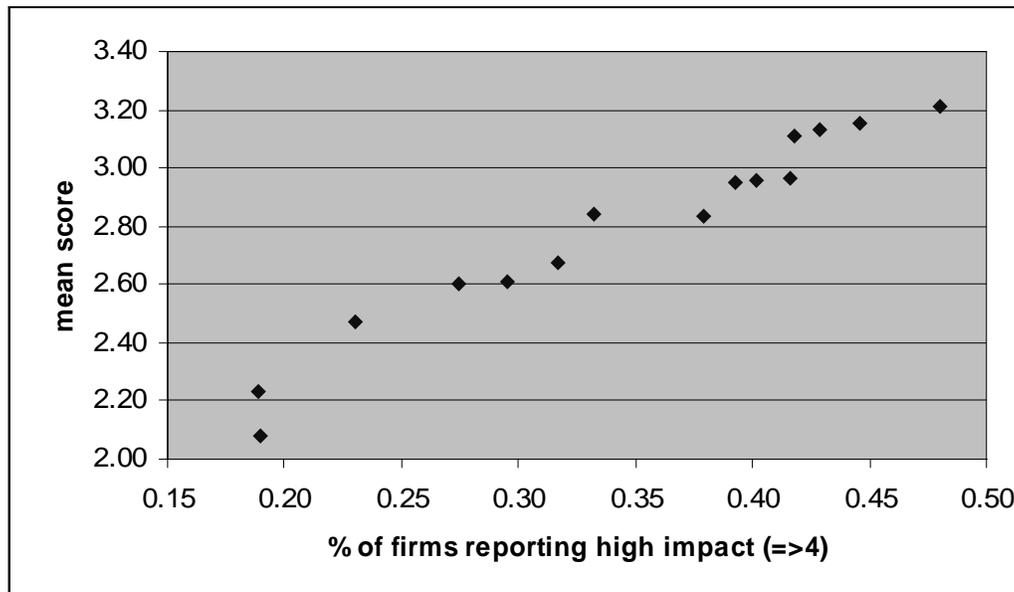
Source: Choi, Stahl, and Whinston, 1997

Figure 3: customer transaction cycle



Source: Bloch, Pigneur and Segev, 1996

Figure 4: Reported Impacts of Internet technologies and e-business solutions among Atlantic Canadian SMEs, 2005



The vertical axis represents the mean reported impact on a five-point Likert scale:

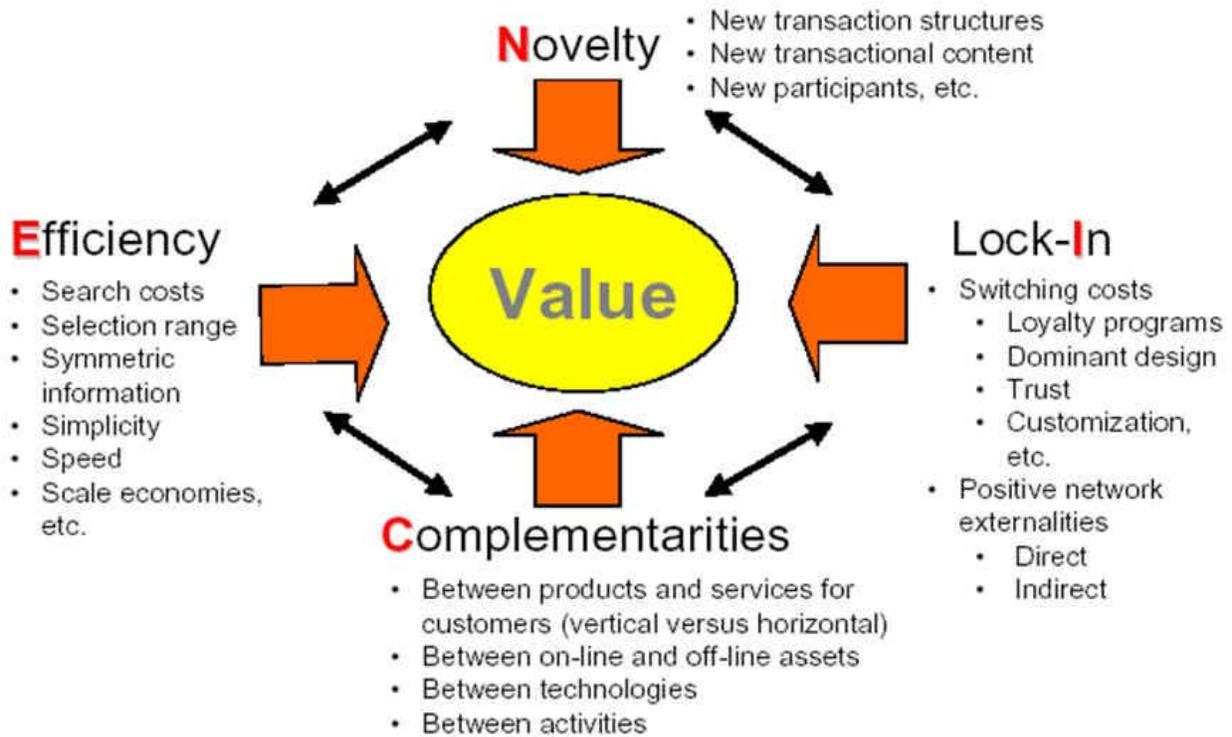
1 = No Impact; 2 = Low Impact; 3 = Medium Impact; 4 = High Impact; 5 = Very High Impact

The horizontal axis represents the percentage of firms reporting a High or Very High Impact (=> 4)

- 0.48 Improved the brand and image of the business and its product/service
- 0.45 Allowed business to keep up with its competitors
- 0.43 Building and enhancing relationships with existing customers
- 0.42 Increased the speed of supplying and/or delivering services or goods
- 0.42 Increased level of customer service and satisfaction
- 0.4 Increased the ability to adapt to different client demands
- 0.39 Increased the business productivity
- 0.38 Improved co-ordination with partners or suppliers
- 0.33 Increased the business profitability
- 0.32 Improved the quality of goods or services
- 0.3 Improved rate of development and introduction of new products/services
- 0.27 Developing unique expertise or a unique market
- 0.23 Increased the business domestic market share
- 0.19 Decreased the cost of producing goods or services
- 0.19 Increased the business international market share

Source: Davis, Lin, and Vladica, 2006. N = 776 SMEs

Figure 5: model of sources of value creation in e-business



Source: Amit and Zott, 2001.

References

- Al-Qirim, Nabeel A.Y., 2004. *Electronic Commerce in Small to Medium-Sized Enterprises: Frameworks, Issues and Implications*. Hershey, Pa.: Idea Group.
- Amit, Raphael, and Christoph Zott, 2001. "Value Creation in e-Business," *Strategic Management Journal* 22: 493-520.
- Arbore, Alessandro, and Andrea Ordanini, 2006. "Broadband Divide Among SMEs," *International Small Business Journal* 24(1): 83–99.
- Austin, Robert D., and Stephen P. Bradley, eds., 2005. *Broadband Explosion. Leading Thinkers on the Promise of a Truly Interactive World*. Boston: Harvard Business School Press.
- Bloch, Michael, Yves Pigneur, and Arie Segev, 1996. *On the Road of Electronic Commerce-a Business Value Framework, Gaining Competitive Advantage and Some Research Issues*. Berkeley: The Fisher Center for Information Technology & Management, March.
- Bresnahan, Timothy F., and Shane Greenstein, 2001. "The Economic Effects of Information Technology: Towards Comparative and User Studies," *Journal of Evolutionary Economics* 11: 95-118.
- Brynjolfsson, Erik, and Loren M. Hitt, 2000. "Beyond Computation: Information Technology, Organizational Transformation and Business Performance," *Journal of Economic Perspectives* 14(4): 23-48.
- Burke, K., 2005. "The Impact of Firm Size on Internet Use in Small Business," *Electronic Markets* 15(2): 79-93.
- Carlaw, Kenneth I., and Richard G. Lipsey, 2002. "Externalities, Technological Complementarities and Sustained Economic Growth," *Research Policy* 31: 1305-1315.
- CEBI, 2004. *Net Impact Study Canada: Strategies for Increasing SME Engagement in the e-Economy*. Final Report, Canadian e-Business Initiative, September.
- CFIB, 2007. *Building Business Success. A Survey of SMEs on Productivity*, by A. Debus. Ottawa: Canadian Federation of Independent Business.
- CFIB, 2006. *Ontario Small Business Profile. An Overview of Ontario's Small and Mid-sized Business Sector*, by M. Currie and P. Petkov. Ottawa: Canadian Federation of Independent Business.
- Charles, S., M. Ivis, and A. Leduc, 2002. *Embracing e-Business: Does Size Matter?* Ottawa: Statistics Canada Catalogue No. 56F0004MPE, No. 6.

- Choi, Soon-Yoong, Dale O. Stahl, and Andrew B. Whinston, 1997. *The Economics of Electronic Commerce*. Indianapolis: McMillan Technical Publishing.
- Davis, Charles H., and Elaine Sun, 2006. "Business Development Capabilities in Information Technology SMEs in a Regional Economy," *Journal of Technology Transfer* 31: 145-161.
- Davis, Charles H., and Florin Vladica, 2007. "Value of Internet Technologies and e-Business Solutions to Microenterprises in Atlantic Canada," pp. 125-156 in S. Barnes, ed., *e-Commerce and V-Business. Digital Enterprise in the Twenty-First Century*. London: Butterworth-Heinemann.
- Davis, Charles H., Carinna Lin, and Florin Vladica, 2006. "Use and Business Impacts of Internet Technologies and e-Business Solutions Among SMEs in Atlantic Canada," *Proceedings of the 7th World Congress on e-Business Management*, Halifax.
- De Berranger, P., D. Tucker, and L. Jones, 2001. "Internet Diffusion in Creative Micro-businesses. Identifying Change Agent Characteristics as Critical Success Factors," *Journal of Organizational Computing and Electronic Commerce* 11(3): 197-214.
- Draca, Mirko, Raffaella Sadun, and John Van Reenen, 2007. "Productivity and ICTs: a Review of the Evidence," pp. 100-147 in R. Mansell, C. Avgerou, D. Quah, and R. Silverstone, eds., *The Oxford Handbook of Information and Communication Technologies*. Oxford: Oxford University Press.
- EC, 2005. *The New SME Definition. User Guide and Model Declaration*. Brussels: European Commission, Enterprise and Industry Publication.
- Fillis, I., U. Johansson, and B. Wagner, 2004. "A Qualitative Investigation of Smaller Firm e-Business Development," *Journal of Small Business and Enterprise Development* 11(3): 349-361.
- Friar, J.H., and M.H. Meyer, 2003. "Entrepreneurship and Start-ups in the Boston Region: Factors Differentiating High-Growth Ventures from Micro-Ventures," *Small Business Economics* 21: 145-152.
- Government of Canada, 2007. *Mobilizing Science and Technology to Canada's Advantage*. Ottawa: Government of Canada.
- Hitt, Lorin, and Erik Brynjolfsson, 1996. "Productivity, Profit and Consumer Welfare: Three Different Measures of Information Technology," *MIS Quarterly* 20(2): 121-142.
- IDC Canada, 2006. *Does ICT Matter to SMBs?* Ottawa: Information Technology Association of Canada. Executive summary at <http://www.itac.ca/PolicyandAdvocacy/06OctSMBExecutiveSummary.pdf>
- Illuminas, 2006. *Net Impact Canada: Small and Medium-sized Enterprises*. <http://www.netimpactstudy.com/ca/>

- Industry Canada, 2001. *Microenterprises Survey 2000: a Progress Report*. Ottawa: Industry Canada, Small Business Policy Branch.
- Lefebvre, Élisabeth, and Louis A. Lefebvre, 1996. *Information and Communication Technologies. The Impact of their Adoption on Small and Medium-Sized Enterprises*. Ottawa: International Development Research Centre.
- Martin, Roger L., and James B. Milway, 2007. *Enhancing the Productivity of Small and Medium Enterprises through Greater Adoption of Information and Communication Technology*. Ottawa: Information and Communications Technology Council, March.
- MEDT, 2006. *Submission to the Telecommunications Policy Review Panel by the Ontario Ministry of Economic Development and Trade*. Toronto, 15 August.
- MSBE, 2006. *Destination Success. A Pocket Guide to Small Business in Ontario, Canada*. Toronto: Ministry of Small Business and Entrepreneurship, Government of Ontario.
- Noce, Anthony, and Catherine Peters, n.d. *Barriers to Electronic Commerce in Canada: a Size of Firm and Industry Analysis*. Ottawa: Industry Canada, Electronic Commerce Branch.
- Nordicity, 2004. *Profile of Small and Medium Sized Enterprises in the Canada Cultural Industries*. Toronto: report prepared for Department of Canada Heritage.
- OECD, 2007. *OECD Communications Outlook*. Paris: Organisation for Economic Cooperation and Development.
- OECD, 2006. *OECD Information Technology Outlook*. Paris: Organisation for Economic Cooperation and Development.
- OECD, 2005a. *OECD Communications Outlook*. Paris: Organisation for Economic Cooperation and Development.
- OECD, 2005b. *SME and Entrepreneurship Outlook*. Paris: Organisation for Economic Cooperation and Development.
- Papadaki, E., and B. Chami, 2002. *Growth Determinants of Micro-Businesses in Canada*. Ottawa: Industry Canada, Small Business Policy Branch.
- Perren, L., 1999. "Factors in the Growth of Microenterprises. Part 1: Developing a Framework," *Journal of Small Business and Enterprise Development* 64: 366-385.
- Raymond, L., F. Bergeron and S. Blili, 2005. "The Assimilation of E-Business in Manufacturing SMEs: Determinants and Effects on Growth and Internationalization," *Electronic Markets* 15(2): 106-118.

Rosson, Philip, and Charles H. Davis, 2004. "Electronic Marketplaces and Innovation: the Canadian Experience," *International Journal of Information Technology and Management* 3(1): 41-58.

Secor, 2005. *Broadband Access for Every Canadian Home: the Business Case*. Submissino to the Telecommunications Policy Review Panel by Secor Consulting, August.

Sharpe, Andrew, 2006. *The Relationship between ICT Investment and Productivity in the Canadian Economy: a Review of the Evidence*. Ottawa: Centre for the Study of Living Standards Research Report 2006-05.

Statistics Canada, 2007. *Portrait of the Canadian Population 2006, 2006 Census*. Ottawa: Statistics Canada.

Storey, D.J., 1994. *Understanding the Small Business Sector*. London: International Thomson Business Press.

Telecommunications Policy Review Panel, 2006. *Final Report*. Ottawa: Industry Canada.

Trites, Gerald, and David Pugsley, 2003. *E-Business. A Canadian Perspective for a Networked World*. Toronto: Prentice Hall.

Tuomi, Ilkka, 2004. "Economic Productivity in the Knowledge Society. A Critical Review of Productivity Theory and the Impacts of ICT," *First Monday* 9(7).
http://www.firstmonday.org/issues/issue9_t/tuomi/index.html

Van der Veen, M., 2004. "Measuring e-Business Adoption in SMEs," pp. 31-53 in *New Technology-Based Firms in the New Millenium*, v. 3. (W. During, R. Oakey, and S. Kauser, eds.). Amsterdam: Elsevier.

Von Hippel, Eric, 2005. *Democratizing Innovation*. Cambridge, Mass.: the MIT Press.

Warda, Jacek, 2005. *Incentives for ICT Adoption: Canada and Major Competitors*. Ottawa: Information Technology Association of Canada.

Zilber, Julie, 2003. *Sustainable Broadband Networks in British Columbia's Remote and Rural Communities*. Unpublished report, Simon Fraser University, January.