



# CONNECTEDNESS

*Series*



Electronic Commerce and Technology Use

*G. Peterson*



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**Director:** Fred Gault

For further information:  
Science, Innovation and Electronic Information Division  
R.H. Coats Building, 7-L  
Ottawa, Ontario, K1A 0T6  
Telephone: (613) 951-2581  
Facsimile: (613) 951-9920

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# Electronic Commerce and Technology Use

*G. Peterson*

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For further information, please contact G. Peterson at (613) 951-3592  
Email: [Greg.Peterson@statcan.ca](mailto:Greg.Peterson@statcan.ca)

**Editor:** George Sciadas

**Review Committee:** Mike Sheridan, Philip Smith, Louis-Marc Ducharme, Paul Johanis, Philip Cross.

**Production:** Lucienne Sabourin

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# Abstract

The use of information and communications technologies (ICTs), and electronic commerce in particular, has often been cited as a significant factor in sustaining economic growth. With the burst of the dot-com bubble in 2000, this exuberance was deflated and the pendulum swung the other way. Between 1999 and 2000, Internet selling became concentrated into fewer, larger businesses, as the proportion of businesses selling over the Internet declined to 6%. At the same time, however, measurements reveal that the value of orders received by the private sector over the Internet with or without online payments expanded by 73% to \$7.2 billion, doubling in importance from 0.2% to 0.4% of total operating revenue. The proportion of businesses purchasing over the Internet also increased to 18%.

Larger businesses were more likely to engage in Internet commerce and business-to-business sales exceeded business-to-consumer sales by a factor of four-to-one. A sizeable proportion of online sales was exported. Information and cultural services industries were most likely to both sell and purchase online, followed by enterprises in private education services.

In 2000, 63% of business enterprises used the Internet, accounting for 90% of all economic activity. In addition, 60% used e-mail, 51% used wireless communications, 26% had a Web site, 12% had an Intranet, a smaller proportion (4%) had an Extranet, while 10% used EDI not on the Internet. In general, larger businesses are the early adopters of progressively more sophisticated technologies.

The public sector emerges as a model user of ICTs and their applications. Internet and e-mail use was nearly universal with 99% of public sector institutions using these technologies. As well, 73% had Web sites, 52% had Intranets, 24% had Extranets, while 49% purchased goods or services online.

# Electronic Commerce and Technology Use

By G. Peterson

Greg Peterson is with the Science, Innovation and Electronic Information Division

## 1. INTRODUCTION

The use of information and communications technologies (ICTs) has often been cited as a significant factor in sustaining economic growth. Towards the end of the 1990s, Internet use, and electronic commerce in particular, was seen almost as a panacea that would address all business problems. With the burst of the dot-com bubble in 2000, this exuberance was deflated and the pendulum swung the other way. Media hype aside, such developments give rise to interesting questions. How extensive is the use of the Internet and other ICTs among businesses? What is the magnitude of electronic commerce in Canada and how is it evolving? These are the questions that this paper sets out to explore.

Statistics Canada has been measuring and analyzing Internet use among households for several years (e.g. Dickinson and Sciadas 1997) and, more recently, among individuals (Dryburgh 2001). Information regarding household engagement in Internet commerce has also been collected and analyzed (Ellison, Earl and Ogg 2001). While readings of business use of selected ICTs have also been taken for some time, they were part of a broad range of advanced technologies and mainly focused on the manufacturing sector (Statistics Canada 1988, 1991, Sabourin and Beckstead 1999). The

explosion of interest in the subject matter lead to the creation of an economy-wide survey vehicle dedicated to the systematic measurement of ICTs and e-commerce. Results from the first such survey revealed that Internet commerce was in its infancy. In addition, they provided estimates of the extent to which the public and private sectors used the Internet, developed Web sites and engaged in electronic commerce (Bakker 2000).

This paper, largely based on the second economy-wide survey, presents new findings and offers comparative analysis. It reveals that between 1999 and 2000, the value of orders received over the Internet by the private sector with or without online payments expanded by 73% to \$7.2 billion, doubling in importance from 0.2% to 0.4% of total operating revenue. Over this same period, however, the proportion of businesses selling over the Internet declined, becoming concentrated into fewer, larger businesses. Business-to-business sales were higher than business-to-consumer by a factor of four-to-one, and a sizeable proportion of online sales were exported. The paper also analyzes in some detail information concerning the use of various ICTs by the public and private sectors, uncovers industrial differences and emphasizes recent changes.

Networked Canada, a compendium publication based on a variety of information sources, presented a synthesis of the supply of ICTs and the demand for ICTs by all sectors (Statistics Canada 2001). International comparisons of the ICT sector are provided by the OECD (2000a)

## NOTE TO READERS

The 2000 Survey of Electronic Commerce and Technology (SECT) collected information on the use of ICTs and e-commerce among private and public sector enterprises. The survey covered all economic sectors, with the exception of agriculture and construction. The findings are based on a sample of approximately 21,000 enterprises with a response rate of 77%, representing 93% of economic activity.

The collection entity for the survey was the *enterprise*. This differs from production surveys, which are typically establishment-based. An enterprise is the "organizational unit of a business that directs and controls the resources relating to its domestic organization and for which consolidated financial and balance sheet accounts are maintained..." (Statistics Canada 1998, p. 9). The implication is that the survey collected data on transactions that occur between enterprises, while it specifically excludes intra-firm transactions, i.e. Internet transactions that may occur between two establishments within the same enterprise.

Likewise, the industrial classification assigned to the enterprise engaged in electronic commerce will be the industrial classification of the establishment with the highest value-added within that enterprise. For instance, if an Internet transaction is conducted in a retail establishment within a manufacturing enterprise, that activity would be classified as a sale of the manufacturing sector. While this distinction poses no problem for the vast majority of Canadian businesses, it represents a different view of large, complex, and vertically integrated enterprises.

## 2. THE STATE AND EVOLUTION OF ELECTRONIC COMMERCE

The media hype surrounding electronic commerce in the late 1990s generally left the feeling that businesses not engaged in electronic commerce would fall by the wayside. In the aftermath of the "dot-com blowout," businesses exclusively engaged in electronic commerce have been pummeled in equity markets and have seen venture capital dry up. Despite this turn of events, there are a number of reasons why a business may engage in electronic business practices, and electronic commerce in particular.

Electronic commerce may allow a business to reduce its transaction costs. Some of the costs involved in selling a good or a service are shifted to the consumer, saving on labour costs for the selling firm. The use of online ordering offers the potential to reduce errors in processing orders. Disintermediation may also eliminate some wholesale and retail margins.

The use of the Internet allows for the entry of smaller sellers and buyers into Electronic Data Interchange (EDI) procurement systems that migrate from proprietary networks to the Internet. In addition to reducing the error rate associated with purchasing, such practices reduce costs and ensure compliance with corporate standards and procedures. Internet-based EDI may also allow purchasers to better manage their inventories, thus reducing inventory-carrying costs.

In all, while the spread of electronic commerce may not have been as spectacular as some claims in the late 1990s would have it, it is growing. As well, although the proportion of sellers appears to be declining, the proportion of firms using the Internet for purchases is rising.

Electronic commerce refers to Internet transactions, defined as the sale or purchase of goods or services over the Internet, with or without online payment. This differs from an electronic transaction, defined as the sale or purchase of goods or services over all computer-mediated networks (including both the Internet and proprietary networks). The goods and services are ordered over these networks, but the payment and ultimate delivery of the good or service may be conducted off-line (OECD 2000b). In this paper, Internet sales and online sales are used interchangeably.

## 2.1 Selling online

Between 1999 and 2000, the evolution of e-commerce was characterized by increased volume and fewer sellers. In 2000, private sector enterprises received \$7.2 billion worth of orders over the Internet, 73% higher than online sales in 1999. Despite this strong advance, only 6% of enterprises sold online, a decline from 10% in 1999. Among the enterprises that were in the sample for both 1999 and 2000, for every two businesses that started selling online in 1999, five stopped.

This decline in the proportion of businesses selling online was observed in all industry sectors. However, the proportion of gross business income (GBI) accounted for by the businesses that sold online between 1999 and 2000 increased from 17% to 25%. This indicates that Internet sales were consolidated into fewer, larger firms. Overall, in the private sector, Internet sales accounted for 0.4% of operating revenue, an increase from 0.2% in 1999. These results are shown in Table 1 (which will also serve as a reference for the remainder of this section).

**Table 1.**  
Sales over the Internet, by industry

	Enterprises that use the Internet to sell goods or services		Internet sales with or without online payment		Internet sales as a proportion of total operating revenue		Internet sales to customers	Internet sales to outside of Canada
	1999	2000	1999	2000	1999	2000	2000	2000
	%		\$ million		%		%	
Forestry, logging and support activities	1	2	..	..	..	..	-	21
Mining and oil and gas extraction	7	0	15.0	x	.	x	-	3
Utilities	9	5	15.8	x	0.1	x	..	-
Manufacturing	15	8	900.0	1,304.8	0.2	0.2	3	23
Wholesale trade	14	14	156.3	1,041.2	0.1	0.3	27	14
Retail trade	11	9	610.6	889.9	0.3	0.4	49	3
Transportation and warehousing	10	2	164.3	990.2	0.3	1.5	17	23
Information and cultural industries	20	19	552.7	273.9	1.0	0.5	28	..
Finance and insurance	15	7	320.8	634.5	0.1	0.3	19	11
Real estate and rental and leasing	10	5	114.8	137.0	0.3	0.4	61	17
Professional, scientific and technical services	12	7	406.1	334.6	0.8	0.6	14	56
Management of companies and enterprises	8	1	..	7.2	..	..	53	4
Administration and support, waste management and remediation services	17	6	..	63.5	..	0.1	19	7
Educational services (private sector)	17	16	..	71.4	..	2.6	54	15
Health care and social assistance (private sector)	3	1	10.0	3.1	0.1	..	26	1
Arts, entertainment and recreation	10	5	..	10.5	..	0.2	88	52
Accommodation and food services	8	5	429.3	175.3	1.3	0.6	72	50
Other services (except public administration)	4	3	27.4	x	0.1	x	2	-
<b>All private sector</b>	<b>10</b>	<b>6</b>	<b>4,179.7</b>	<b>7,245.6</b>	<b>0.2</b>	<b>0.4</b>	<b>20</b>	<b>17</b>
Educational services (public sector)	32	28	125.9	82.9			97	12
Health care and social assistance (public sector)	3	1	20.1	0.1			98	5
Public administration	25	22	98.6	28.5			64	1
<b>All public sector</b>	<b>15</b>	<b>9</b>	<b>244.6</b>	<b>111.5</b>			<b>89</b>	<b>9</b>

.. figures not available  
 - nil or zero  
 -- amount too small to be expressed  
 x confidential

The value of Internet sales by the public sector was small in comparison to the private sector. Almost three-quarters of that came from education, as many institutions allow students to register for courses online (15% in 2000). Public administration<sup>1</sup> accounted for about one-quarter of the sector's Internet sales. However, compared to the private sector, a higher proportion of public sector institutions were equipped for online sales.

**E-commerce by size of business**

Larger businesses were more likely to sell over the Internet and were responsible for a greater proportion of online sales. In 2000, almost one-third of enterprises with more than 500 employees sold goods or services over the Internet, and were responsible for 43% of online sales. By contrast, only 6% of businesses with less than 20 employees sold online and they accounted for 18% of online sales (Chart 1).

Although there is a relationship between business size and Internet sales, this relationship is complex. Because of the industry-specific nature of business size, what may be a large enterprise in one industry will be small in another.

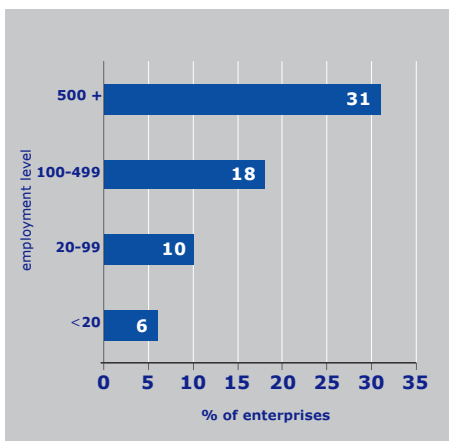
**E-commerce by industry**

One-in-five enterprises in information and cultural services<sup>2</sup> sold over the Internet, more than any other industry sector. Within this sector, nearly two-fifths (38%) of enterprises in the publishing industry and almost one-fifth of enterprises in the information and data processing services sold over the Internet in 2000. Private sector educational services also had a high percentage of businesses selling online (16%).

Wholesale trade was next in third place. Within the sector, 21% of motor vehicle and parts wholesalers sold goods or services over the Internet in 2000, higher than any other wholesale industry. By contrast, only 1% of enterprises in the private sector health care and social assistance industry received online orders. The proportion was even lower among enterprises in the

mining, and oil and gas extraction industries.

Measured by value, in 2000, Internet sales were highest in manufacturing, followed by wholesale trade, transportation and warehousing, and retail trade. Manufacturing enterprises sold \$1.3 billion worth of goods and services, representing 0.2% of their operating revenue. Most of these sales were from manufacturers of transportation equipment.



1 -- Public administration includes federal and provincial governments. Municipal governments were excluded from the survey frame.

**Chart 1.**  
*Proportion of enterprises with Internet sales, by size, 2000*

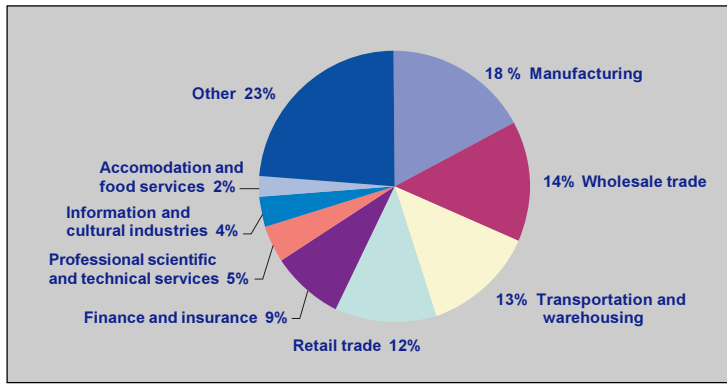
Wholesale trade enterprises sold \$1.0 billion in goods and services, representing 0.3% of the industry's total operating revenue. Internet sales by retail trade enterprises rang-in at \$890 million, accounting for 0.4% of the industry's operating revenues. Online sales by the retail industry were driven by strong sales by motor vehicle and parts dealers, and food retailers. The industrial shares of Internet sales are shown in Chart 2.

**Households ... not the customer of choice**

While much of the attention surrounding sales over the Internet had been focused on business-to-consumer (B2C) sales, households remain a comparatively unimportant market – accounting for 20% of private sector online sales in 2000.

2 -- The information and cultural services industry includes businesses engaged in publishing, motion picture and sound recording, broadcasting and telecommunications, as well as information services and data processing services (Statistics Canada 1998).





**Chart 2.**  
*Share of Internet sales by industry, 2000*

Of the \$1.4 billion sold directly to consumers, retail enterprises had the largest share at 30%, followed by wholesale trade (19%), and transportation and warehousing (12%)<sup>3</sup>.

The industries most dependent on B2C sales were arts, entertainment and recreation (88% of their Internet sales), accommodation and food services (72%), and real estate, rental and leasing services (61%). While more dependent on consumers for their online sales, these industries accounted for a very small proportion of total B2C sales (15% - Chart 3).

Business-to-business (B2B) transactions had the lion's share, with \$5.8 billion (80% of private sector Internet sales). Manufacturing enterprises accounted for the largest share of B2B sales, with 22%. Within manufacturing, transportation equipment manufacturers were the most important contributors (only 2% of their Internet sales were to consumers). Wholesale trade enterprises had a 13% share of the B2B market, with \$762 million in

sales. Retail trade enterprises had a 8% share, owing to the high value of B2B sales in food. Transportation and warehousing accounted for 14%.

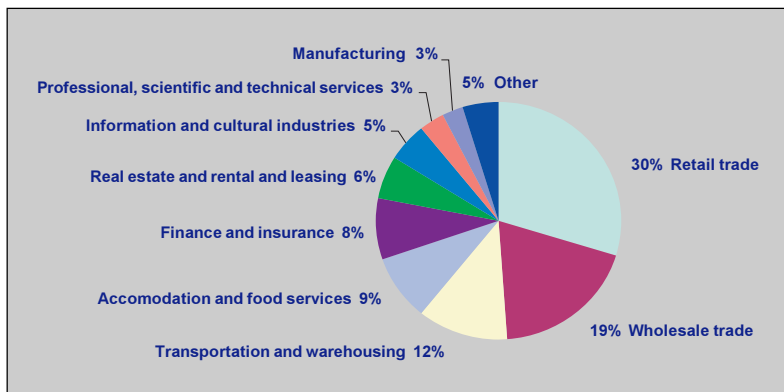
The industries most dependent on B2B for their online sales were manufacturing (97% of their Internet sales), professional, scientific and technical services (86%), and transportation and warehousing (83%). While almost all online sales by manufacturers were to businesses rather than to consumers, B2C sales were highest in clothing manufacturers and non-metallic mineral product manufacturers.

**Exports online**

The Internet is a useful tool for expanding the reach of businesses beyond national borders. Overall, 17% of online sales in 2000 were for export<sup>4</sup>. The industries with the highest proportion of Internet sales destined for other countries were professional, scientific and technical services (56% of their online sales), arts, entertainment and recreation (52%), and accommodation and food services (50%).

3 -- Some food store enterprises include wholesale establishments that sell goods to their franchisees or other retailers. As a consequence, the proportion of their online sales attributed to consumers was less than 1% of these sales.

4 -- The survey did not collect information on the break-out of exports by class of customer (i.e. business vs. consumers).



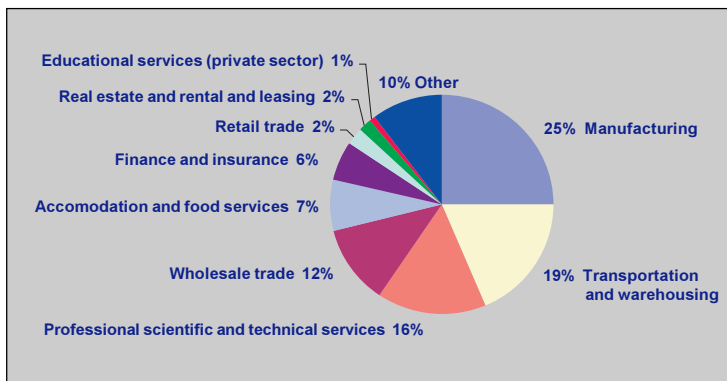
**Chart 3.**  
*Share of business-to-consumer Internet sales, by industry, 2000*

Within the professional, scientific and technical services industry, exports represented 80% of Internet sales by architectural, engineering and related services, 77% by advertising and related services, and 72% by scientific research and development services. Among the arts, entertainment and recreation industries, performing arts and spectator sports had the highest percentage of Internet sales for export (62%), while a smaller percentage of Internet sales for exports was reported by heritage institutions and the amusement, gambling and recreation industry.

Whereas the above industries were the most dependent on exports to support their electronic commerce, they were responsible for only a

small percentage of online exports. Of the \$1.2 billion in exports sold over the Internet, one-quarter was accounted for by manufacturing enterprises. Within this sector, most of the online exports came from transportation equipment manufacturers. However, wood product and paper manufacturers had the highest percentage of on-line sales for export.

Transportation and warehousing enterprises were responsible for about one-fifth of online exports, on the strength of the air transportation industry. Professional, scientific and technical services had a 16% share, with more than three-quarters of that originating in the scientific research and development services (Chart 4).



**Chart 4.**  
*Share of e-export Internet sales, by industry, 2000*

**2.2 Purchasing online**

While the selling of goods and services over the Internet offers the potential to reach new markets at comparatively low cost, the motivation behind purchasing online is cost reduction. The increased competition, due to the wider choice of suppliers, may lead to lower prices. As well, the use of Internet-based inventory management systems may permit a reduction in inventories and the associated carrying costs. For digital products or services, purchasing and downloading online is also expected to reduce distribution costs. In addition, the use of efficient logistics management<sup>5</sup> practices, including the use of third party logistics service providers, means that trucks move fully loaded, reducing transportation costs.

Although the proportion of private sector enterprises selling online decreased between 1999 and 2000, the proportion purchasing over the Internet rose from 14% to 18%. In all industries, the proportion of businesses purchasing online was greater than the proportion selling online.

The size of the enterprise emerges again as a factor, with larger firms using the Internet for their purchases more than smaller ones. The economic activity attributable to businesses that purchased online in 2000 (measured in terms of GBI) was 37%, an increase from 25% in 1999.

5 -- Logistics management involves the planning, implementation and control of the movement and storage of raw materials, goods in process, finished products and related information from the point of origin to consumption (Bess and McKeown 1998).

The industries with the highest percentage of businesses purchasing online were information and cultural (53%), private educational services (41%), and professional, scientific and technical services (41%) (Table 2).

Within the information and cultural services sector, businesses in the information services industry and data processing industry were most likely to purchase online. About three-quarters (76%) of these enterprises purchased goods or services online in 2000, representing 85% of the sector's economic activity. The high percentage of businesses purchasing online in the professional, scientific and technical services industry was driven by computer systems design and related services (58% of enterprises, representing 83% of the sector's economic

activity), and advertising and related services (59% of enterprises, representing 56% of the sector's economic activity).

### **Strong public sector presence**

Purchasing over the Internet was more prevalent in the public sector than in the private. In 2000, 49% of public sector institutions purchased goods or services online, an increase from 44% in 1999. Within the public sector, the largest percentage increase was recorded in the education sector, where nearly three-quarters of institutions made purchases over the Internet. Almost 60% of the enterprises in public administration used the Internet to purchase goods or services, while the proportion of institutions in health care and social services was smaller.

**Table 2.**  
*Purchases over the Internet, by industry*

	Enterprises purchasing over the Internet		Economic activity attributable to enterprises purchasing over the Internet	
	1999	2000	1999	2000
			%	
Forestry, logging and support activities	7	4	11	10
Mining and oil and gas extraction	19	20	25	33
Utilities	25	26	38	54
Manufacturing	19	21	32	45
Wholesale trade	14	23	23	24
Retail trade	11	13	16	32
Transportation and warehousing	11	15	28	44
Information and cultural industries	50	53	54	64
Finance and insurance	13	20	40	45
Real estate and rental and leasing	8	9	11	19
Professional, scientific and technical services	30	36	40	58
Management of companies and enterprises	13	8	17	24
Administration and support, waste management and remediation services	13	22	18	28
Educational services (private sector)	27	41	35	66
Health care and social assistance (private sector)	10	14	14	19
Arts, entertainment and recreation	12	16	17	23
Accommodation and food services	4	10	9	18
Other services (except public administration)	7	10	10	31
<b>All private sector</b>	<b>14</b>	<b>18</b>	<b>25</b>	<b>37</b>
Educational services (public sector)	61	74	66	68
Health care and social assistance (public sector)	35	41	38	47
Public administration	51	59	60	80
<b>All public sector</b>	<b>44</b>	<b>49</b>	<b>52</b>	<b>64</b>

### 2.3 E-commerce and financial performance

Many of the benefits associated with e-commerce, whether expanding markets through online sales, or reducing costs through purchases, may imply positive impacts on the profitability of businesses (OECD 1999). Analysis performed at the industry level, shows no evidence of a relationship between online sales or purchases and operating margins<sup>6</sup>.

The industries with the highest rate of sales over the Internet were transportation and warehousing (1.5%), accommodation and food services (0.6%), and professional, scientific and technical services (0.6%). In all these industries, the ratio of Internet sales to total operating revenue was miniscule. Consequently, the potential savings that could be achieved by online vendors will also be very small.

While there was a higher percentage of enterprises purchasing over the Internet rather than selling, online purchases are still a reasonably rare event and there was little relationship between the percentage of

enterprises in an industry purchasing online and the aggregate operating margin in that industry.

### 2.4 Use of EDI not on the Internet

While the survey focused mainly on electronic transactions over the Internet, there are electronic transactions that occur over proprietary networks. This may have an impact on the overall level of electronic commerce, as larger businesses with older EDI systems running on proprietary networks may be reluctant to invest in new Internet-based EDI systems. These EDI systems, however, remain important. The benefits that they offer to businesses are similar to those associated with buying and selling over the Internet. They entail the reduction of transaction costs and a decline in the inventory carrying costs, as businesses use such systems to drive their inventory out of their location and up the supply chain.

In 2000, 10% of private sector enterprises reported using EDI on a proprietary network. These tended to be larger businesses, accounting for half of all GBI in the private sector (Table 3).

6 -- A thorough investigation of this hypothesis would require the analysis of the data reported by individual enterprises in the SECT, appropriately linked to detailed financial data for the same enterprises - beyond the scope of the present study. As well, operating margins are determined by many more factors than the propensity to engage in electronic commerce. One year also catches firms at different points of cyclical changes in demand. Internet sales are still a new and rare phenomenon, used only by a minority of enterprises within an industry.

**Table 3.**  
*Use of EDI, by industry, 2000*

	Enterprises with EDI not on Internet	Economic activity attributable to enterprises with EDI not on Internet
	%	
Forestry, logging and support activities	1	10
Mining and oil and gas extraction	8	62
Utilities	16	65
Manufacturing	14	62
Wholesale trade	14	64
Retail trade	12	37
Transportation and warehousing	7	46
Information and cultural industries	12	36
Finance and insurance	18	67
Real estate and rental and leasing	6	14
Professional, scientific and technical services	10	36
Management of companies and enterprises	6	17
Administration and support, waste management and remediation services	7	19
Educational services (private sector)	10	34
Health care and social assistance (private sector)	23	26
Arts, entertainment and recreation	5	12
Accommodation and food services	4	12
Other services (except public administration)	4	26
<b>All private sector</b>	<b>10</b>	<b>50</b>
Educational services (public sector)	41	35
Health care and social assistance (public sector)	31	50
Public administration	57	55
<b>All public sector</b>	<b>37</b>	<b>49</b>

Non-Internet EDI was most prevalent in the private health care and social assistance industry (23% of enterprises, accounting for over one-quarter of the industry's GBI), followed by finance and insurance industries (18%, accounting for 67% of the industry's GBI). These are industries likely to turn to the use of proprietary networks, as this may offer the perception of enhanced security since it is more difficult to intercept personal health or financial information. For example, among health and personal care stores, 41% used such systems. The latter includes pharmacies, which would use these proprietary networks to transmit protected patient information.

Among industries that deal mainly with the sales of goods rather than services, 14% of manufacturing enterprises used a non-Internet EDI system. These were larger manufacturers, accounting for 62% of the industry's GBI. The figures were similar for enterprises in wholesale trade. In retail trade, 12% of enterprises used an EDI system, but they accounted for a smaller proportion of the industry's GBI.

The use of EDI does not preclude the use of the Internet. Industries with higher usage of non-Internet EDI systems also had a higher Internet penetration rate. This suggests that industries that have invested in legacy EDI systems are more apt to try newer technologies.

### 3. USE OF ICTS BY CANADIAN INDUSTRY

If electronic commerce is the epitome of the use of ICTs, it should be viewed in the context of an evolutionary chain of technologies, starting with the use of computers, followed by the use of the Internet and the creation of Web sites, which will eventually become transactional. Moreover, various other ICTs come into play as well, such as Intranets and Extranets<sup>7</sup> and we start to see the proliferation of wireless devices, such as wireless phones and personal digital assistants. All these are indicative of the transformation of business to e-business.

Computers have become business staples. Electronic mail facilitates the communications and transfer of knowledge within and outside an organization. The use of the Internet can bring intelligence, knowledge and opportunities from outside an organization. An enterprise's Web site may offer information on its goods or services, product and customer support or it could directly distribute digital products. It could be a transactional and secure Web site, offering goods or services available for sale online. The same technology used to create Web sites may also be used to facilitate communication within an organization, through an Intranet, or permit the sharing of this information with outside organizations, through an Extranet. Wireless communications help employees keep in touch with the organization beyond the constraints of the physical location. This section analyzes the degree of absorption and the extent to which such ICTs are utilized among the public and private sectors.

#### 3.1 Computer use

Computers have now become a basic technology and enable the use of other ICTs. In 2000, 81% of private sector enterprises used computers. These enterprises accounted for almost all economic activity (96% of GBI). As well, 58% of private sector employees had direct access to a personal computer, workstation or terminal. There was considerable variation by industry, though, ranging from nearly nine-in-ten (89%) employees in professional, scientific and technical services to just over one-quarter (27%) in accommodation and food services.

In the same year, all public sector enterprises used computers, while about two-thirds of public sector employees had direct access to computers. In education and public administration, over nine-in-ten employees had access to a computer. By contrast, only about half (54%) of health care workers had direct access to a computer.

*E-business* is broader than *e-commerce* and encompasses the introduction and use of ICTs associated with the automation and efficiency of all business processes, in addition to commercial transactions.

<sup>7</sup> -- An Intranet is an internal communications network using the same protocol as the Internet and allowing the exchange and sharing of information within an organization. Intranets are typically set up behind a firewall to control access to corporate information holdings. An Extranet is a secure extension of an Intranet that allows for external access to some parts of the organization's Intranet. This provides a business, for instance, a means to share data and build relationships with customers and suppliers. It could be a means of facilitating Internet-based EDI systems too.

As computers are an established technology, there was not much change in these figures from 1999. While the use of computers is widespread, there are still pockets of businesses that do not use them.

Computer use was lowest in the management of companies and enterprises, accommodation and food services, and forestry, logging and support activities (Table 4).

**Table 4.**  
*Computer use, by industry, 2000*

	Enterprises with computers	%	Employees with direct access to computers
Forestry, logging and support activities	66		28
Mining and oil and gas extraction	94		56
Utilities	99		76
Manufacturing	89		41
Wholesale trade	90		67
Retail trade	76		48
Transportation and warehousing	76		51
Information and cultural industries	94		89
Finance and insurance	84		79
Real estate and rental and leasing	71		58
Professional, scientific and technical services	95		89
Management of companies and enterprises	63		49
Administration and support, waste management and remediation services	87		60
Educational services (private sector)	95		83
Health care and social assistance (private sector)	90		72
Arts, entertainment and recreation	87		57
Accommodation and food services	66		27
Other services (except public administration)	76		55
<b>All private sector</b>	<b>81</b>		<b>58</b>
Educational services (public sector)	100		93
Health care and social assistance (public sector)	100		54
Public administration	100		92
<b>All public sector</b>	<b>100</b>		<b>67</b>

### 3.2 Internet use

The use of the Internet has also become commonplace in Canadian industry, with 63% of business enterprises using it in 2000 - up from 53% in 1999. These enterprises accounted for 90% of GBI.

Internet use was highest in the information and cultural services industry (93%), followed by private education services (89%), professional, scientific and technical services (84%), and utilities (81%). Within the information and cultural services industry, Internet use was highest in the ICT-sector industries. All broadcasters and telecommunications enterprises used the Internet in 2000, as did all enterprises in information and data processing. The forestry and logging sector had the lowest percentage of businesses using the Internet (42%), followed by accommodation and food industries (44%).

Increases in Internet use between 1999 and 2000 were greatest in administrative and support, waste management and remediation services<sup>8</sup>. While in 1999 55% of these enterprises used the Internet, this proportion rose to 75% in 2000. Advances were also strong in arts, entertainment and recreation (from 51% to 69%) and private sector health care and social assistance (from 46% to 62%).

The proportion of private sector employees with direct access to the Internet also increased between 1999 and 2000 from 28% to 39%. In general, industries that had a higher percentage of enterprises with Internet access also had a higher percentage of employees with Internet access. For instance, three industries gave access to the Internet to at least three-quarters of their employees: information and cultural (80%), professional,

8 -- This is a very heterogeneous industry, composed of businesses that provide support to the day-to-day activities of other businesses (i.e. facilities support, employment and travel agencies), and businesses providing waste management services (Statistics Canada 1998).

technical and scientific services (75%), and private educational services (75%), all the industries with high rates of Internet utilization. By contrast, less than one-quarter of employees in retail trade (24%), forestry and logging (17%), and accommodation and food services (13%) had access to the Internet in 2000. These industries had among the lowest Internet penetration rates.

Manufacturing was an exception, as a high proportion (78%) of enterprises used the Internet in 2000, but only 27% of their employees had direct access. Manufacturing is an industry with a relatively low percentage of salaried employees, who would likely have limited access to the Internet at work.<sup>9</sup> By contrast, in the professional, scientific and technical services, establishments have a high percentage of salaried employees and a high percentage of enterprises with Internet access. The same can be said of wholesale trade, finance and insurance, and information and cultural industries.

In addition to manufacturing, retail trade and accommodation and food services also have lower proportions of salaried employees and a smaller percentage of employees with access to the Internet.

**The public sector leads Internet use**

In the public sector, Internet use has gained near universal acceptance with 99% of public sector institutions using it in 2000, up from 95% in 1999. Over the same period, though, the proportion of public sector employees with access to the Internet fell from 59% to 50%, even though the proportion of employees with access to the Internet increased in all public sector industries (Table 5).

This can be explained by the fact that a small proportion of employees in health care and social assistance have access, in conjunction with the stronger advances in employment in that industry, particularly among hourly-paid employees, who were less likely to have access to the Internet<sup>10</sup>.

9 -- The distinction here is between salaried employees and those paid an hourly wage. Data come from the Survey of Employment, Payroll and Hours (SEPH). Comparisons should be seen as indicative only, since the employment estimates are establishment-based. A complex enterprise may contain establishments in different industries.

10--Between 1999 and 2000, employment in health care and social assistance establishments rose by about 13,000 (with a decline in employment of salaried employees and a 30,000 rise in the number of hourly employees). Over the same period, there were an additional 3,000 employees in education and 8,000 in public administration. These figures do not distinguish between public and private sector entities in the education, and the health care and social assistance industries.

**Table 5.**  
*Internet use, by industry*

	Enterprises using the Internet		Economic activity attributable to enterprises using the Internet	Employees with direct access to the Internet	
	1999	2000	2000	1999	2000
			%		
Forestry, logging and support activities	33	42	58	17	17
Mining and oil and gas extraction	61	78	97	30	39
Utilities	82	81	100	59	53
Manufacturing	64	78	95	20	27
Wholesale trade	63	75	94	46	45
Retail trade	41	53	83	13	24
Transportation and warehousing	44	57	91	18	28
Information and cultural industries	89	93	99	74	80
Finance and insurance	66	76	98	48	61
Real estate and rental and leasing	46	51	69	35	36
Professional, scientific and technical services	78	84	89	60	75
Management of companies and enterprises	47	53	77	37	35
Administration and support, waste management and remediation services	55	75	90	33	46
Educational services (private sector)	75	89	98	66	75
Health care and social assistance (private sector)	46	62	76	27	37
Arts, entertainment and recreation	51	69	91	24	40
Accommodation and food services	32	44	74	7	13
Other services (except public administration)	45	52	74	37	33
<b>All private sector</b>	<b>53</b>	<b>63</b>	<b>90</b>	<b>28</b>	<b>39</b>
Educational services (public sector)	99	99	100	90	91
Health care and social assistance (public sector)	93	99	99	23	32
Public administration	98	100	100	82	86
<b>All public sector</b>	<b>95</b>	<b>99</b>	<b>100</b>	<b>59</b>	<b>50</b>

### 3.3 E-mail

Between 1999 and 2000, the percentage of private sector enterprises using e-mail<sup>11</sup> increased from 53% to 60%. These enterprises accounted for 89% of GBI in 2000.

E-mail use was not uniform across industries. The information and cultural services sector was the highest user (91% of enterprises), with all individual industries of the sector reporting high use. Almost all enterprises in the broadcasting and telecommunications industries used e-mail, and about nine-in-ten enterprises in the publishing, motion picture and sound recording industries did so. E-mail use was also high in the professional, scientific and technical service industries (85%), private educational services (84%), and utilities (83%).

The increase in e-mail usage was greatest in industries with moderate e-mail use in 1999. Industries with the strongest advances were: administrative support, waste

management and remediation (from 52% to 70%), health care and social assistance (46% to 59%), and transportation and warehousing (39% to 51%).

The proportion of employees with direct access to e-mail advanced modestly in the private sector, from 34% in 1999 to 38% in 2000. There was again, however, considerable variability among industries. The list was topped by information and cultural (79%), followed by the professional, scientific and technical services (where over three-quarters of employees had access to e-mail), educational services, and finance and insurance. The industries with the smaller percentages of employees with e-mail access were industries with a smaller proportion of salaried (as opposed to hourly-paid) employees - accommodation and food services, forestry, retail and manufacturing (Table 6).

11--For the purposes of the SECT, e-mail is used to communicate within or outside an organization and includes e-mail over the Internet or other computer networks using X.400 and X.500 mail transfer protocols. Only unformatted text files are included in e-mail.

**Table 6.**  
*E-mail use, by industry*

	Enterprises using e-mail		Employees with direct access to e-mail	
	1999	2000	1999	2000
	%			
Forestry, logging and support activities	29	34	15	15
Mining and oil and gas extraction	60	73	42	40
Utilities	84	83	78	57
Manufacturing	63	75	28	28
Wholesale trade	65	74	56	44
Retail trade	40	48	19	21
Transportation and warehousing	39	51	26	27
Information and cultural industries	90	91	79	79
Finance and insurance	76	76	72	65
Real estate and rental and leasing	46	50	35	36
Professional, scientific and technical services	79	85	67	76
Management of companies and enterprises	45	49	44	32
Administration and support, waste management and remediation services	52	70	38	44
Educational services (private sector)	78	84	67	66
Health care and social assistance (private sector)	46	59	31	35
Arts, entertainment and recreation	52	62	29	36
Accommodation and food services	29	40	8	12
Other services (except public administration)	43	48	38	31
<b>All private sector</b>	<b>53</b>	<b>60</b>	<b>34</b>	<b>38</b>
Educational services (public sector)	99	100	90	93
Health care and social assistance (public sector)	94	99	36	39
Public administration	100	100	92	91
<b>All public sector</b>	<b>97</b>	<b>99</b>	<b>67</b>	<b>56</b>



Virtually all public sector enterprises used e-mail in 2000, and a greater percentage of public sector employees had access to e-mail (56%) than they did to the Internet (50%). More than nine-in-ten employees in the education and public administration sectors had access to e-mail, but the proportion was only 39% among employees in health and social services. This is consistent with what was observed in Internet use - salaried employees may be more likely to use e-mail at work.

Again, the apparent decline in the proportion of public sector employees with direct access to e-mail - despite increased use in each industry - is a result of the relative levels of employment in this sector, the relatively low rate of e-mail penetration among workers in health care, and the disproportionate employment growth in this industry.

### 3.4 Other ICTs

Web sites, Intranets, Extranets and wireless technologies are also parts of e-business and have penetrated Canadian business to varying degrees. In 2000, more than half of all business enterprises used wireless communications and 26% had a Web site, up from 22% in 1999. Moreover, 12% had an Intranet, while a smaller proportion (4%) had an Extranet.

Enterprises in the information and cultural services sector were most likely to have Intranets and Extranet (26% and 15%, respectively), and more than three-quarters of them used wireless communications. Use of Intranets and Extranets was also relatively high in finance and insurance, and private educational services. The latter topped the list for availability of Web sites. Industries least likely to use wireless communications were management of companies and enterprises (although they had relatively high availability of Intranets and Extranets), and accommodation and food services. The complete set of figures is shown in Table 7.

**Table 7.**  
*E-mail use, by industry, 2000*

	Enterprises with a Web site	Enterprises with Intranet	Enterprises with Extranet	Enterprises using wireless communications
	%			
Forestry, logging and support activities	5	2	0	43
Mining and oil and gas extraction	23	16	3	76
Utilities	31	25	8	71
Manufacturing	38	17	5	63
Wholesale trade	34	17	6	64
Retail trade	23	8	4	40
Transportation and warehousing	13	7	4	63
Information and cultural industries	54	26	15	76
Finance and insurance	34	29	11	54
Real estate and rental and leasing	22	11	4	45
Professional, scientific and technical services	30	19	6	64
Management of companies and enterprises	17	11	10	28
Administration and support, waste management and remediation services	33	13	5	65
Educational services (private sector)	70	29	10	39
Health care and social assistance (private sector)	16	7	2	43
Arts, entertainment and recreation	36	10	2	52
Accommodation and food services	18	3	1	36
Other services (except public administration)	22	6	1	39
<b>All private sector</b>	<b>26</b>	<b>12</b>	<b>4</b>	<b>51</b>
Educational services (public sector)	99	72	36	76
Health care and social assistance (public sector)	61	38	17	63
Public administration	96	91	42	81
<b>All public sector</b>	<b>73</b>	<b>52</b>	<b>24</b>	<b>68</b>

Larger businesses emerge again as the early adopters of progressively more sophisticated technologies. Enterprises that used wireless telecommunications accounted for three-quarters of economic activity, those with a Web site for 64%, and those with an Intranet for 56%. Even more revealing, the few that had Extranets accounted for a full 36% of GBI.

The significance of size was especially true in manufacturing (5% of enterprises with Extranets accounted for 45% of GBI), utilities (9% of enterprises with Extranets accounted for 58% of GBI), finance and insurance (11% of enterprises with Extranets accounted for 47% of GBI) and information and cultural service industries (15% of enterprises with Extranets accounted for 47% of GBI).

There was considerable variability in the evolution of penetration rates between 1999 and 2000, both by industry and by technology. In Web sites, for instance, private sector education services posted the largest increase (from 44% of enterprises to 70%), to become the industry with the highest proportion. The percentage of enterprises in information and cultural industries with a Web site actually fell (from 62% to 55%), whereas their proportion of the industry's economic activity increased from 81% to 89%. This may be related to the collapse of the pure dot-com companies and represents further evidence of consolidation.

In general, industries with a high rate of computer use and higher percentage of employees with access to a computer also had a higher penetration rate of Intranets. In turn, Extranets were more likely to be used by enterprises in industries where there is a high Intranet penetration rate.

There were exceptions to these. Among enterprises in the private health care and social services sector, a high proportion of employees had access to a computer, but only 7% of the industry's enterprises had an Intranet. These tend to be smaller

offices of doctors or dentists, which may have no need for an internal company communications network. The manufacturing sector was also an exception. The sector had a sizeable 17% of enterprises with an Intranet, but only 41% of employees with direct access to a computer. As discussed earlier, though, manufacturers had a higher proportion of hourly-paid employees, who were less likely to have access to a computer. The same holds true for mining and oil and gas, which also had a high percentage of businesses with an Intranet but a lower proportion of employees with access to a computer.

### **ICT use higher in public sector**

While there seems to be some reticence among private sector businesses to adopt these technologies, the public sector emerges again as a heavy user. Almost three-quarters (73%) of public sector institutions had Web sites - a proportion that remained unchanged from 1999. Moreover, the pervasiveness among educational services and the public administration is nearly complete. It is only the high number of enterprises in the health and social services sector that dampens the aggregate rate.

The use of Intranets is also widespread, with the lowest rate, in health and social services, exceeding the highest rate among private sector industries. The same holds true for Extranets. In addition to the high level of usage already achieved, 14% of public sector institutions expected to have one in 2001.

### **Web offerings**

Finally, it is instructive to begin to understand what uses these technologies are being put to and what characteristics they possess. Overall, among private sector enterprises, nearly one-quarter (24%) of private sector Web sites offered interactivity, 18% had secure sites, 16% offered information about employment opportunities, 13% offered digital products or services, 12% had a privacy policy statement, and 8% offered online payment.

Utilities were more likely than other sectors to offer more advanced features, such as online payment (19% of Web sites), interactivity (38%), a secure site (36%), and information concerning employment opportunities (34%). The detailed results are shown in Table 8.

The public education and public administration sectors were more likely to offer more sophisticated Web sites, even compared with the private sector. In the public education sector, nearly one-in-five

Web sites offered online payment and over two-fifths offered interactivity. A majority offered information on employment opportunities.

Public administration was more likely to offer interactivity, digital products, a secure Web site and a privacy policy statement than any other industry, public or private. This suggests that governments at both the federal and provincial levels are well on their way to delivering products and services.

**Table 8.**  
*Characteristics of web sites, by industry, 2000*

	Online payment	Interactivity	Digital products or services	Secure web sites	Private policy statement	Information about employment opportunities
	%					
Forestry, logging and support activities	15	1	7	26	1	26
Mining and oil and gas extraction	9	14	3	11	7	15
Utilities	19	38	6	36	14	34
Manufacturing	5	23	8	14	5	13
Wholesale trade	8	19	7	21	7	10
Retail trade	12	26	17	22	20	17
Transportation and warehousing	9	30	7	19	4	20
Information and cultural industries	16	29	21	31	14	24
Finance and insurance	15	31	16	32	33	20
Real estate and rental and leasing	3	23	11	17	11	10
Professional, scientific and technical services	7	21	24	17	12	24
Management of companies and enterprises	10	34	4	4	10	29
Administration and support, waste management and remediation services	2	23	16	15	8	16
Educational services (private sector)	4	33	16	22	18	31
Health care and social assistance (private sector)	5	18	1	3	7	18
Arts, entertainment and recreation	2	22	2	10	2	10
Accommodation and food services	13	26	10	16	14	18
Other services (except public administration)	9	21	5	17	11	7
<b>All private sector</b>	<b>8</b>	<b>24</b>	<b>13</b>	<b>18</b>	<b>12</b>	<b>16</b>
Educational services (public sector)	19	44	26	52	36	66
Health care and social assistance (public sector)	2	14	1	20	16	53
Public administration	10	59	31	52	49	63
<b>All public sector</b>	<b>7</b>	<b>30</b>	<b>13</b>	<b>34</b>	<b>27</b>	<b>58</b>

#### 4. SUMMARY REMARKS AND FUTURE WORK

Electronic commerce is becoming an established feature of the Canadian business landscape. Between 1999 and 2000, the value of orders received by the private sector over the Internet with or without online payments expanded by 73% to \$7.2 billion, doubling in importance from 0.2% to 0.4% of total operating revenue. Over the same period, however, the proportion of businesses selling online declined, as Internet selling became concentrated into fewer, larger businesses. By contrast, the proportion of businesses purchasing goods or services over the Internet was much more prevalent and increased. Nearly one-in-five private sector enterprises bought goods or services online. Monitoring of the developments will show whether this trend will hold or be reversed.

In 2000, 80% of all Internet sales were to businesses. The industries with the highest shares of B2B sales were manufacturing, wholesale trade and retail trade. In addition, 17% of all Internet sales (to businesses and consumers) were for export. The most important e-exporting industries were manufacturing; transportation and warehousing, and professional, scientific and technical services.

Among businesses that did not buy or sell over the Internet, over half believed that their goods or services did not lend themselves to Internet transactions. About one-third preferred to maintain their current business model. A smaller proportion of these enterprises felt that security was a concern or that the cost of development and maintenance was too high.

In addition, to using the Internet, EDI over proprietary networks was also used by one-in-ten private sector enterprises. The use of EDI over proprietary networks was highest in health care, finance and insurance, utilities, wholesale trade and manufacturing industries.

As well, the use of other ICTs generally advanced between 1999 and 2000 and the percentage of private sector employees with Internet access rose.

Moreover, it has been the public sector that has been leading in the use of these technologies. The Internet was used by almost all public sector institutions, between 1999 and 2000. Nearly three-quarters had a Web site, which was generally more sophisticated than those of the one-quarter of private sector enterprises. Over one-half of public sector institutions had an Intranet, and almost one-quarter had Extranets. At the same time, slightly more than one-in-ten private sector enterprises had Intranets and only a handful large ones had Extranets. A higher percentage of public sector institutions used e-mail, and a higher percentage of public sector employees had direct access to e-mail.

This paper focused on e-commerce and the use of ICTs, with an emphasis on sectoral analyses. While the technologies are becoming more pervasive, the impacts of their use remain unexplored. E-commerce in particular is still a rare occurrence and impacts are unclear in the aggregate data. The focus of future work will be the analysis of microdata, with an emphasis on linking the data collected in SECT with other data that could uncover the relationship between the use of ICTs and the firms' financial performance. As well, future work will take interest in particular industries.

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