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Networked Canada

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A few words from the Editor

We are surrounded by computers and countless other digital devices. Few people today have not heard of the Internet. Yet, despite the wide recognition and influence of information and communications technologies (ICTs), we should not forget that many such goods and services are parts of our lives only for a short time. Together, new and earlier ICTs have created a maelstrom, the outcomes and full impacts of which are still too early to assess. But we can begin by monitoring the state and growth of their penetration and use.

Information in this area plays a crucial role in understanding where we are and where we are going as societies. Statistics Canada has been active on this front by taking the pulse of the nation, from households to businesses to governments, and by examining new issues, including pioneering work on e-commerce. Our current contribution comes in the form of this compendium publication, produced under our Connectedness program. Such a product would not have been possible even three years ago, as household statistics on the accessibility and use of ICTs were at their early stages, there were no indicators on business, government and education connectivity, and there was no agreed-upon definition of the ICT sector.

The publication is organized in two parts. Part I contains a statistical profile of the ICT sector, as defined by the OECD on the basis of work carried out by its Working Party on Indicators for the Information Society (WPIIS). The sector represents a collection of businesses, through the industries to which they belong, that are at the core of the supply of ICTs, whether on the manufacturing or the services side. A compilation of key variables – GDP, employment, exports, imports, revenues and R&D – is presented, together with an analysis of their growth performance over recent years. As well, international comparisons are offered. Part II follows a different approach, and goes beyond the ICT sector. It examines individual ICTs, notably the Internet, and analyzes their penetration and use across all economic sectors – households, businesses and governments, including education. In effect, Part II provides an alternative appreciation of the transformation brought about by the widespread diffusion of ICTs.

It is the first time that we have produced such a comprehensive ICT compendium. The integration of data from numerous sources, intended for diverse uses, posed several challenges that needed to be overcome. Some relate to the transition of statistical programs from one industrial classification to another (1980 SIC to NAICS), some to the unavailability at present of data at the level of industry detail required by the definition of the ICT sector, and others to variables measured both by industry surveys and cross-economy vehicles. Although no effort was spared to produce the best product possible, some limitations remain. These are documented in the Notes, Methodologies and Data sources section of the publication. Bibliographical references are also included.

Your feedback and suggestions on how to tailor future products in a way that will serve your needs better are most welcome. While we shall continue to improve our work in this area, I hope you find this publication useful.

George Sciadas, April 2001

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Symbols

The following standard symbols are used in Statistics Canada publications:

..	figures not available.
...	figures not appropriate or not applicable.
-	nil or zero.
r	revised figures.
x	confidential to meet secrecy requirements of the Statistics Act.
()	negative value.

Abbreviations

CAGR	Compound Annual Growth Rate
CANSIM	Canadian Socio-Economic Information Management System
EU	European Union
G7	Group of Seven (industrial nations)
GDP	Gross Domestic Product
GOL	Government Online
ICT	Information and communications technology
ISIC	International Standard Industrial Classification
NAICS	North American Industry Classification System
OECD	Organization for Economic Co-operation and Development
R&D	Research and development
SEPH	Survey of Employment, Payrolls and Hours
SIC	Standard Industrial Classification
WPIIS	Working Party on Indicators for the Information Society

Acknowledgments

This publication would not have been possible without the collective effort over time of many individuals in many places. In many ways, it reflects the power of collaboration in the incremental building of knowledge.

Thanks are due to colleagues from many countries who came to a consensus on the definition of the ICT sector under the OECD'S Working Party on Indicators for the Information Society (WPIIS). Fred Gault, as the chair of WPIIS, was instrumental in that effort. In addition, he was supportive throughout this project and provided valuable comments and suggestions. George Sciadas supervised the project and edited the final manuscript. Daniel April carried out all the necessary classification work, developing the concordances between the ISIC-based definition and NAICS, as well as the 1980 SIC. He also offered expert assistance regarding concepts, methods and data sources. Heidi Ertl was the principal author of the compendium, shouldering the brunt of the work, enduring the everyday responsibilities of collecting, synthesizing and analyzing the data, and dealing with information sources, concepts, definitions and methodologies. Robert Trudeau assisted throughout the various stages of the project in administrative, research and technical duties. Lucienne Sabourin did a superb job in the layout and the publication of the final product.

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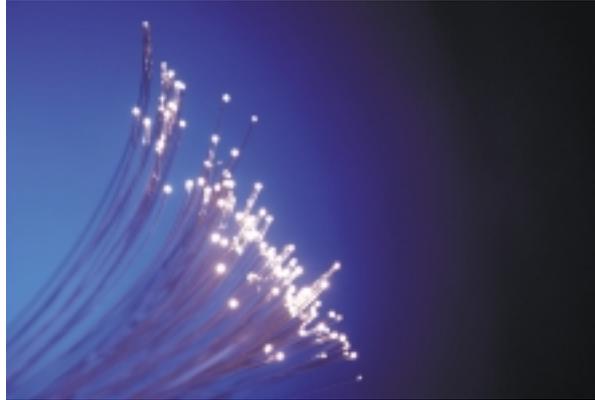


Part I

A Statistical Profile of the ICT Sector

1.1 Defining the ICT sector

For years, the term 'information and communications technologies' (ICTs) has been widely used to describe both the fast-paced, new-growth industrial segment of the economy, as well as the continuous introduction of new technologies that foster the information society. Policy makers and analysts in Canada and around the world have been striving to understand and measure the importance of the 'ICT sector'. However, without a widely accepted and consistently applied definition of the sector, this was an impossible task – efforts were either not comparable over time or across countries. In 1998, major progress was achieved when countries within the Organization of Economic Co-operation and Development (OECD) reached an important consensus on an industry-based definition of the ICT sector, under work carried out by the Working Party on Indicators for the Information Society (WPIIS). The development of the ICT sector definition provides a statistical framework for international comparisons and intertemporal measurements of this rapidly evolving sector (*Measuring the ICT Sector*, OECD, 2000).



Manufacturing industries in the ICT sector include establishments that manufacture products intended to fulfill information processing and communications functions including transmission and display, or use electronic processing to detect, measure and/or record physical phenomena, or to control a physical process.

The products of the ICT services industries must be intended to enable the function of information processing and communication by electronic means.

The ICT sector is defined as the combination of manufacturing and services industries, which electronically capture, transmit and display data and information. This list of industries was drawn from the International Standard Industrial Classification (ISIC, Rev.3). Concordances were developed between these industries and the industry classification standards used in Canada (*Innovation Analysis Bulletin*, Statistics Canada, 2000). Until recently, the industry standard used in Canada was the 1980 Canadian Standard Industrial Classification (SIC), which is now being replaced by the 1997 North American Industry Classification System (NAICS). This new classification system has the advantage of recognizing new industries, especially in the two fast-growth areas of computer services and telecommunications. To the extent possible, the statistical analysis presented here is NAICS-based.

Figure 1.

NAICS-based ICT sector industries

Manufacturing:	Services:
Commercial and service industry machinery (33331)	Software publishers (51121)
Computer and peripheral equipment (33411)	Cable and other program distribution (51322)
Telephone apparatus (33421)	Telecommunications services (5133)
Radio and television broadcasting and wireless communications equipment (33422)	Other information services (51419)
Audio and video equipment (33431)	Data processing services (51421)
Semiconductor and other electronic components (33441)	Computer systems design and related services (54151)
Navigational, measuring, medical, and control instrumentation (33451)	Electronic and precision equipment repair and maintenance (81121)
Communication and energy wire and cable (33592)	Computer, computer peripheral and pre-packaged software wholesaling (41731)
	Electronic components, navigational and communications equipment and supplies wholesaling (41732)
	Office and store machinery and equipment wholesaling (41791)
	Office machinery and equipment rental and leasing (53242)

Due to data limitations, the industries of Office machinery and equipment rental and leasing (NAICS 53242) and Electronic precision equipment repair and maintenance (NAICS 81121) are not included in the ICT sector totals presented in this publication.

Figure 2.

1980 SIC-based ICT sector industries

Manufacturing:	Services:
Record players, radio and t.v. receivers (3341)	Cable television (4814)
Telecommunications equipment (3351)	Telecommunication carriers (4821)
Electronic parts and components (3352)	Other telecommunication industries (4839)
Other electronic equipment industries (3359)	Computer services (7721)
Electronic computers and peripheral equipment (3361)	Computer equipment maintenance and repair (7722)
Electronic office, store and business machines (3362)	Electronic machinery, equipment and supplies, wholesale (5743)
Other office, store and business machine industries (3369)	Computer and related machinery, equipment and software, wholesale (5744)
Communications and energy wire and cable (3381)	Office and store machinery, equipment and supplies, wholesale (5791)
Indicating and recording instruments (3911)	Office furniture and machinery rental and leasing (9913)
Other instruments and related products (3912)	

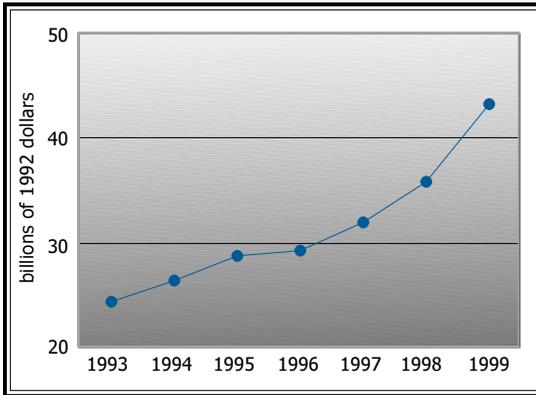
1.2 The ICT sector at a glance

- The ICT sector contributed \$43.3* billion to Canada's gross domestic product (GDP) in 1999, accounting for 6.9% of business sector GDP, and 5.8% of total economy GDP.
- ICT sector growth over the 1993-1999 period was a remarkable 78.3%, substantially higher than business sector growth and more than three times the growth of the total economy.
- In 1998, the ICT sector accounted for 3.5% of economy-wide employment.
- Between 1993 and 1998, employment in the ICT sector increased by 23.0%, more than double the economy-wide employment growth (10.0%).
- Exports of ICT goods and services totaled \$30.3 billion and imports \$53.8 billion in 1999, representing 8.0% and 15.4% of total exports and imports, respectively.
- Despite strong growth in ICT merchandise exports, the deficit in ICT trade has grown from \$12.0 billion in 1993 to \$23.5 billion in 1999.
- ICT revenues reached \$78.8* billion in 1998, or 4.4% of total industry revenues.
- ICT sector expenditures on research and development (R&D) reached \$4.2 billion in 1998, accounting for 46.0% of total private sector R&D.
- The Canadian economy is more ICT intensive than the average for OECD countries, when measured in terms of employment and R&D expenditures.

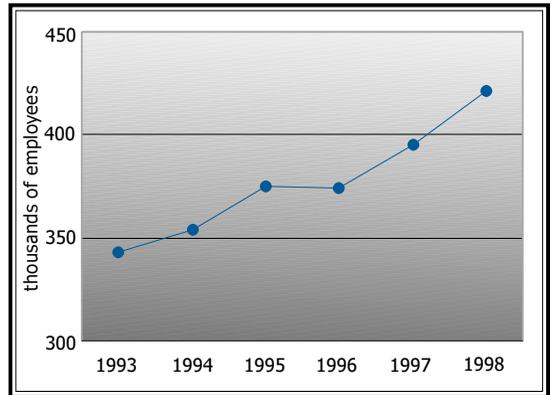
* ICT wholesaling is not included.

ICT Sector

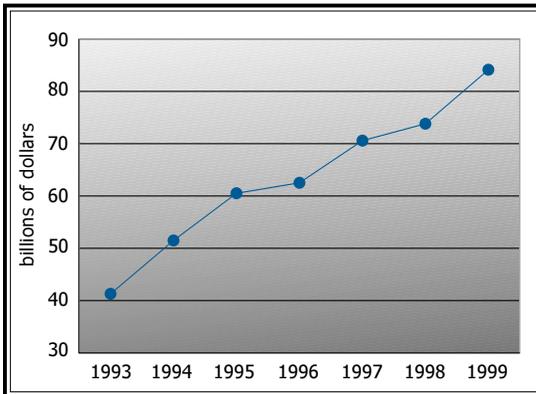
GDP



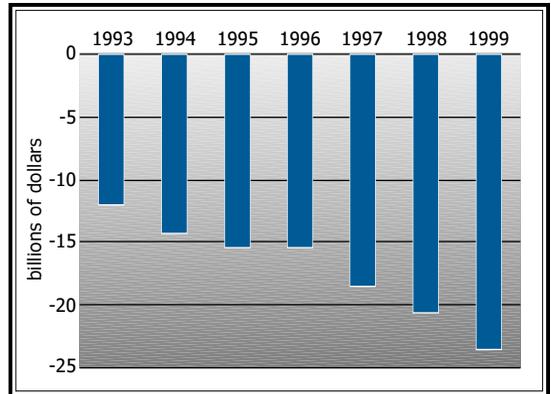
Employment



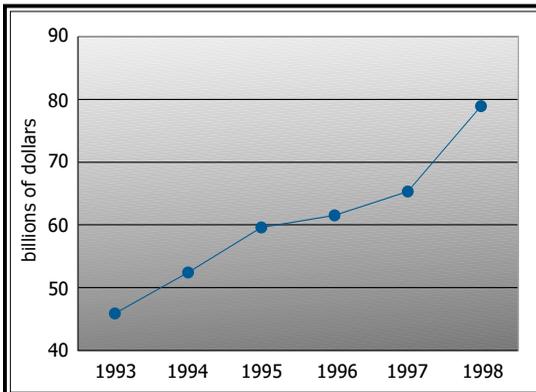
Exports and Imports



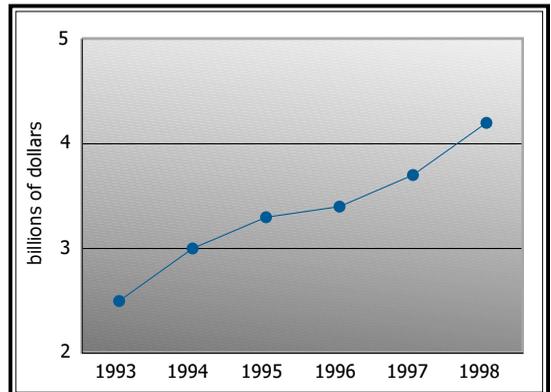
Trade balance



Revenues



R&D



2.1 Production

The Canadian ICT sector is making a substantial contribution to economic growth in Canada. ICT industries contributed \$43.3* billion to Canada's GDP in 1999, representing 6.9% of business sector GDP, and 5.8% of total economy GDP. Fast growth in the ICT sector, particularly over the last two years, has led to an increasing share of business sector GDP – up by nearly two percentage points from its 5.0% share in 1993.

Figure 3. ICT sector GDP*, 1993-1999

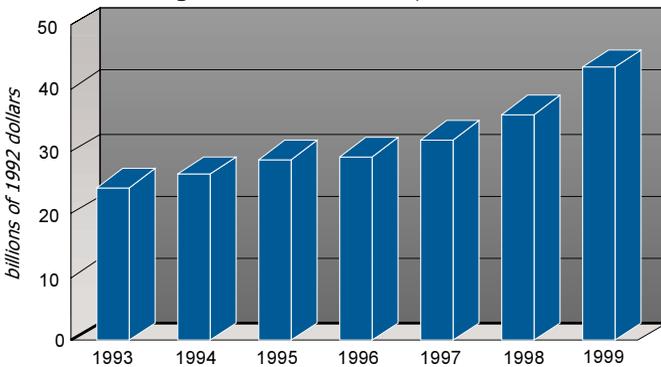
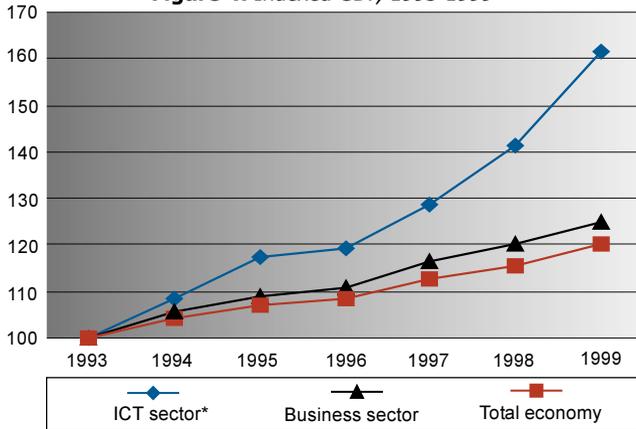


Figure 4. Indexed GDP, 1993-1999



Gross Domestic Product at factor cost (GDP) is a measure of the economic production, which takes place within the geographical boundaries of Canada. GDP by industry is designed to show the industrial distribution of total output. GDP for a single industry is also referred to as net output, or value added. Conceptually, it is equal to the total value of production by the industry (gross output) less the value of inputs purchased from other industries or inputs which have been imported (intermediate inputs) (Gross Domestic Product by Industry, Industry Measures and Analysis Division, Statistics Canada).

Average annual compounded GDP growth for the ICT sector was 10.1% over the 1993-1999 period, as compared to business sector growth of 4.2%, and economy-wide growth of 3.3%. Over the same period, total growth for the ICT sector was a remarkable 78.3%, substantially higher than business sector growth (27.8%), and more than three times the growth of the total economy (21.8%).

* GDP for ICT wholesaling is not included.

Between 1993 and 1999, GDP shares for the manufacturing and services industries of the ICT sector have generally remained stable, with services generating the largest share. Within the services sector, the telecommunications industry boasted the largest contribution to Canadian GDP at \$19 billion. However, GDP for ICT sector manufacturing industries is growing somewhat faster than the services industries.

Figure 5. ICT sector structure, 1999 (GDP)*

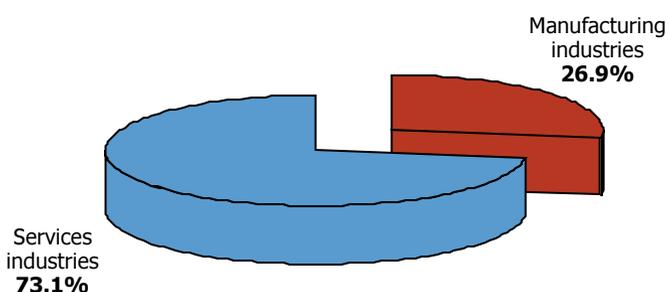


Table 1.

ICT sector GDP*, 1993-1999

	1993	1994	1995	1996	1997	1998	1999	99/93	CAGR (99/93)
	<i>billions of 1992 dollars</i>							<i>%</i>	
Manufacturing	6.1	6.8	7.8	7.4	8.3	9.6	11.6	90.6	11.4
Services	18.2	19.6	21.0	21.8	23.6	26.4	31.7	74.2	9.7
Total ICT sector	24.3	26.4	28.8	29.2	31.9	36.0	43.3	78.3	10.1
Business sector	489.6	516.6	533.2	545.3	574.5	595.5	625.7	27.8	4.2
ICT as a %	5.0	5.1	5.4	5.4	5.6	6.0	6.9	...	...
Total economy	618.4	646.0	663.1	672.8	700.0	721.9	753.0	21.8	3.3
ICT as a %	3.9	4.1	4.3	4.3	4.6	5.0	5.8	...	...

Source: Industry Measures and Analysis Division, Statistics Canada.

* GDP for ICT wholesaling is not included.

2.2 Employment

The ICT sector is a major source of new jobs, as its share of employment continues to grow steadily. In 1998, 421 thousand employees were working in the sector, accounting for 3.5% of economy-wide employment. This represents a steady increase from previous years when ICT sector employment was 3.2% (1993) and 3.3% (1995) of total economy employment. Between 1993 and 1998, employment in the sector increased by 23.0%, well surpassing economy-wide employment growth of 10.0%. In the last two years, ICT sector employment growth has been especially strong.

Figure 6. ICT sector employment, 1993-1998

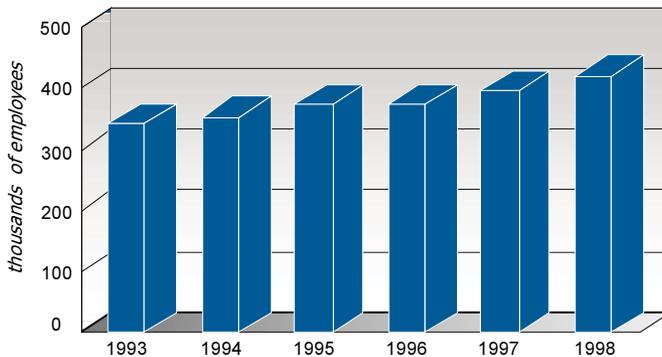
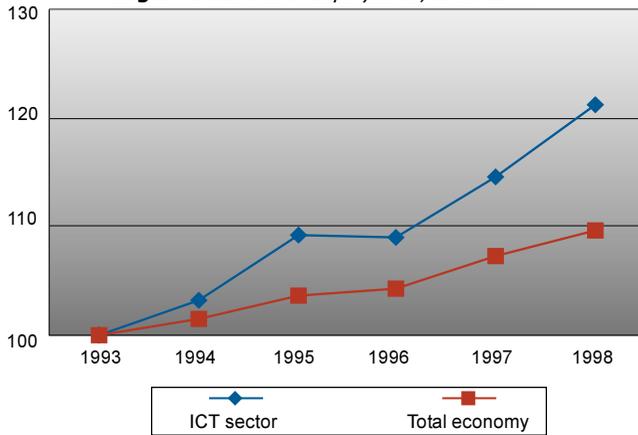


Figure 7. Indexed employment, 1993-1998

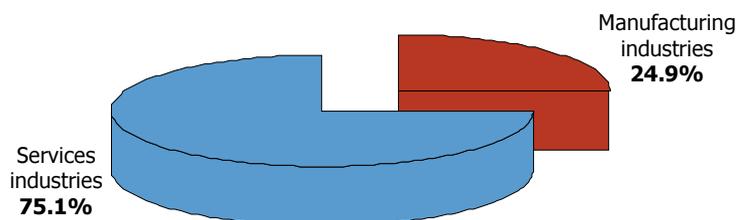


In most cases, employment estimates were drawn from the various industry surveys and do not include self-employment. Employment data for ICT wholesale (NAICS 4173, 41791) and telecommunications (NAICS 5133) industries were taken from the Survey of Employment, Payrolls and Hours (SEPH). For the Computer Services industries (NAICS 51121, 51419, 51421, 54151), 1997 and 1998 employment figures also include estimates for those who filed Canada Customs and Revenue Agency non-employer income tax forms for those years. See the Notes, Methodologies and Data sources section for more information.

Average annual employment growth over the period was 4.2% for the ICT sector, more than double the annual economy-wide employment growth of 1.9%.

Employment in the services industries expanded by 25.6% over the reference period – most of these employment gains occurred in the computer services industry, where the number of employees has grown by 71.0% since 1993. This fast-paced growth has led to an increasing share of employment for ICT sector services industries, which accounted for three quarters of total ICT sector employment in 1998.

Figure 8. ICT sector structure, 1998 (Employment)

Table 2.
ICT sector employment, 1993-1998

	1993	1994	1995	1996	1997	1998	98/93	CAGR (98/93)
	<i>thousands of employees</i>						<i>%</i>	
Manufacturing	90.5	90.3	95.0	93.5	99.6	104.7	15.8	3.0
Services	252.2	263.7	279.8	280.8	295.5	316.7	25.6	4.7
Total ICT sector	342.7	354.0	374.8	374.3	395.1	421.4	23.0	4.2
Total economy	10,831.3	10,994.4	11,228.3	11,311.1	11,643.2	11,918.3	10.0	1.9
ICT as a %	3.2	3.2	3.3	3.3	3.4	3.5	...	...

Source: Various industry surveys. See Notes, Methodologies and Data sources section for more information.

Table 3.
ICT sector employment by industry, 1998

NAICS Industries	<i>thousands of employees</i>	1998
Manufacturing		
3333	Commercial and Service Industry Machinery	10.6
3341	Computer and Electronic Products	14.9
33421, 33422	Communications Equipment	26.2
3343	Audio and Video Equipment	1.2
3344	Semiconductor and Other Electronic Components	20.5
3345	Navigational, Measuring, and Control Devices	24.2
33592	Communication and Energy Wire and Cable	7.1
Services		
4173, 41791	ICT Wholesaling	71.7
51121, 51419, 51421, 54151	Computer Systems Design and Related Services	122.1
5133	Telecommunications	113.6
51322	Cable	9.3

Source: Various industry surveys. See Notes, Methodologies and Data sources section for more information.

2.3 International trade

Canadian ICT trade is growing at a remarkable pace. Exports were valued at \$30.3 billion in 1999, more than twice as much as their value in 1993. This represents 8.0% of total exports. Imports reached \$53.8 billion, more than double their value in 1993, representing 15.4% of total Canadian imports. Between 1993 and 1998, total Canadian exports experienced unprecedented growth, at an average annual rate of 11.2%, and ICT exports grew even more at an average rate of 12.8% annually. Over the same period, ICT imports grew at an average annual rate of 12.5%, while average annual growth for total imports was 10.9%.

Merchandise trade data are captured as commodities. In an effort to produce industry trade data, Statistics Canada assigns exported commodities to industries. Trade data for services are reported by product category. See Notes, Methodologies and Data Sources for more information.

Figure 9. ICT exports, 1993-1999

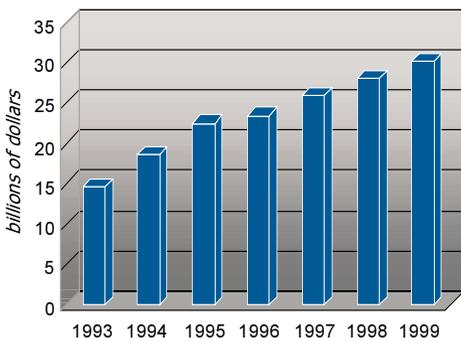
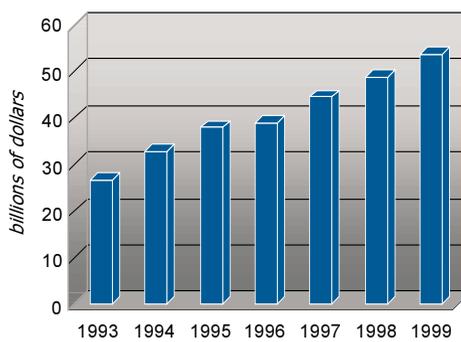


Figure 10. ICT imports, 1993-1999



Most of our ICT trade comes from merchandise. ICT merchandise exports expanded to \$27.4 billion in 1999, accounting for 90.6% of ICT exports, 7.7% of total merchandise exports, and 7.2% of total exports. Imports of ICT goods represented 16.0% (\$51.1 billion) of total merchandise imports, up from its share of 14.7% in 1993. Receipts for ICT services totaled \$2.9 billion in 1999, while payments for ICT services stood at \$2.6 billion.

Figure 11. ICT exports structure, 1999

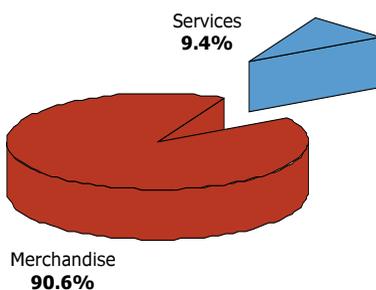
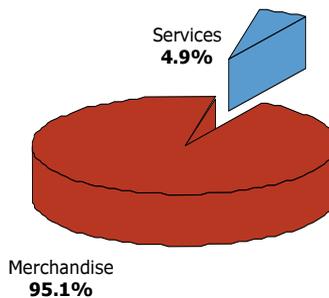


Figure 12. ICT imports structure, 1999



At 24.5%, exports of computers and peripheral equipment represented the largest share of ICT merchandise exports in 1999. Exports of communication equipment and electronic components were valued at \$15.6 billion, accounting for over half of ICT merchandise exports. Together, these ICT industries represented 4.4% of total Canadian merchandise exports.

Electronic components represented the largest share of ICT merchandise imports (34.4%), accounting for 5.5% of total Canadian merchandise imports. Computer and peripheral equipment imports were valued at \$11.0 billion, or 21.5% of ICT merchandise imports.

Exports of computer services were valued at \$1.4 billion in 1999, followed by telecommunications carriers at \$1.2 billion, and information services at \$0.2 billion. Imports of telecommunications carriers were the highest (\$1.4 billion) of the ICT services, accounting for over half (54.8%) of total ICT services payments.

Despite the strong growth in ICT merchandise exports, the ICT trade deficit has almost doubled, from \$12.0 billion in 1993 to \$23.5 billion in 1999. Increasing imports of electronic components have contributed significantly to this rising deficit.

The U.S. is our largest trading partner, with slightly more than 83% of ICT merchandise exports destined for that country. ICT imports are more diversified with just over half of the merchandise imports coming from the United States. Canadian ICT merchandise exports also go to the U.K. (3.3%), Hong Kong (1.1%), and Germany (0.8%), while a significant portion of Canadian ICT merchandise imports also comes from Japan (8.9%), Taiwan (4.6%), and Mexico (4.5%).

Figure 13. ICT trade balance, 1993-1999

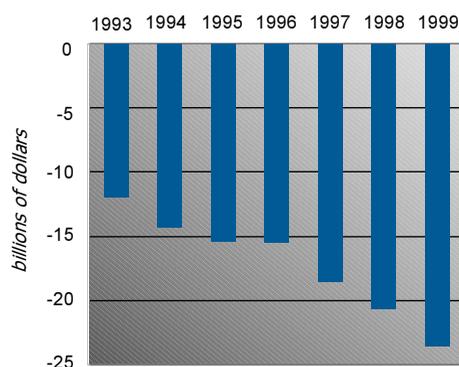


Table 4.

ICT merchandise exports, top 5 countries of destination, 1993-1999

	1993	1994	1995	1996	1997	1998	1999	99/93
	<i>billions of dollars</i>							<i>%</i>
United States	10.0	13.1	16.1	17.0	18.7	20.6	22.9	129.9
United Kingdom	0.3	0.4	0.6	0.6	0.7	0.7	0.9	167.9
Hong Kong	0.1	0.2	0.2	0.2	0.3	0.3	0.3	168.6
Germany	0.2	0.2	0.4	0.4	0.2	0.2	0.2	7.6
France	0.1	0.1	0.1	0.1	0.2	0.2	0.2	77.7
Others	2.1	2.5	2.7	3.0	3.3	3.1	3.0	42.9
Total ICT Exports								
All countries	12.8	16.5	20.1	21.3	23.4	25.1	27.4	114.2

Source: International Trade Division, Statistics Canada.

Table 5.
ICT exports, 1993-1999

	1993	1994	1995	1996	1997	1998	1999	99/93	CAGR (99/93)
<i>billions of dollars</i>								<i>%</i>	
Merchandise	12.8	16.5	20.1	21.3	23.4	25.1	27.4	114.2	13.5
Services*	1.9	2.1	2.4	2.2	2.6	3.0	2.9	52.4	7.3
Total ICT sector	14.7	18.6	22.5	23.5	26.0	28.1	30.3	106.3	12.8
Total Merchandise Exports	187.5	225.7	262.3	275.8	299.3	318.5	354.1	88.8	11.2
ICT as a %	6.8	7.3	7.7	7.7	7.8	7.9	7.7	...	...
Total Commercial Services Exports	13.1	15.5	16.8	19.4	21.9	25.0	26.2	100.0	12.2
ICT as a %	14.3	13.7	14.5	11.5	11.9	12.1	10.9	...	...
Total Exports	200.6	241.2	279.1	295.2	321.3	343.6	380.3	89.6	11.2
ICT as a %	7.3	7.7	8.1	8.0	8.1	8.2	8.0	...	...

Source: International Trade Division, Balance of Payments Division, Statistics Canada.

* Includes telecommunications, computer and information services. Information services includes news agency services, which do not belong to ICTs.

Table 6.
*ICT exports, by type, 1999**

	<i>billions of dollars</i>	1999
Merchandise		
Record Player, Radio and Television Receiver		0.3
Telecommunication Equipment		6.3
Electronic Parts and Components		5.8
Other Communication and Electronic Equipment		3.5
Electric Computing and Peripheral Equipment		6.7
Office, Store and Business Machine		0.5
Communications and Energy Wire and Cable		1.1
Indicating, Recording and Controlling Instruments		1.3
Other Instruments and Related Products		1.9
Services		
Telecommunications		1.2
Computer		1.4
Information		0.2

Source: International Trade Division, Balance of Payments Division, Statistics Canada.

* Merchandise trade data are captured as commodities. In an effort to produce industry trade data, Statistics Canada assigns exported commodities to industries.

Table 7.
ICT imports, 1993-1999

	1993	1994	1995	1996	1997	1998	1999	99/93	CAGR (99/93)
<i>billions of dollars</i>								<i>%</i>	
Merchandise	25.0	30.9	36.0	37.0	42.2	45.9	51.1	104.7	12.7
Services*	1.5	1.8	1.9	2.0	2.4	2.9	2.6	76.8	10.0
Total ICT sector	26.5	32.7	38.0	39.0	44.6	48.7	53.8	103.1	12.5
Total Merchandise Imports	170.0	202.7	225.6	232.6	272.9	298.5	320.0	88.2	11.1
ICT as a %	14.7	15.2	16.0	15.9	15.5	15.4	16.0	...	...
Total Commercial Services Imports	16.9	19.6	20.3	22.4	24.8	27.5	28.2	67.4	9.0
ICT as a %	8.8	9.3	9.5	8.8	9.6	10.4	9.3	...	...
Total Imports	186.8	222.3	245.8	254.9	297.6	326.0	348.1	86.4	10.9
ICT as a %	14.2	14.7	15.4	15.3	15.0	14.9	15.4	...	...

Source: International Trade Division, Balance of Payments Division, Statistics Canada.

* Includes telecommunications, computer and information services. Information services includes news agency services, which do not belong to ICTs.

Table 8.
*ICT imports, by type, 1999**

	<i>billions of dollars</i>	1999
Merchandise		
Record Player, Radio and Television Receiver		3.3
Telecommunication Equipment		2.7
Electronic Parts and Components		17.6
Other Communication and Electronic Equipment		3.7
Electric Computing and Peripheral Equipment		11.0
Office, Store and Business Machine		1.4
Communications and Energy Wire and Cable		1.2
Indicating, Recording and Controlling Instruments		4.6
Other Instruments and Related Products		5.6
Services		
Telecommunications		1.4
Computer		0.8
Information		0.4

Source: International Trade Division, Balance of Payments Division, Statistics Canada.

* Merchandise trade data are captured as commodities. In an effort to produce industry trade data, Statistics Canada assigns exported commodities to industries.

2.4 Financial performance - Revenues

Revenues in the ICT sector are also increasing. The ICT sector share of total industry revenue has grown considerably over the last decade – ICT sector revenue reached \$78.8* billion in 1998, representing 4.4% of total industry revenue. ICT sector revenue shares have increased substantially from 1993, when the ICT sector accounted for 3.2% (\$45.9 billion) of total industry revenue.

Figure 14. ICT sector revenues*, 1993-1998

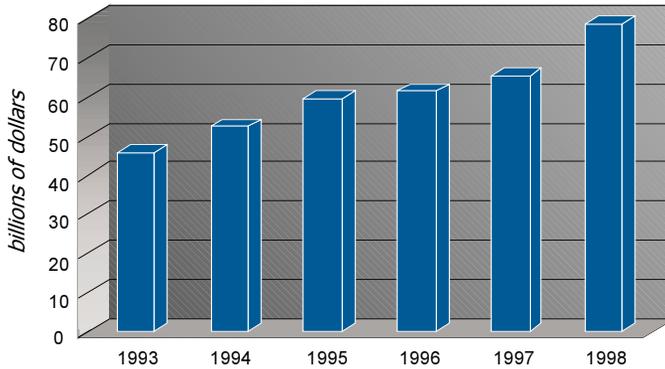
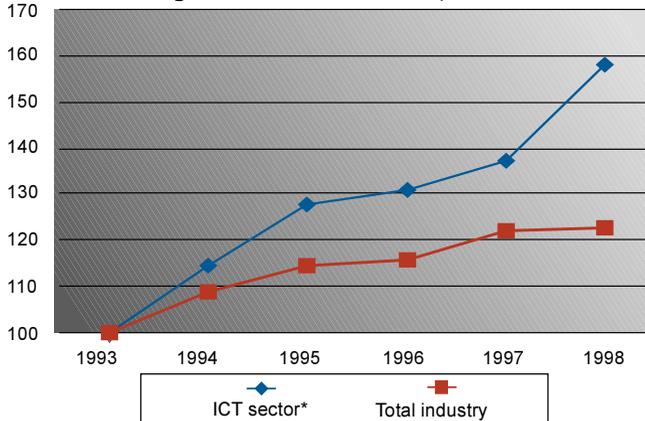


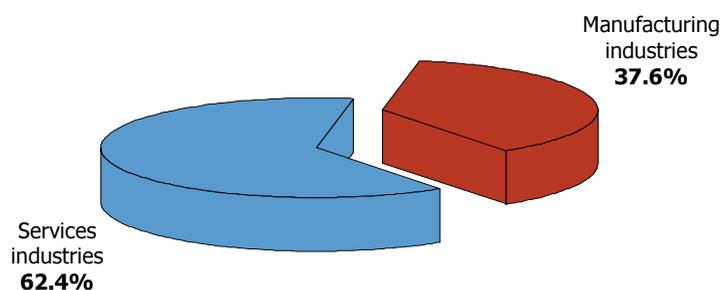
Figure 15. Indexed revenues, 1993-1998



Between 1993 and 1998, annual average revenue growth for the ICT sector was 11.5%, as compared with total industry growth of 4.5% per year. Total ICT sector revenue growth over this period was a remarkable 72.0%, easily out-pacing total industry revenue growth (24.4%).

Within the ICT sector services industries, telecommunications generated the highest revenues. ICT sector services revenue has been increasing steadily since 1993 – its share of total industry revenue reached 62.4% in 1998.

* Revenue for ICT wholesaling is not included.

Figure 16. ICT sector structure, 1998 (Revenues)***Table 9.**
ICT sector revenues, 1993-1998*

	1993	1994	1995	1996	1997	1998	98/93	CAGR (98/93)
<i>billions of dollars</i>							<i>%</i>	
Manufacturing	18.5	22.2	27.0	25.7	26.8	29.6	60.5	9.9
Services	27.4	30.2	32.6	35.8	38.5	49.2	79.7	12.4
Total ICT sector	45.9	52.4	59.6	61.5	65.3	78.8	72.0	11.5
Total Industry	1,440.6	1,565.9	1,652.8	1,674.4	1,782.3	1,719.7	24.4	4.5
ICT as a %	3.2	3.3	3.6	3.7	3.7	4.4	...	...

Source: Various industry surveys. See Notes, Methodologies and Data sources section for more information.

* Revenue for ICT wholesaling is not included.

Table 10.
ICT sector revenues by industry, 1998*

NAICS Industries	<i>billions of dollars</i>	1998
Manufacturing		
3333	Commercial and Service Industry Machinery	1.8
3341	Computer and Electronic Products	5.4
33421, 33422	Communications Equipment	9.1
3343	Audio and Video Equipment	0.2
3344	Semiconductor and Other Electronic Components	6.9
3345	Navigational, Measuring, and Control Devices	3.8
33592	Communication and Energy Wire and Cable	2.4
Services		
51121, 51419, 51421, 54151	Computer Systems Design and Related Services	17.6
5133	Telecommunications	28.5
51322	Cable	3.1

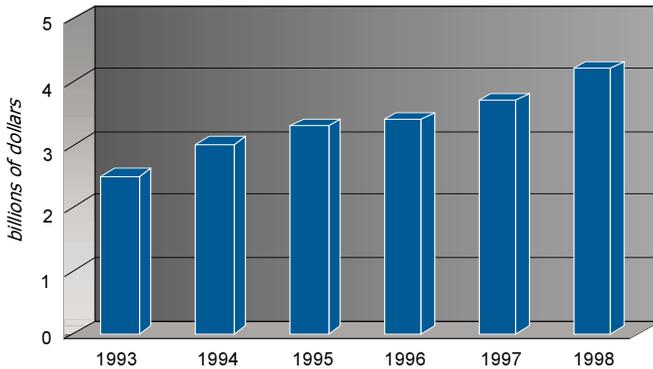
Source: Various industry surveys. See Notes, Methodologies and Data sources section for more information.

* Revenue for ICT wholesaling is not included.

2.5 Research and development

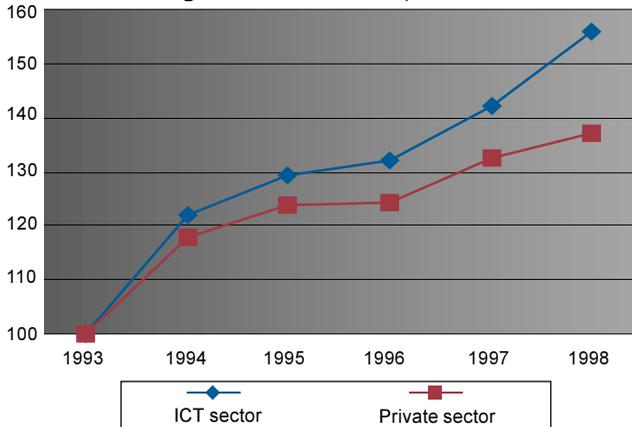
The ICT sector is one of the largest R&D performers in Canada. ICT sector expenditures on R&D reached \$4.2 billion in 1998, accounting for a whopping 46.0% of total private sector R&D. Over the 1993-1998 period, the ICT sector has spent \$20.0 billion on R&D, or 42% of total private sector R&D expenditures.

Figure 17. ICT sector R&D, 1993-1998



Research and development is at the heart of the innovation process. While R&D is also carried out by other sectors, including governments and universities, industrial R&D is most closely linked to technological innovation and, hence, economic growth (Industrial Research and Development, Science, Innovation and Electronic Information Division, Statistics Canada)

Figure 18. Indexed R&D, 1993-1998



ICT sector R&D expenditures grew at an annual average rate of 11.0% between 1993 and 1998, as compared with an annual average of 7.2% for the private sector. Total ICT sector spending on R&D grew by 68.2% over this period.

In 1998, ICT manufacturing industries spent \$3.2 billion on R&D – over three quarters of total ICT sector R&D expenditures. Telecommunications equipment accounted for over half of ICT R&D investment, and 23.4% of total private sector R&D.

Figure 19. ICT sector structure, 1998 (R&D)

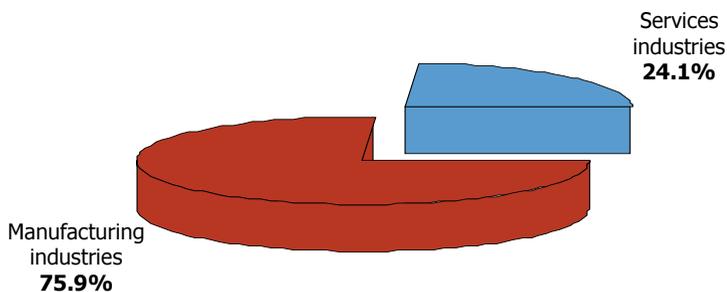


Table 11. ICT sector R&D, 1993-1998

	1993	1994	1995	1996	1997	1998	98/93	CAGR (98/93)
<i>billions of dollars</i>							<i>%</i>	
Manufacturing	1.8	2.1	2.3	2.4	2.7	3.2	79.9	12.5
Services	0.7	0.9	1.0	1.0	1.0	1.0	39.4	6.9
Total ICT sector	2.5	3.0	3.3	3.4	3.7	4.2	68.2	11.0
Private sector	6.4	7.6	8.0	8.0	8.7	9.1	41.8	7.2
ICT as a %	38.8	40.1	40.7	41.8	42.4	46.0	...	...

Source: Science, Innovation and Electronic Information Division, Statistics Canada.

3.1 How ICT intensive is the Canadian economy?

The Canadian economy is more ICT intensive than the average for OECD countries when measured in terms of employment and R&D expenditures.

- Canada's ICT share of business sector employment is higher than the OECD, EU and G7 averages.
- Canada ranks 8th among OECD countries in its share of business sector employment.
- Nordic countries have the highest share of business sector employment.
- Canada's ICT share of business sector R&D is higher than the OECD, EU and G7 averages.
- Canada ranks 3rd among OECD countries in its share of business sector R&D.



The Canadian economy is less ICT intensive than the average for OECD countries when measured in terms of value added and total trade.

- Canada's ICT share of business sector value added is lower than the OECD and G7 averages.
- Canada ranks 8th among OECD countries in its share of business sector value added.
- Nordic countries, Korea, and the U.S. have the highest shares.
- Canada's ICT share of total trade is lower than the OECD, EU and G7 averages.
- Canada ranks 11th among OECD countries in its share of total trade.
- Finland and Japan have the highest shares.

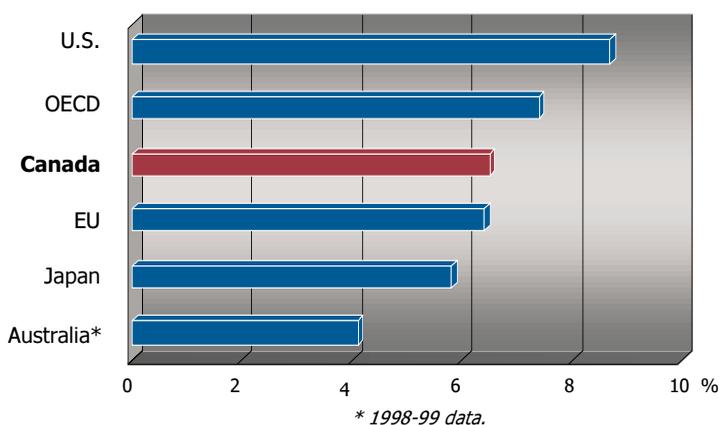
The source of data for this chapter, as well as the country rankings, is the OECD publication 'Measuring the ICT sector', 2000. As the statistics are based on the common definition agreed upon by Member countries, they achieve a greater level of international comparability than has previously been possible. For the same reason, they will differ from the statistics published by individual member countries. They may also differ due to data revisions by member countries.

3.2 Value added

The value added by the ICT sector in Canada was estimated at 6.5% of total business sector value added in 1997, lagging behind the U.S. (8.7%) and the OECD average (7.4%), but slightly ahead of the EU average, and ahead of Japan (5.8%) and Australia* (4.1%).

The share of the business sector's value added coming from the ICT sector was between 8% and 9% in Sweden, Hungary, the United Kingdom and Finland. Korea had the highest proportion at 10.7%.

Figure 20. ICT sector share of business sector value added, 1997



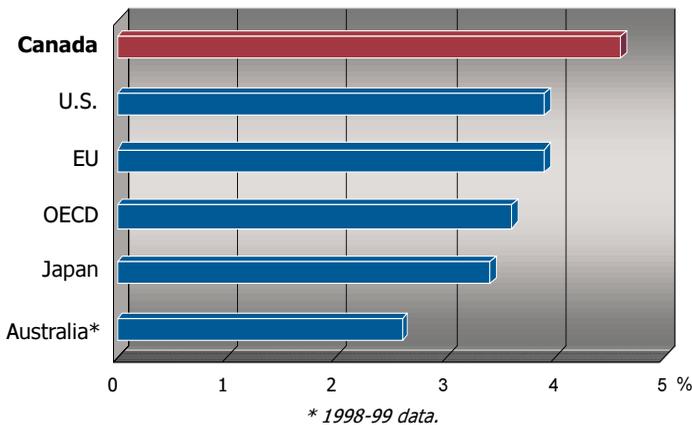
Value added data have been obtained from all OECD member countries with the exception of Denmark, Greece, Iceland, Ireland, Luxembourg, Mexico, New Zealand, Poland, Spain, Switzerland and Turkey). Value added data have been aggregated across countries using Purchasing Power Parity indices. Australian data are for the year 1998-99.

For the countries for which data are available, total ICT sector value added in 1997 was estimated to be US\$1.2 trillion. Reflecting the country's relative size in the OECD group of countries, the United States accounted for almost half (49%) of the total ICT sector value added. Japan accounted for 13%, while Germany and the U.K. contributed 7.5% and 6.9%, respectively. Canada's share of ICT sector value added was 2.9%. Overall, the G7 countries accounted for 87% of the OECD total. Korea's share was the largest of the non-G7 countries, representing 5% of the OECD total.

3.3 Employment

Unlike its share of business sector value added, Canada’s share of ICT employment in the business sector (estimated at 4.6% in 1997) was substantially higher than that of the U.S. (3.9%), EU (3.9%), the OECD average (3.6%), Japan (3.4%) and Australia (2.6%). Among individual countries, Sweden had the highest share of ICT sector employment (6.3%), followed by Switzerland (6%).

Figure 21. *ICT sector share of business sector employment, 1997*



Employment data have been obtained from all OECD Member countries with the exception of Greece, Luxembourg, Mexico, Poland and Spain.

For the OECD Member countries for which data are available, 1997 ICT sector employment was estimated at 12.8 million persons. The United States accounted for about 35% of this total, with 4.5 million persons. Countries in the EU represented 35% of the OECD total, Japan 16%, the United Kingdom 9% and Germany 8%. Canada’s share was 3.4%, as was the share of all the Nordic countries as a group (Denmark, Finland, Iceland, Norway, and Sweden).

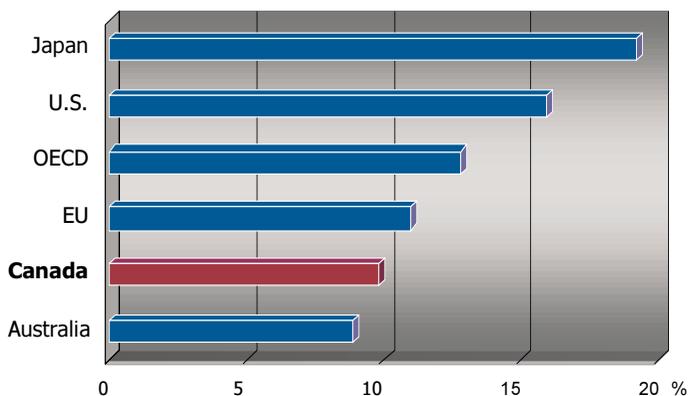
The G7 countries made up a combined 82% of overall ICT sector employment. Outside this group, Korea had the largest share of ICT sector employment, with 462,000 persons, or 3.6% of the OECD total. Australia, Austria, Belgium, the Czech Republic, Hungary, the Netherlands, Sweden and Switzerland all had employment of between 1% and 2% of the total.

3.4 International trade

Canadian ICT sector trade represented about 10% of total business sector trade, a proportion almost half of Japan's (19.2%) and lower than the OECD average of 12.8%. The share of the ICT sector trade was 15.9% in the U.S., 11% in EU countries and 8.9% in Australia.

Trade in ICT merchandise and services was highly important in Ireland, where the proportion of trade was about one third of the country's total trade. Hungary, Korea and Mexico each had ICT trade that accounted for about 20% of their total trade.

Figure 22. ICT sector share of business sector trade, 1998



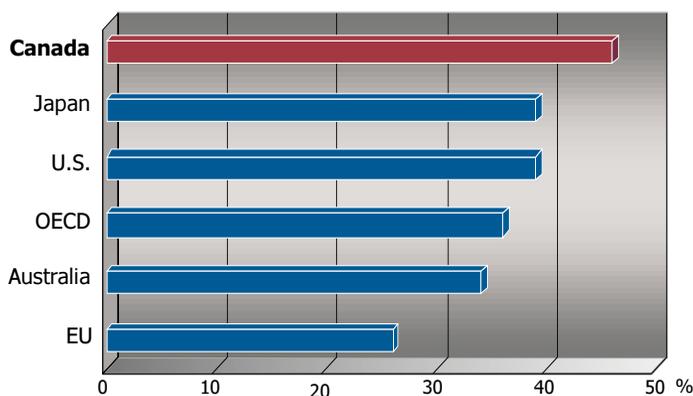
Data on both merchandise and services trade are generally available for all OECD Member countries for 1998. In the case of Denmark, Greece, Ireland, Mexico, Switzerland and Turkey, the available data for trade in services are incomplete. As the services component tends to be relatively small compared to the goods component in most countries, the data that are available (mainly for merchandise trade) have been used as an approximation of the total. Data for both exports and imports for individual countries include imported goods that are subsequently re-exported.

In 1998, only six countries reported a surplus in ICT sector trade – Japan, Korea, Finland, Ireland, Mexico, Sweden and Hungary. The United States, Germany, Italy and Australia all reported large deficits, ranging from US\$36 billion in the U.S. to US\$7 billion in Australia. Canada's ICT sector also had a balance of trade deficit of US\$12 billion.

3.5 Research and development

Canada's ICT sector R&D expenditures as a proportion of total business sector R&D was 43.7% in 1997, exceeding that of the U.S. (38%), the EU (23.6%) and the OECD average (34.6%). However, Finland had the largest share at 51%. In Ireland, Greece, Korea and Japan, ICT R&D accounted for more than 40% of total business sector R&D. Hungary's share was 11.3%, while Poland, the Czech Republic and Mexico all recorded proportions of about 8% or less.

Figure 23. ICT sector share of business sector R&D, 1997



R&D expenditure data are available for all member countries with the exception of Austria, Luxembourg and Switzerland. R&D data have been aggregated across countries using Purchasing Power Parity price indices.

Overall, for the OECD countries, expenditures on R&D in the ICT sector stood at US\$116 billion in 1997. The United States accounted for 52% of that, Japan for 22.4%, and Germany, Korea and France accounted for 4.9%, 4.8% and 3.8% of the total, respectively. Canada's share of ICT sector R&D expenditures was 2.7% of the OECD total.

Part II

Sectoral Measurements of Information and Communications Technologies

Businesses in the ICT sector are responsible for most of the technical infrastructure necessary for the functioning of a 'networked economy' - from the manufacturing of hardware to the build-up and maintenance of networks, to the provision of required software and services. At the same time, they utilize information and communications technologies (ICTs) themselves in the process of carrying out their business. What makes such technologies far more important, though, is their diffusion throughout the economy - their uptake by businesses in industries across the economy, as well as by governments and individuals. It is this diffusion that magnifies the significance of ICTs, and in many ways defines the yardstick with which to measure their true impacts. The extent of the penetration and use of ICTs, in conjunction with their rates of growth, will be critical in determining future developments.

The birth of new businesses, even industries, is a significant achievement, but transforming existing practices in all facets of business and everyday life is quite another. These aspects will be examined in this part of the compendium. Here we step outside the confines of the ICT sector and look at selected ICTs rather as commodities, goods and services, and examine their sectoral penetration and use. This approach complements the analysis of the ICT sector by expanding the perspective necessary to comprehend the profound changes brought about as ICTs permeate the whole economy. With available data, Part II amply documents that ICTs, and the Internet in particular, have had quite an impressive entry in a few short years and are used widely everywhere. One chapter is devoted to each sector - households, business and governments.

Chapter 4 profiles the evolution of the penetration of ICTs among households, as well as the pattern of use and spending of these households. This is critical in that if more innovative applications are to emerge and the full societal impact of ICTs is going to be felt, they must be adopted and used by people. Moreover, household spending stimulates total market demand for ICTs and is an integral component of the incentives and infusion of money necessary for continuous investments in the development of new infrastructure and the delivery of better services. At any given point in time, the size and expected growth of a critical demand mass, inclusive of households and individuals, is crucial in determining the future viability of emerging technologies and applications. Someone must ultimately pay, whether for high-speed Internet access or e-commerce, if such technologies and applications are not to be restricted to only business transactions. At the same time, monitoring household use of ICTs provides early insights into the path from economic to societal transformations, with their effects on time use, personal, family and community relationships, and the like.

Information and communications technologies (ICTs) are an important and growing part of our economy. The information revolution which we have come to embrace touches everyone who lives, works, plays and learns in the twenty-first century. Whether you're 'connected' or not, the benefits of ICTs extend beyond productivity and profit - ICTs provide new opportunities to learn, improved health care, government information online, and more choices to consumers ('Improving Performance with Connectedness', The Conference Board of Canada, 1999).

Chapter 5 presents recent information on business connectivity. It offers an account of the degree of computerization, the use of the Internet, and the Web presence of businesses, as well as employee access to such technologies. Progressively, in recognition of the hierarchical nature of the technologies involved, this chapter proceeds to shed light on the state of e-commerce as an emerging phenomenon. In the process, the analysis differentiates and compares across industries and firm size. In doing so, it highlights findings of relative significance and allows for comparative inferences among businesses within and outside the ICT sector. Such indicators are useful for businesses, in conducting benchmarking exercises and designing competitive strategies; for policymakers, in the monitoring of stated objectives and the potential development and implementation of new policies, and; for researchers, in deepening our understanding of the magnitude, scope and pace of the underlying transformations. Moreover, they can be used for all-important international comparisons, to the extent that comparable data become available, to assess Canada's relative strengths and areas for improvement.

The public sector plays a central role with respect to ICTs, and its presence and influence are critical in many respects. This is the subject of inquiry in Chapter 6. Not only are federal and provincial governments major users - something that, by itself, generates significant spillover effects throughout the economy - but they are also promoting the dispersion and use of ICTs as a means to economic growth and competitiveness. The federal government has embarked on numerous connectedness initiatives, including programs to address the 'digital divide' and government online. Many national governments around the globe are engaging in similar activities. Within the broadly-defined public sector there are important areas, such as education and health, which are susceptible to far-reaching transformation from the use of suitably adapted ICTs. There is potential for radical re-thinking of both the efficiency of the delivery of services and the eventual quality of these sectors' outputs. Available data permit us to look at connectivity in education.

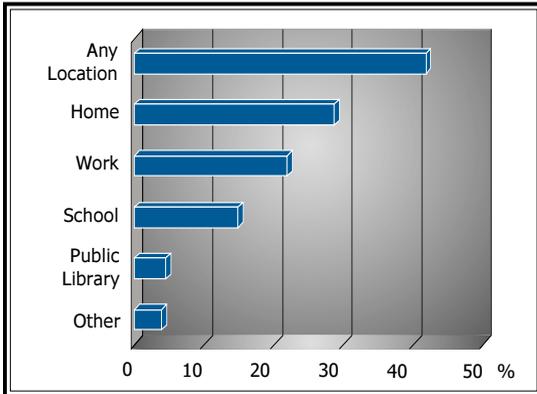
The totality of the subject matter addressed in Part II is frequently referred to as the demand side. However, it is only fair to say that businesses outside the ICT sector and governments alike utilize ICT infrastructure and services in such a way as to create important applications, which themselves can be seen as part of an extended supply. This can happen in-house or externally, and is true for the financial sector, as it is for content industries and others. Therefore, more than the demand side is reflected in what follows.

"We will build on a pilot project, now under way, to make www.access.ca a personal gateway to government information and community content on the Internet, and we will encourage all Canadians to make use of this address" (Speech from the Throne, 1999).

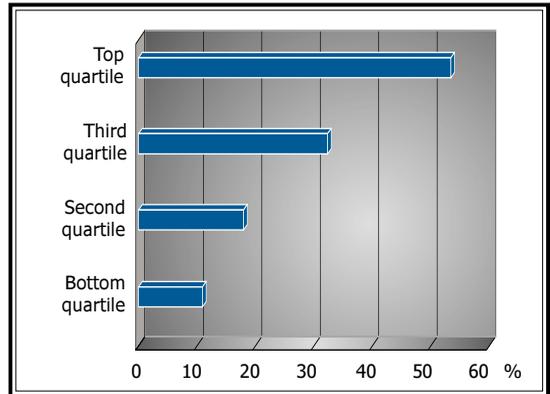
Highlights

- Canadian households are embracing the Internet in growing numbers. In 1999, 42% contained at least one regular Internet user, up from 29% in 1997. For the first time, home-use (29%) surpassed use from work (22%), followed by use from school (15%), public libraries (5%), and other locations (4%).
- 7% of all households (almost a quarter of home-users) engaged in Internet shopping from home, placing 3.3 million orders worth \$417 million. On average, each household placed 4 orders and committed \$517.
- Households that use the Internet are more likely to be higher income families with children, headed by someone 35-54 years of age, residing in urban areas and having higher levels of education than non-users.
- In 1999, 82% of enterprises used computers, while 53% used the Internet, 22% had a Web site and 10% actually used the Internet to sell goods or services. Over 28% of employees in the private sector had access to the Internet.
- The value of orders received over the Internet, with or without online payment, was estimated at \$4.2 billion, representing 0.2% of total economic activity. Manufacturers received orders worth \$900 million, while retailers received \$611 million, accounting for 22% and 15% of total Internet sales, respectively.
- In 1999, all federal and provincial government institutions were using personal computers, 98% were using the Internet and 88% had a Web site. As well, 94% of their employees had access to computers, 92% to e-mail and 82% to the Internet.
- 44% of home-use households used the Internet to search for government information.
- In 1998-99 computerization was widespread and Internet connectivity nearly complete among schools. Most students at the elementary, intermediate and secondary levels in Canada, attended schools that had access to the Internet for educational purposes. Computers were more readily available to students in higher grade levels, with one computer for every seven students at the secondary level, one for every eight intermediate students and one for every nine elementary students.
- About one-third of elementary and intermediate students, and half of all secondary students, had used e-mail, while 76% of elementary, 80% of intermediate and 87% of secondary students has made use of external databases to find and extract information.

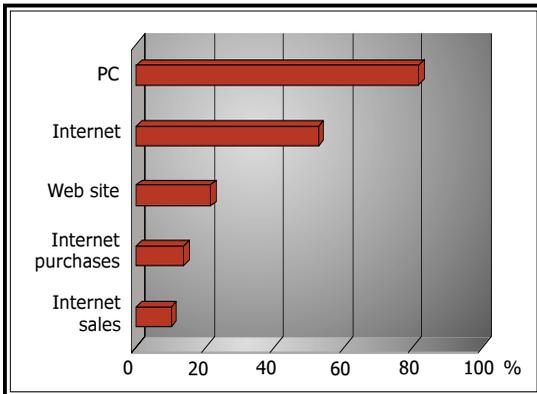
Household Internet use, by location, 1999



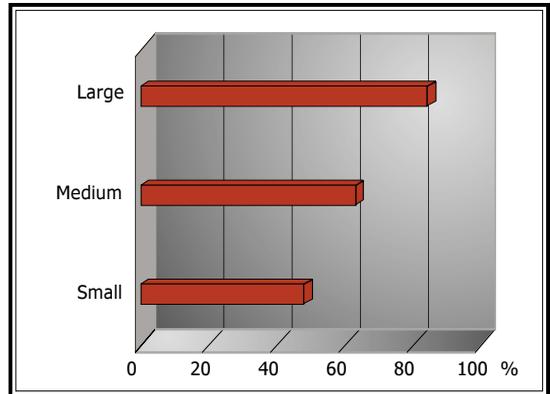
Home-use Internet penetration, by household income, 1999



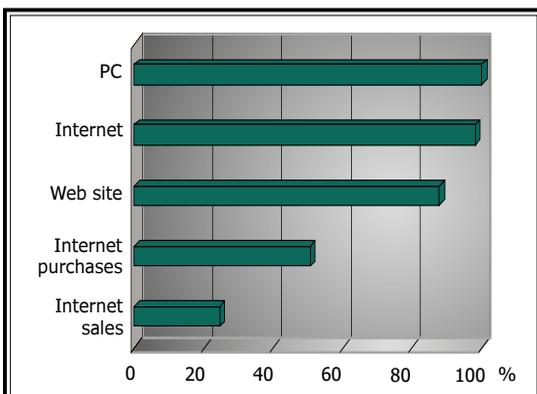
Business use of ICTs, 1999



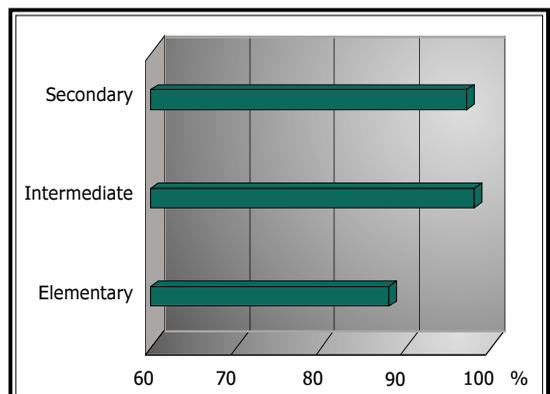
Business Internet use, by size, 1999



Government use of ICTs, 1999



Percentage of students attending schools with Internet access, 1998-99



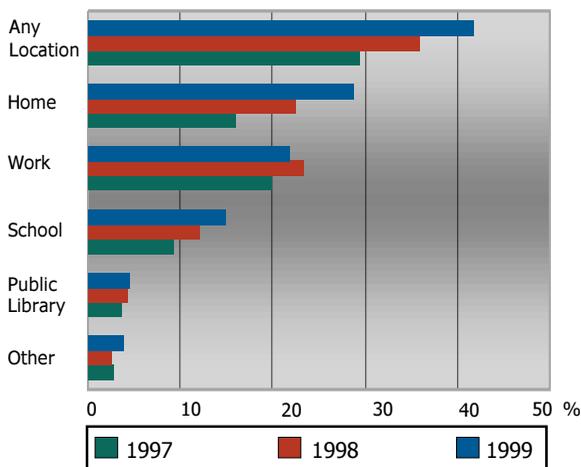
Canada's highly developed and accessible information and communications infrastructure is reflected in the penetration of ICTs among households. Penetration of telephones is nearly complete and penetration of cable is the highest in the world. Although these have been stabilized for some time, penetration of newer technologies is increasing every year. In 1999, 98.2% of households had telephones, 73.3% had cablevision service, 49.8% owned home computers, and 31.9% had cell phones. New technologies that allow access to services for the information age are still evolving, but Canadian households are well on their way to being 'plugged in'.



4.1. Use of ICTs by households

Information from Statistics Canada's 1999 Household Internet Use Survey (HIUS) shows that a growing number of Canadians are logging onto the Internet. In 1999, almost half (48.8%) of all households had ever used the Internet, while 41.8% of households contained at least one regular Internet user. The rate of home Internet use has nearly doubled since 1997, reaching 3.3 million households. For the first time, home-use was the highest (28.7%), followed by use from work (21.9%), school (14.9%), public libraries (4.5%), and other locations (3.9%), such as cyber cafés or the homes of friends, neighbours or relatives.

Figure 24. Household Internet use, by location, 1997-1999



Statistics Canada has collected data on Internet use since 1996. It first conducted the Household Internet Use Survey (HIUS) in October 1997 to collect detailed data about the use of computer communications by Canadian households. The survey was repeated in 1998 and again in 1999. The HIUS collected information from one household member about the Internet activities of the entire household. Over 38,000 respondents in private households were interviewed in 10 provinces. A 'regular user' refers to at least one person in the household who uses the Internet during a typical month, whether at home, work, school, public library or other location.

Being 'connected' includes more than simply surfing the Net. Households with Internet access are also more likely to use other information and communications technologies. Cellular phones, compact disc players, VCRs and cablevision are all more likely to be found in homes with Internet access than in those without.

Table 12.
Household penetration of selected ICTs, 1999

	Households with Internet access	Households without Internet access
	%	
Telephone		
1	10.4	28.0
2	27.4	38.1
3 or more	62.1	31.5
Cellular telephone	50.8	22.8
Compact disc player	91.0	59.7
Cablevision	77.4	71.9
VCR		
1	52.8	63.9
2 or more	44.8	20.7
Home computer	100.0	25.1
Colour television		
1	29.7	47.1
2	39.1	36.3
3 or more	30.6	15.4

Source: Survey of Household Spending, Income Statistics Division, Statistics Canada.

4.2 Household spending on ICTs

In parallel with higher penetration and use of ICTs, spending by Canadian households is also on the rise. In 1999, reporting households spent an average of almost four thousand dollars on ICTs, ranging from telephone, cablevision and satellite equipment and services to computer and home entertainment goods and services. Expenditures on telephone, computer and home entertainment equipment and services accounted for over half of total household spending on ICTs.

Table 13.
Household expenditures on selected ICTs, 1999

	Average expenditure per household reporting (\$)	% of total expenditure
Telephone equipment and services	732	18.6
Home entertainment equipment and services	618	15.7
Computer equipment and supplies	915	23.2
Cablevision and satellite services	450	11.4
Photographic goods and services	199	5.1
Cellular services	459	11.7
Recreation (electronic games & parts, video game rental)	301	7.6
Internet services	262	6.7
Total expenditure on selected ICTs	3,936	100.0
Total expenditure	53,474	...

Source: Survey of Household Spending, Income Statistics Division, Statistics Canada.

4.3 Frequency, intensity and type of use

While television viewing is on the decline, Canadian households are using the Internet more often, for a longer period of time, and for a wider variety of services than in the past. In 1999, almost one in five households used the Internet from home everyday, an increase of over 90.0% since 1997. More than two-thirds of home-use households used the Internet for at least ten hours per month, while 47.0% spent at least twenty hours on the Internet.

The home-use household has also become more diversified in its use of Internet services. In 1999, more than nine out of every ten households using the Internet from home used e-mail. Over half of home-use households used the Internet to search for medical and health information, while the vast majority used it to search for other specific information. Other popular uses included games, music, and general browsing.

Table 14.
Proportions of households using the Internet from home, by type of use, 1999

	All households	Regular-use households
	%	
E-mail	26.3	91.7
Electronic banking	8.0	27.7
Medical/health information	15.6	54.2
Formal education/training	9.2	32.0
Government information	12.7	44.1
Other specific information	24.4	85.1
General browsing	24.3	84.7
Playing games	12.3	42.7
Chat groups	7.5	26.2
Obtaining/saving music	7.8	27.1
Listening to radio	5.0	17.5
Other Internet services	10.0	34.7

Source: Household Internet Use Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

4.4 Household Internet use by income, education, age and family type

A strong relationship exists between household income and Internet use, regardless of the location of use. In 1999, more than half of the households in the top income quartile used the Internet from home compared with only 10.9% of households in the bottom quartile. But penetration rates are increasing in every income quartile, meaning that more households in each group are connected to the Internet from year to year. This growth has been fastest in the lower income groups.

Cost may explain some of the relationship between household income and Internet use, but there are various other reasons why households do or do not use the Internet. In fact, only about one in four households with computers indicated that affordability was the reason that they did not access the Internet from home, less than the 29.2% who said they simply had no need to use the Internet from home or did not find it useful to do so.

Households were grouped into quartiles according to their household incomes - the top quartile represents the 25% of households with the highest incomes, the bottom quartile represents the 25% of households with the lowest incomes.

Table 15.
Internet use, by household characteristics, 1999

	Home	Any location
	%	
All households	28.7	41.8
Household income		
<i>Bottom quartile</i>	10.9	18.8
<i>Second quartile</i>	18.0	29.2
<i>Third quartile</i>	32.4	48.1
<i>Top quartile</i>	53.5	71.2
Education level of household head		
<i>Less than high school</i>	9.6	16.1
<i>High school or college</i>	29.6	44.4
<i>University degree</i>	52.4	70.1
Age of household head		
<i>Less than 35</i>	32.8	53.0
<i>35 to 54</i>	38.0	54.9
<i>55 to 64</i>	24.6	32.7
<i>65 and over</i>	8.2	10.1
Family type		
<i>One-person household</i>	12.6	22.1
<i>Single-family household, no children under 18</i>	28.3	38.7
<i>Single-family household, children under 18</i>	40.6	59.0

Source: Household Internet Use Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

A strong correlation is also observed between education and Internet use. In 1999, the home penetration rate for households whose heads had a university degree was more than five times higher than that of households in which the head had not completed high school. Again, significant increases in overall household Internet use are observed over time, across all levels of education.

Age exerts its own influence on Internet use, as does family type. Households with older heads are still less likely to be Internet users than those with younger heads, while one-person households have the lowest overall Internet penetration rate. Internet use was highest among households headed by someone 35-54 years old (54.9%), and single-family households with children under the age of 18 (59%).

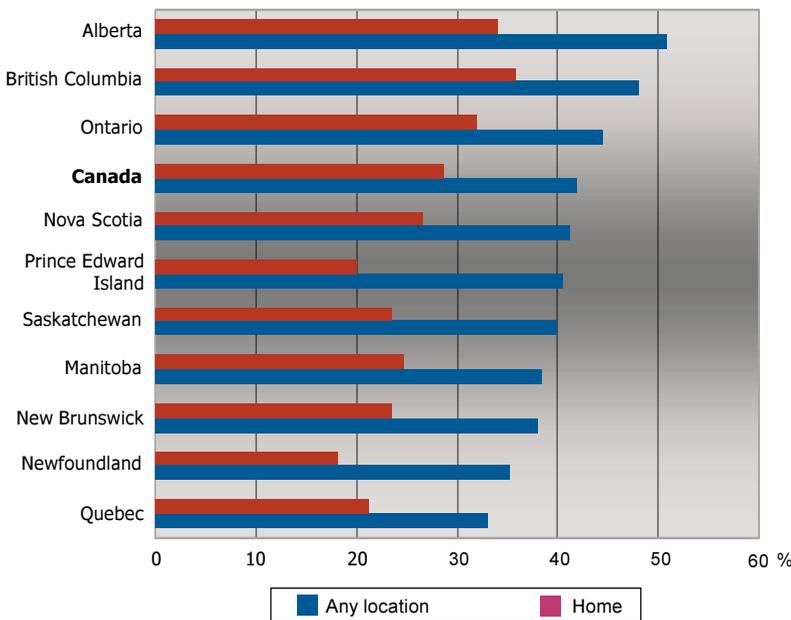
4.5 Use of the Internet by province and by CMA

Ontario, Alberta, and British Columbia, the three provinces with the highest average incomes, also have the highest overall Internet penetration rates. They are the only provinces where Internet use exceeds the national average. Overall penetration rates increased in every province between 1997 and 1999. Quebec's Internet penetration rate was still the smallest, but it experienced the biggest percentage increase, from 20.1% in 1997 to 33.1% in 1999.

Internet use from home grew fastest for households with heads 65 years of age and older, as 54.7% more of these households connected from home over the 1998-1999 period ("Plugging In: The Increase of Household Internet Use Continues into 1999, Connectedness Series, Statistics Canada, 2000).

Single-family households with unmarried children under 18 had the highest Internet penetration rate, from any location, as 59% of them regularly logged on in 1999. Part of this pattern can be explained by the higher rate of use from school for households with younger kids ("Plugging In: The Increase of Household Internet Use Continues into 1999, Connectedness Series, Statistics Canada, 2000).

Figure 25. *Internet use, by province, 1999*



There was considerable variability across Census Metropolitan Areas (CMAs), with overall Internet penetration rates ranging from highs of 60.7% in Ottawa and 60.1% in Calgary, to lows of 33.6% in Windsor and 33.9% in Quebec City. Between 1997 and 1999 Internet penetration increased for every one of the largest 15 CMAs, although the rates of increase differed. Montreal had the largest increase in overall Internet penetration over the reference period.

Table 16.
Internet penetration rates from any location, by CMA, 1997-1999

	1997	1998	1999
		%	
Canada	29.4	35.9	41.8
Halifax	39.2	50.2	52.4
Quebec City	23.9	28.6	33.9
Montreal	24.3	31.6	39.1
Ottawa*	55.6	55.4	60.7
Toronto	38.0	42.0	48.5
Kitchener-Waterloo	34.9	42.4	43.7
Hamilton	30.4	41.2	43.1
St. Catherines-Niagara	26.1	29.3	34.4
London	31.8	40.4	45.9
Windsor	25.7	26.8	33.6
Winnipeg	33.1	37.8	42.1
Calgary	41.1	52.8	60.1
Edmonton	35.9	43.9	48.8
Vancouver	35.9	45.7	49.7
Victoria	40.1	48.5	56.4

Source: Household Internet Use Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

* Ottawa excludes the Hull component of the Ottawa-Hull CMA. The 1999 penetration rate for the entire Ottawa-Hull CMA was 56.7%.

4.6 Household e-commerce spending

In addition to their general use of the Internet, households have started to engage in e-commerce. In 1999, 1.8 million households indicated that at least one member of their household had engaged in some aspect of Internet shopping, either using the Internet as part of their buying process by researching characteristics and prices of goods and services (window-shopping), or placing orders for purchases online.

These households represented 15.3% of all households and more than half (53.2%) of the 3.3 million households that used the Internet from home. 806,000 households took the extra step and actually placed orders on the Internet from home, accounting for 6.9% of all households, and almost a quarter of all home-use households. These households placed 3.3 million orders¹ for goods and services online, regardless of whether or not these orders were paid for online or through alternative methods.

¹ Orders refer to the number of distinct transactions and may be for one or more items.

The value of these orders amounted to \$417 million, which accounted for a very small fraction of annual consumer spending. On average, households that engaged in Internet shopping placed just over 4 orders and committed \$517 per household to Internet purchases. The average expenditure per order stood at \$125.

From the total number of orders placed, 1.8 million or just over half (54.5%) were to Canadian firms. This leaves a sizeable proportion of orders that was made to firms in foreign countries. The dollar value of orders to Canadian firms stood at \$250 million, representing 60% of the total.

Electronic window-shopping households checked out "big ticket" items, with travel arrangements topping the list, followed by automotive products and books, magazines and newspapers. However, households that actually committed to purchasing by placing orders on the Internet were inclined towards products and services that often had smaller price tags, such as books, magazines and newspapers, which ranked first, followed by computer software and music.

Table 17.
Household e-commerce, 1999

	E-commerce households	Window-shopping households
	%	
Books, magazines & newspapers	47.5	30.0
Travel arrangements	28.8	31.5
Computer software	35.9	23.9
Automotive products	20.8	30.1
Music (CDs, tapes, mp3)	29.5	20.5
Clothing, jewelery & accessories	24.3	22.6
Computer hardware	24.1	21.0
Consumer electronics	18.4	18.8
Other entertainment (tickets)	16.9	13.5
Banking and financial	15.8	13.7
Housewares (furniture & appliances)	13.1	13.3
Other	16.4	7.3
Videos, Digital Video Discs (DVDs)	11.7	8.8
Hobbies	8.5	5.6
Food, condiments & beverages	5.8	4.7
Toys and games	4.3	2.7

Source: Household Internet Use Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

Canada enjoys a high standing internationally with regard to household penetration of the Internet from home. Examples of other countries with high penetration rates are:

- The U.S., with 42% in August 2000, a big increase from 26% in December 1998.
- Australia, with 34% in August 2000, up from 25% in November 1999.
- Finland, with 32% in the fourth quarter of 2000, up from 25% during the same period of 1999.
- The U.K., with 30% at the end of September 2000, also a large increase from the 18% one year earlier.

Among major countries with lower penetration rates are:

- Japan, with 19% in 1999, up from 11% in 1998.
- France, with 12% in May 2000, up from 7% in May 1999.

However, the extensive use of the Minitel in France is well-known, as is the increasing use of wireless access in Japan.

Internet use is quickly becoming an everyday routine for many Canadian households. In 1999, 41.8% of households accessed the Internet in a typical month, and 28.7% did so from home.

Well-educated, high-income households were most likely to use the Internet, as well as younger families with children under 18. Homes with access also tended to have higher average spending patterns than homes without. But Internet use has increased for all households and can accelerate the way in which we develop and improve our quality of life.

The pervasiveness of the use of ICTs, and of applications based on them, is clearly visible in the business sector. Whether motivated by the desire to gain a competitive edge or simply reacting to the momentum of competitive forces, businesses are increasingly adopting new technologies directed towards the modernization and expansion of their communication infrastructure. Such investments are generally intended to improve both the internal functioning of businesses and the management of their external relationships with suppliers and customers.



The economic advantages attributed to 'connected' business range from increased efficiency and enhanced innovative capacity, through the faster flow and sharing of information and the management of knowledge, to the broadening of their customer bases and their long-term success, through access to new markets. These are closely related to issues of competitiveness in the context of globalization.

This new wave of connectedness has obvious and profound implications for the skill sets of an increasingly knowledge-based workforce. Up-skilling through education and post-recruitment training and development of human resources, are critical in empowering workers with new and evolving technologies at their fingertips.

The economic advantages and possibilities of connected business are growing exponentially. Businesses who use ICTs are reducing costs and improving productivity, increasing revenues, broadening customer bases, enhancing innovative capabilities, increasing efficiency of supply and delivery, expanding trade, and transforming global competitiveness ('Improving Performance with Connectedness', The Conference Board of Canada, 1999).

Canadian investment in ICT machinery and equipment reached \$13.6 billion in 1997, representing 20% of total capital expenditures on machinery and equipment. The largest share of this investment was accounted for by communications industries, at \$5.4 billion, followed by the distribution (\$1.5 billion) and manufacturing (\$0.8 billion) sectors (Capital Expenditures by Type of Asset, Investment and Capital Stock Division, Statistics Canada).

Use of computers, e-mail and the Internet, have now become a daily routine for many employees in their working lives. Depending on their employer's line of business and their own occupation, employees use computers as a matter of course in a software company, the Internet in an online mall, scanning devices in a retail store, and touch-screens to take orders in a restaurant.

As more ICT goods and services are introduced into the marketplace, their relative significance changes and new concepts and performance indicators are required to measure their penetration and monitor the social and economic impacts on end-users, whether businesses, governments or consumers.

"Because the Internet is such a powerful communication and distribution channel, it enables companies across many sectors – regardless of size or location – to become global companies, placing many customers and markets within easy reach" (Fast Forward 2.0. Report of the Canadian E-Business Opportunities Roundtable, The Boston Consulting Group (Canada), 2001).

Table 18.

Percentage of employees with access to personal computers, e-mail and the Internet, by industry, 1999

	Employee access to PC, workstation or terminal	Employee access to e-mail	Employee access to the Internet
		%	
Forestry, logging and support activities*	34.6	15.0	17.0
Mining and oil and gas extraction	53.4	41.8	29.7
Utilities	80.7	78.2	58.6
Manufacturing	42.7	28.2	20.4
Wholesale trade	77.0	55.7	46.1
Retail trade	53.4	19.0	13.1
Transport and warehousing	40.6	25.5	17.9
Information and cultural industries	91.2	78.9	73.8
Finance and insurance	88.0	71.9	47.9
Real estate and rental and leasing	58.7	34.7	34.8
Professional, scientific and technical services	86.0	66.7	60.3
Management of companies and enterprises	60.1	44.4	37.2
Administration and support, waste management and remediation services	53.7	38.1	33.4
Educational services (private sector)	76.9	66.9	66.2
Health care and social assistance (private sector)	62.0	30.5	27.1
Arts, entertainment and recreation	49.0	29.0	24.4
Accommodation and food services	30.5	7.9	7.1
Other services (except public administration)	56.3	37.5	37.4
Total private sector	55.6	34.4	28.4

Source: Information and Communications Technologies and Electronic Commerce Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

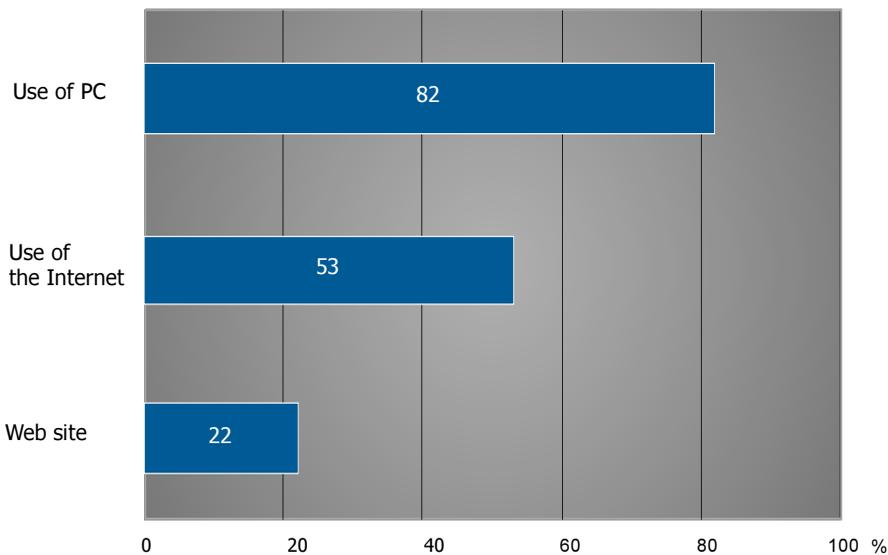
* Includes forestry and logging and support activities for agriculture and forestry.

5.1 Use of ICTs

The gradual introduction and use of computers in business dates back more than two decades. Eventually, computers found their way onto desktops and, more recently, they became interconnected in networks. By 1999, computerization in the business world was widespread. Computers were used by 82% of enterprises, accounting for most of the overall economic activity (96%). Penetration of hierarchically more sophisticated and complex ICTs and applications was lower. Over half (53%) of all enterprises used the Internet, while 22% had a Web site. These enterprises accounted for 75% and 45% of total economic activity, respectively. (A more modest proportion of enterprises used the Internet for e-commerce, that is, to purchase and sell goods and services, as we shall see later in this chapter).

The proportionately higher economic significance attributable to enterprises that use such technologies clearly implies that the pattern of usage is subject to significant variability by size. More specifically, it is slanted towards larger enterprises. As well, there are considerable differences in usage across industries. These are explored next.

Figure 26. Business penetration of ICTs, 1999



5.1.1 Use by enterprise size

Almost all large enterprises use computers and have much higher rates of Internet utilization than smaller enterprises. As well, more than half have a Web presence. In general, smaller enterprises lag behind, although this is not true for each and every industry. In the information and cultural industries, for instance, size has little to do either with the use of the Internet or the availability of Web sites.

Table 19.
Use of ICTs, by enterprise size, 1999

	Large	Medium	Small
		%	
Use of the Internet	84	63	48
Web site	56	30	17

Source: Information and Communications Technologies and Electronic Commerce Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

Note: Size boundaries are based on gross business income and differ by industry.

5.1.2 Use by industry

Analyzing the use of computers, the Internet and the availability of Web sites among enterprises by industry is quite revealing. The information and cultural industries emerge as the champion of ICTs.

Computerization was very high in information and cultural industries, professional, scientific and technical services, private educational and health services, wholesale trade, manufacturing, finance and insurance, and utilities. The information and cultural industries used the Internet at much higher rates than other industries, followed by utilities, albeit at a distance. This was also the case with respect to Web site availability, as these industries were several times more likely to have a Web presence than the overall average.

Information and cultural industries include enterprises engaged in publishing, broadcasting, telecommunications, information services and data processing. Many of these industries belong to the ICT sector.

Table 20.
Use of ICTs, by industry, 1999

	Use of PC	Use of the Internet	Web site
		%	
Forestry, logging and support activities*	65.7	32.8	5.7
Mining and oil and gas extraction	87.7	60.6	27.6
Utilities	89.7	82.4	27.3
Manufacturing	90.8	63.7	31.7
Wholesale trade	91.6	63.0	26.1
Retail trade	76.1	40.5	16.0
Transport and warehousing	72.4	43.8	17.6
Information and cultural industries	93.5	89.1	61.7
Finance and insurance	89.8	65.9	27.2
Real estate and rental and leasing	76.3	46.3	18.4
Professional, scientific and technical services	93.7	77.5	27.6
Management of companies and enterprises	69.6	47.0	9.9
Administration and support, waste management and remediation services	81.5	55.4	29.5
Educational services (private sector)	93.6	74.5	44.0
Health care and social assistance (private sector)	89.9	46.2	10.0
Arts, entertainment and recreation	88.0	51.0	29.7
Accommodation and food services	66.4	32.0	17.4
Other services (except public administration)	75.8	44.5	19.3
Total private sector	81.9	52.8	21.7

Source: *Information and Communications Technologies and Electronic Commerce Survey, Science, Innovation and Electronic Information Division, Statistics Canada.*

* Includes forestry and logging and support activities for agriculture and forestry.

5.2 E-commerce

Electronic commerce is a phenomenon that has emerged as a tangible example of ICT-based applications and has generated enormous interest of late, due to its potential to transform existing economic arrangements as they pertain to transactions among all economic sectors, whether businesses, governments or individual consumers. Moving from the early days of the Internet, as a new medium for information and entertainment, to a powerful network capable of facilitating the conduct of transactions in a commercially viable way has provided the impetus. Others networks, of a proprietary nature, such as those used in electronic data interchange (EDI), existed before and continue to exist, while others, based on wireless technologies, are emerging. How far are we down this road?

E-commerce definitions

These nested definitions have been developed by the WPIIS and are the result of consultation from a broad range of policy makers, business executives, statisticians, and data users.

An ***Internet transaction*** is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over *Internet protocol-based* networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off-line.

An ***Electronic transaction*** is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over *computer-mediated* networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off-line.

Source: 'Defining Electronic Commerce', OECD, 2000.

Work in the area of e-commerce is in the relatively early stages, considering its newness and the conceptual and practical challenges associated with its definition and measurement. But some evidence has started to accumulate.

Results from the Survey of Information and Communications Technologies and Electronic Commerce (ICTEC) show that in 1999, 10% of enterprises used the Internet to sell goods and services, while 14% purchased goods and services over the Internet. These enterprises accounted for 17% and 25% of all economic activity, respectively. This indicates again that larger enterprises are, on average, more active. However, differences across industries are quite pronounced.

The information and cultural industries led the way, with 20% of enterprises using the Internet to sell goods and services. The private educational services sector, and the administration and support services sector had the next highest proportion of goods and services for sale on the Internet, while only 1.0% of companies in the forestry, logging and support activities sector used the Internet for sales.

For purchases over the Internet, the information and cultural industries again ranked first – half of these enterprises reported using the Internet to purchase goods or services. The only industrial sectors for which the proportion of enterprises with Internet sales exceeded the proportion with Internet purchases were accommodation and food services, administration and support services, and finance and insurance. These industries include hotels, resorts, restaurants, employment services, call centres, travel agencies, banks, insurance carriers and pension funds.

The Information and Communications Technologies and Electronic Commerce survey was conducted for the first time from October 1999 to March 2000, collecting information for 1999. The survey covered the entire economy, with the exception of construction, local governments, production of crops and animals, fishing, hunting and trapping. About 16,000 enterprises responded to the questionnaire. Respondents were asked to report the value of orders received over the Internet, extranets and electronic data interchange (EDI) on the Internet, with or without online payment.

Table 21.
Percentage of enterprises using the Internet to purchase and sell, by industry, 1999

	Use of the Internet to sell	% of economic activity	Use of the Internet to purchase	% of economic activity
		%		
Forestry, logging and support activities*	1.1	0.9	7.4	10.6
Mining and oil and gas extraction	7.1	5.2	19.3	24.5
Utilities	9.2	9.8	24.7	37.7
Manufacturing	14.9	16.3	18.9	31.8
Wholesale trade	13.6	17.1	13.9	23.2
Retail trade	10.9	21.9	10.8	15.7
Transport and warehousing	10.1	21.1	10.7	27.8
Information and cultural industries	20.1	44.3	49.6	53.6
Finance and insurance	14.7	23.0	12.7	39.5
Real estate and rental and leasing	9.5	11.5	8.2	11.3
Professional, scientific and technical services	11.5	14.9	30.0	39.7
Management of companies and enterprises	8.0	3.7	12.9	16.8
Administration and support, waste management and remediation services	17.3	23.3	13.4	17.7
Educational services (private sector)	17.3	22.2	27.2	35.3
Health care and social assistance (private sector)	3.1	6.3	9.5	14.4
Arts, entertainment and recreation	10.1	9.8	12.1	16.5
Accommodation and food services	7.9	16.3	3.9	8.5
Other services (except public administration)	3.7	5.0	6.5	10.3
Total private sector	10.1	17.0	13.8	25.1

Source: *Information and Communications Technologies and Electronic Commerce Survey*, Science, Innovation and Electronic Information Division, Statistics Canada.

* Includes forestry and logging and support activities for agriculture and forestry.

5.3 The value of Internet sales

The total amount of Internet-based customer orders, with or without online payment, was \$4.2 billion in 1999, representing 0.2% of total economic activity.

Manufacturers received orders worth \$900 million on the Internet, representing about 22% of overall private sector Internet-based sales, but only 0.2% of manufacturing shipments in 1999. Similarly, retailers, who had Internet sales valued at \$611 million, accounted for 15% of total Internet sales and 0.3% of total retail sales in 1999.

The highest share for all industrial sectors was reported by accommodation and food services, with estimated Internet sales of 1.3% of their total sales. Information and cultural industries followed with 1.0% of their total sales, professional, scientific and technical services were third with 0.8%.

Table 22.
Internet sales, by industry, 1999

	Internet sales with or without online payment	Internet sales as a % of total operating revenue
<i>millions of dollars</i>		
Manufacturing	900	0.2
Retail trade	611	0.3
Information and cultural industries	553	1.0
Accommodation and food services	429	1.3
Professional, scientific and technical services	406	0.8
Finance and insurance	321	0.1
Transport and warehousing	164	0.3
Wholesale trade	156	0.1
Real estate and rental and leasing	115	0.3
Other industry sectors	525	0.2
Total private sector	4,180	0.2

Source: Information and Communications Technologies and Electronic Commerce Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

While information regarding business use of ICTs exists for some countries, very limited information exists to allow quantitative international comparisons for e-commerce. The only official estimates available come from the U.S. Bureau of the Census and the Australian Bureau of Statistics, which use definitions comparable to Canada.

The U.S. reports e-commerce activity only for the retail trade industry, which amounted to US\$5.2 billion during the fourth quarter of 1999 and \$5.3 billion in the third quarter of 2000. This ranges between 0.6%-0.7% of total sales in the U.S. retail sector.

Over the 1999-2000 year, Australia reported 76% of businesses using computers, 56% with access to the Internet and 16% with a Web site, while 8% received

orders and 10% placed orders for goods and services over the Internet. In Australia the proportion of Internet commerce accounted for 0.4% of total annual sales during 1999-2000.

Use of ICTs is quite high among businesses in the Nordic countries of Denmark, Finland, Norway and Sweden. Internet connections were most frequent in Finland, where 85% of businesses had Internet access in 1999. Business Internet penetration reached 78% in Denmark and Sweden, and 66% in Norway. In the same year, 57% of businesses in Sweden had a home page, followed by 53% in Denmark, 49% in Finland, and 35% in Norway. 19% of businesses in Denmark had the possibility of receiving orders over the Internet, as did 17% in Finland, 14% in Sweden, and 12% in Norway.

5.4. Barriers to the use of ICTs

Clearly, e-commerce has made in-roads among Canadian businesses but there is a lot of room for growth, as the majority still does not participate. The main reason cited by enterprises which use the Internet but do not engage in e-commerce is that they prefer to maintain their current business model (e.g. face-to-face interaction with customers or suppliers) – 46% percent of enterprises considered it ‘very important’ or ‘important’. Following this was their perception that the goods and services they produce do not lend themselves to transactions over the Internet (31% thought it to be ‘very important’ or ‘important’). The same reasons, but in reverse order, were cited by those enterprises that did not use the Internet (at 56% and 51%, respectively), followed by security concerns (40%).

Much more remains to be learned, as measurements of business connectivity continue over time, not only with regard to business adoption and use of ICTs and e-commerce, but also in understanding the outcomes of the transformation of e-business processes and the overall macroeconomic impacts of such transformation.

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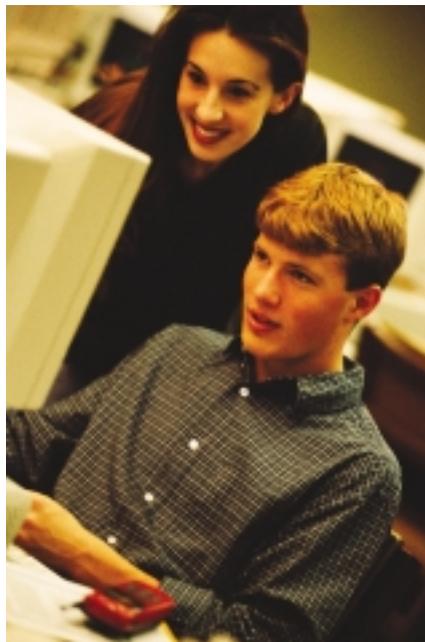
Making use of ICTs to create new channels for the delivery of services has kindled the interest of governments from early on. Use of the Internet, in particular, has been a major initiative of governments for some years, as this new medium offers versatility and promises efficiency. In Canada, several specific applications, such as the electronic filing of income tax returns, have been used extensively as early examples of successful implementation. Many more are in the works. With the heaps of information and many programs and departments, anyone who has ever tried to search for specific government information, or to contact the right department and person to answer a question, can appreciate the promise of easy and convenient accessibility, free from the constraints of a specific time and place.

Governments around the world are trying to take advantage of new opportunities and overcome new challenges. Connectedness is one area that has created business-like competition among governments to seize perceived advantages in the quality of the delivery of services, lower costs, and even country branding, as it is widely believed that connectedness fosters innovation, economic growth, and improves the competitiveness of the economy. Ambitious programs have been announced in many countries and levels of government.

The role of governments is catalytic not only because they can use the new ICTs to deliver services more effectively, but also because they can generate momentum by acting as a model user. In addition, governments actively facilitate developments in the 'networked economy' by aiming to create a competitive and level playing field for all businesses and industries involved.

"The Government will become a model user of information technology and the Internet. By 2004, our goal is to be known around the world as the government most connected to its citizens, with Canadians able to access all government information and services online at the time and place of their choosing" (Speech from the Throne, 1999).

"The Government will continue to work toward putting its services on-line by 2004, to better connect with citizens" (Speech from the Throne, 2001).



The world is moving rapidly toward an information society in which knowledge, goods and services are created and exchanged over networks made possible by information and communications technologies (ICTs). Adapting to the growth, development and use of ICTs is essential to the development of world-leading infrastructure and technology, increased industrial competitiveness and productivity, and the knowledge and skills of our people and communities. The ability of Canadians to use ICTs to interact and transact with one another and with the rest of the world is no longer an indulgence, rather a necessary ingredient for a new economy within what has become a digital world ('Improving Performance with Connectedness', The Conference Board of Canada, 1999).

The Canadian government has established a comprehensive 'connectedness' agenda. Government online (GOL) is one of its six pillars (the others are Canada Online, Smart Communities, Canadian Content Online, Electronic Commerce, and Promoting a Connected Canada to the World). A central idea behind this major initiative is that GOL will complement, not replace, existing delivery channels. Issues of policy and work underway refer chiefly to the deployment of the required infrastructure and the associated delivery of services to businesses and citizens. The GOL vision is to enable Canadians to securely request and receive services and information when and where it is most convenient for them, wherever they live.

Several targets have been set with the intention of a completely customizable, personal interface that will allow for convenient access to Canadian content and services, community and government information.

Statistics Canada, as one of the core departments involved in GOL, is well advanced on this front. It already has a well-developed Web site that provides information services to the public, as well as a functioning system that allows the processing of financial transactions securely on-line. The next phase for the Agency will be an online data reporting option for survey respondents. Several pilot studies will be conducted over the next year to assess respondent acceptance and the implications for cost and data quality.

By the end of 2000, Canadians can expect:

- Up-to-date, accurate, bilingual information on key programs and services available online.
- Commonly-used forms available to download and print.
- The ability to contact government departments and agencies.
- A technology and policy framework that protects the security and privacy of citizens in their electronic dealings with government.

In the next few years, Canadians can expect:

- Key federal programs and services – the ones that matter most to Canadians – will be available online.
- Clients will be able to complete secure and interactive transactions online, and have access to secure and interactive electronic forms.
- Technical and content support will be provided through various help services.
- Advanced search capabilities will be available on the Government of Canada portal and all federal department and agency web sites.
- Clients will be able to find information and services even if the exact name of the program or service is unknown.

Source: Government of Canada (2000). Government Online Web site: <http://www.ged-gol.gc.ca>

6.1 Measuring GOL

Considering the emphasis and the resources placed on such endeavours, measurements general to government connectivity, and specific to GOL are indispensable in order to quantify and monitor progress. Early indicators shed light on both the use of ICTs by the federal and provincial governments in Canada, as well as their uptake by individuals.

All federal and provincial government institutions were using personal computers and almost all were using the Internet. The overwhelming majority also had a Web presence. However, just over half of federal and provincial government institutions purchased goods or services over the Internet and only about a quarter used the Internet to sell goods or services. These accounted for 60% and 28% of the public sector’s total economic activity, respectively².

Table 23.
Government connectedness, 1999

	%
Federal and provincial government institutions that	
<i>used personal computers</i>	100.0
<i>used e-mail</i>	99.5
<i>used the Internet</i>	98.0
<i>had a Web site</i>	87.8
<i>used the Internet to purchase goods or services</i>	50.7
<i>used the Internet to sell goods or services</i>	24.7

Source: Information and Communications Technologies and Electronic Commerce Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

Additional useful indicators were also obtained with regard to employee access to ICTs.

Table 24.
Government employee connectedness, 1999

	%
Federal and provincial government employees with	
<i>access to a personal computer, workstation or terminal</i>	93.5
<i>access to e-mail</i>	92.1
<i>access to the Internet</i>	82.2

Source: Information and Communications Technologies and Electronic Commerce Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

² Weighted by the number of employees.

In order to assess the responsiveness of households and their use of government information on the Internet, the Household Internet Use Survey (HIUS) asks households that regularly use the Internet from home whether they do access such information. Although the households who do so still represent a relatively small proportion of all households, their proportion among regular home Internet users has become sizeable. Moreover, that proportion increased substantially between 1998 and 1999, at the same time at which the home penetration rate also increased substantially.

Table 25.
Households searching for government information online, 1998-1999

	1998	1999
		%
All households	8.2	12.6
Home-use households	36.4	44.1

Source: Household Internet Use Survey, Science, Innovation and Electronic Information Division, Statistics Canada.

New indicators of government connectedness will continue to be compiled, as well as statistics on the government's involvement in e-commerce. Eventually, it will be important to benchmark Canada internationally and identify areas where it is leading or trailing other countries. The task at hand is a challenging one, but essential in order to monitor the progress of government connectedness in the new economy.

6.2 ICTs in education

In parallel with its GOL initiatives the Canadian government has been proactive in ensuring that all Canadians can have access to the Internet by establishing alternative points of access and thus narrowing the 'digital divide'. Well-known programs, such as Community Access Points (CAP) and SchoolNet, date back some time. Schoolnet focuses on leveling the opportunities at schools, regardless of whether or not students have home access.

As ICTs become an established component of the educational systems in Canada and around the world, educators, researchers and policy-makers are faced with the huge challenge of monitoring and assessing the use, effectiveness and impacts of these technological applications on student learning and performance.

The emergence of ICTs in education has been so rapid that there exists a serious information gap regarding their role in reshaping education to respond to the knowledge needs and challenges (*ICT and the Emerging Paradigm for Life Long Learning: a Worldwide Educational Assessment of Infrastructure, Goals and Practices, IEA, 1999*).

The SchoolNet initiative is one example of the federal government's partnerships with the provinces, territories and private sector to connect our nation's schools and classrooms. It encourages the integration of information technology in learning, to help students acquire leading-edge skills in Internet research and communication. In addition to its main thrust, to connect all the nation's schools to the Internet within a short time frame, ongoing support is provided. Its Web site offers educators and students more than 1,000 learning services and resources, including training and research tools (Connecting Canadians (2000). Canada Online Web site <http://www.connect.gc.ca>).

In an effort to narrow this data gap, the Second International Technology in Education Study (SITES) profiled the use of new ICTs in elementary and secondary schools in 26 countries around the world. The Canadian portion of the survey was administered by Statistics Canada on behalf of the International Association for the Evaluation of Educational Achievement, as well as a number of other partners, including the provincial and territorial ministries of education, the Council of Ministers of Education, Industry Canada and Human Resources Development Canada (HRDC).

The SITES initiative addressed four main questions:

- to what extent have schools adopted objectives and practices that reflect a focus on active learning strategies?
- what equipment, software, access to the Internet and other ICT infrastructure is available in schools?
- what staff development and support services are in place for ICT-use in schools?
- to what extent does the school offer a supportive climate for the use of ICTs in the school?

Canadian results for 1998-99 show that schools have made major strides in bringing their students online. Computerization was widespread and Internet connectivity nearly complete, with the majority of students attending elementary, intermediate or secondary schools with access to the Internet for educational purposes. About one-third of elementary and intermediate students, and half of all secondary students, had used e-mail. 76% of elementary, 80% of intermediate and 87% of secondary students had made use of external databases to find and extract information, and over one-third of all students had disseminated information via the Internet.

In all, 73% of students attended an intermediate or a high school that had its own Web site, while about 30% of students had designed or maintained a Web site. Most elementary school students had access to software for word processing, encyclopedias (on CD-ROM), spreadsheet packages, databases and Internet browsers. In addition, intermediate and secondary students had widespread access to software for graphics, presentation and programming.

Internet use varied from province to province. For example, about 65% of students in Prince Edward Island had used e-mail during the last school year compared with 31% of students in New Brunswick. Students in P.E.I. were also ahead in Web site development – 46% had maintained Web sites as compared with only 16% in Saskatchewan.

The Canadian SITES, conducted in January and February 1999, was a random sample covering 4,000 schools. Each school received a questionnaire for the principal and a questionnaire for the person who is most knowledgeable with regard to ICT-use in the school. Both questionnaires inquired about the school environment, the use of communications technologies, the training and professional development of teachers, and barriers to the use of technology at the school. Three specific grade levels are used to represent the majority of schools in Canada: the elementary level corresponds to schools with Grade 5, the intermediate level corresponds to schools with Grade 9 or secondary III, and schools with students in their last year of secondary represent the secondary/high school level of education.

Table 26.
Percentage of students attending schools with Internet access, 1998-99

	Elementary	Intermediate	Secondary
	%		
Newfoundland	82	96	97
Prince Edward Island	100	100	100
Nova Scotia	84	100	95
New Brunswick	100	100	100
Quebec	90	97	99
Ontario	86	98	96
Manitoba	96	99	95
Saskatchewan	96	99	99
Alberta	98	100	100
British Columbia	76	98	99
Canada	88	98	97

Source: *Second International Technology in Education Study, Centre for Education Statistics, Statistics Canada and International Association for the Evaluation of Educational Achievement.*

Table 27.
Use of ICTs in education, 1998-99

	E-mail	External databases	Design/maintain Web sites	Dissemination of information via the Internet	Discuss/explore ideas via video conference
	%				
Newfoundland	52	81	44	45	9
Prince Edward Island	65	83	46	41	2
Nova Scotia	53	79	33	38	8
New Brunswick	31	86	21	29	5
Quebec	44	80	30	40	7
Ontario	34	83	32	31	6
Manitoba	50	81	32	38	15
Saskatchewan	46	82	16	33	3
Alberta	41	81	25	42	7
British Columbia	39	75	30	26	6
Canada	40	81	30	35	7

Source: *Second International Technology in Education Study, Centre for Education Statistics, Statistics Canada and International Association for the Evaluation of Educational Achievement.*

Mathematics was the subject area most likely to be taught using instructional software in all three levels of education. About 87% of elementary students, 76% of intermediate students, and 79% of secondary students attended a school that used software programs to teach math. Courses in geography, language and informatics were also making use of instructional software programs.

Perhaps one of the most important factors affecting the extent to which ICTs are adopted and implemented in educational practice is the teacher. Overall, about 79% of students were attending a school where most teachers had taken at least some basic computer courses. However, the lack of training opportunities available was still seen as a major obstacle by principals and technology educators surveyed in the schools, along with having too few computers, too few software licences, and the lack of technical support to maintain the computers.

In general, computers were more readily available to students in higher grades. This is reflected in the student-computer ratio, which indicates the number of students per computer in the school. At the time of the survey, there was one computer for every seven students at the secondary level, compared with one for every eight intermediate students and one for every nine elementary students. Certainly the student-computer ratio by itself does not convey much information about the actual functionality and use of the equipment, but serves as an indicator of the existing ICT infrastructure in a given school.

Table 28.
Student-computer ratio, 1998-99

	Elementary	Intermediate	Secondary
		%	
Newfoundland	10	11	8
Prince Edward Island	14	9	6
Nova Scotia	15	11	9
New Brunswick	10	9	8
Quebec	11	11	9
Ontario	9	6	6
Manitoba	8	6	5
Saskatchewan	10	8	8
Alberta	7	6	7
British Columbia	8	8	8
Canada	9	8	7

Source: Second International Technology in Education Study, Centre for Education Statistics, Statistics Canada and International Association for the Evaluation of Educational Achievement.

Generally, the speed with which all schools have been connected to the Internet has been impressive considering Canada's geographical reality. This degree of connectedness places Canada in the avant-garde of countries internationally. Undoubtedly, over time many more issues need to be addressed, including classroom connectivity in conjunction with its specific applications and educational use, as well as bandwidth. Above all, how to harness the powers of the new ICTs and how to integrate them with traditional instructional methods in a way that is conducive to the advancement and transfer of knowledge, needs to be understood and evolve.

How does Canada's use of ICTs in education compare...

- In the U.S., 94% of elementary schools and 98% of secondary schools had access to the Internet
- In Italy, 28% of elementary students, 73% of intermediate students and 73% of secondary students attended schools with access to the Internet for instructional purposes.
- In Norway, 56% of elementary, 81% of intermediate and 98% of secondary students attended schools with access to the Internet for instructional purposes.
- In France, 24% of students at the elementary level, 55% of students in intermediate and 73% of students in secondary attended schools with Internet access for instructional purposes.
- Student-computer ratios (number of students per computer) in elementary schools ranged from 12 in Finland to 88 in Italy. At the intermediate level, student-computer ratios ranged from 8 in New Zealand and Singapore, and 9 in Denmark and Norway, to 25 in Hungary and Slovenia, and 34 in the Czech Republic. Secondary schools had lower student-computer ratios, with Singapore at 3, Norway at 4, France at 7, the Czech Republic at 10, Slovenia at 11, and Japan at 12.

In summary, ICT diffusion and use in Canadian governments and schools is a dynamic and growing phenomenon. Following initial deployment of infrastructure, appropriate applications start to emerge. Connecting the people and places with information and knowledge is what makes Canada a strong networked economy, in the global information society.

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Notes, Methodologies and Data sources

Notes and Methodologies

The statistical compilation of the ICT sector was guided by two general principles:

1. The use of business data sources and, in particular, surveys covering individual ICT sector industries, rather than economy-wide vehicles (adherence to this principle entails a trade-off between reliability and timeliness, as typically industry surveys are subject to lengthier time lags);
2. The use of the new NAICS as opposed to the 1980 SIC, as this is the way of the future.

Several divergences from these general principles were necessary, however. Some variables of interest are not measured by industry surveys. R&D data come from the survey of industrial R&D activities, while GDP data are compiled in the System of National Accounts.

In addition, different statistical programs are at different stages of transition to NAICS. This necessitated the use of a mixture of statistics based on both the 1980 SIC and NAICS. For this reason, concordances were developed between each of these classifications and the International Standard Industrial Classification (ISIC Rev.3), which was used by the OECD (see *Innovation Analysis Bulletin*, Vol. 2, No. 1 & No. 2, 2000, Cat. No. 88-003-XIE). Some industries, for instance Telecommunications Services, are not affected much on the aggregate by the change in classification, while the delineation of others, such as Computer Services, has changed more substantially, as these industries were transformed over time.

Moreover, some conversions to NAICS have not necessarily back-cast the series to cover the entire reference period used in the compendium. Again, some mixture of classifications or choice of an alternative data source was necessary.

Instances related to specific divergences from the general principles above were carefully identified, documented and are listed below, together with additional issues.

1. The definition of the ICT sector requires some detailed industry information not currently available. Thus, the industries of Office Machinery and Equipment Rental and Leasing (NAICS 53242) and Electronic Precision Equipment Repair and Maintenance (NAICS 81121) are not included in the sector's totals. In addition, GDP and revenue data for ICT wholesaling industries (NAICS 4173 and 41791) are also not included. These exclusions, lead to an underestimation of the sector. Efforts will be made to close these gaps.
2. GDP, merchandise export and import data, and intramural R&D expenditures are based on the 1980 SIC. NAICS-based data for Computer Services industries are available only for the years 1997 and 1998. Thus, for the 1993-1996 reference period, 1980 SIC data are used (see Note 7 for more information).

3. Wherever possible, employment data have been provided by the various industry surveys. In the case of the ICT Wholesale Trade and Telecommunications Services industries, employment estimates were obtained from the Survey of Employment, Payrolls and Hours (SEPH). For more information about SEPH see Statistics Canada's Annual Estimates of Employment, Earnings and Hours, 1987-1999, Survey Overview, Catalogue No. 72F0002XIB.
4. Employment estimates for 1997 and 1998 from the Annual Survey of Software Development and Computer Services (NAICS 51121, 51419, 51421, 54151) include a small number of self-employed workers who filed non-employer T1 income tax forms. This is not considered adequate to accurately reflect the significant level of self-employment in these industries, which may therefore be underestimated.
5. Merchandise trade data are captured and reported on a commodity basis, as they cross the border. In an effort to quantify industry trade, Statistics Canada's International Trade Division produces industry-based data by allocating the total trade of a commodity to its primary industry of production. For instance, all exports of computers will be assigned to computer manufacturers. In that sense, ICT merchandise exports and imports do not reflect the total exports and imports of all merchandise by ICT industries, but rather the total exports and imports of ICT commodities assigned to these industries. For more information consult Canadian International Merchandise Trade, Catalogue No. 65-001-XIB. Similarly, the Balance of Payments Division generally publishes services trade data by product category, and not by industry. For more information consult Canada's International Transactions in Services, Catalogue No. 67-203-XIB.
6. Beginning with reference year 1996, the physical exports of prepackaged software units for general commercial or personal use are excluded from computer services. The exports are now part of goods, but were included in services for years prior to 1996 to ensure sufficient valuation in the goods and services account. There is also some break in the data for telecommunications services between 1995 and later years.
7. As noted above, between 1993-1996, data for the Computer Services industries are only available by 1980 SIC. Starting with the 1997 reference year, data are NAICS-based. Since both industry classifications are used for the employment and revenue data in Part I, it is important to understand the difference between the Computer Services industry (SIC 772) and the computer services industries under NAICS. The concordance between the two classifications is imperfect:

SIC 772 included:	NAICS includes:
1) Computer Systems and Design	1) Computer Systems and Design
2) Software Publishers	2) Software Publishers
3) Data Processing	3) Data Processing
4) Repair and Maintenance of computer equipment	4) Internet Service Providers (ISPs)

Revenue for ISPs in 1997 represented about 2% of total revenue, while in 1996 Repair and Maintenance of computer equipment represented about 3% of total revenue. In other words, allowing for sampling and non-sampling errors and the relatively small difference in revenues (approximately 1%), it is relatively safe to compare NAICS totals (for 1997 and 1998) to SIC totals (1993-1996). However, this may change in subsequent years if the ISP industry grows. Although the vast majority of the firms that were covered in SIC 772 are now classified in the four NAICS industries mentioned above, the number of employees for 1997 and 1998 is not strictly comparable to data for previous years.

Data sources

All data for the compilation of the ICT sector in Part I, as well as for the sectoral presentation in Part II come from various statistical programs and databases in Statistics Canada. The international comparisons in Chapter 3, Part I are based on OECD data, while the data for other countries, interspersed in Part II, come from these countries' official statistical offices, (The data used in international comparisons on education come through the International Association for the Evaluation of Educational Achievement).

A detailed list of data sources and publication vehicles used in their dissemination follows:

GDP

Gross Domestic Product by Industry, Statistics Canada, Catalogue No. 15-001.

Employment

Annual Survey of Manufactures, Statistics Canada, Catalogue No. 21-203.

Annual Return, Cable Television, Statistics Canada, Catalogue No. 56-205.

Annual Survey of Computer Services, Statistics Canada, Catalogue No. 63-222, CANSIM 7461.

Survey of Employment, Payrolls and Hours, Statistics Canada, Catalogue No. 72-002, CANSIM 4285.

International trade

Canadian International Merchandise Trade, Statistics Canada, Catalogue No. 65-001-XIB.

Trade Data Online, International Trade Division, Statistics Canada, <http://www.strategis.ic.gc.ca>

Canada's International Transactions in Services, Statistics Canada, Catalogue No. 67-203. Balance of Payments Division, Statistics Canada.

Revenues

Annual Survey of Manufactures, Statistics Canada, Catalogue No. 21-203.

Annual Return Cable Television, Statistics Canada, Catalogue No. 56-205.

Annual Survey of Telecommunications Service Providers, Statistics Canada, Catalogue No. 56-001 (1997, 1998).

Annual Report, Telephone Statistics, Statistics Canada, Catalogue No. 56-203 (1993-1996).

Annual Survey of Computer Services, Statistics Canada, Catalogue No. 63-222.

Quarterly financial statistics for enterprises, Statistics Canada, Catalogue No. 61-008.

Intramural R&D expenditures

Industrial Research and Development, Statistics Canada, Catalogue No. 88-202. *Science, Innovation and Electronic Information Division*, Statistics Canada, (special tabulation).

Other

Capital Expenditures by Type of Asset, Statistics Canada, Catalogue No. 62-223, CANSIM 3152.

Household Internet Use Survey (HIUS), 1997-1999, Science, Innovation and Electronic Information Division, Statistics Canada.

Information and Communications Technologies and Electronic Commerce Survey (ICTEC), 1999, Science, Innovation and Electronic Information Survey, Statistics Canada.

Survey of Household Spending in Canada, Income Statistics Division, Statistics Canada, Catalogue No. 62-202.

Second International Technology In Education Study (SITES), 1999, Centre for Education Statistics, Statistics Canada and International Association for the Evaluation of Educational Achievement (IEA).

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Labour Statistics Division

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ELECTRONIC PUBLICATIONS AVAILABLE AT
www.statcan.ca



Bibliography

Bakker, C. (2000). *Information and Communications Technologies and Electronic Commerce in Canadian Industry*, Statistics Canada, Cat. No. 88F0006XIB, No. 4, November.

Dickinson, P. and Ellison, J. (2000). 'Plugging In: The Increase of Household Internet Use Continues into 1999', *Connectedness Series*, Statistics Canada, Cat. No. 56F0004, No. 1, December.

Connecting Canadians (2000). *Canada Online*, <http://www.connect.gc.ca>

Government of Canada (1996). *Building the Information Society: Moving Canada into the 21st Century*, <http://strategis.ic.gc.ca>

Government of Canada (1999). *Speech from the Throne*, <http://www.pco-bcp.gc.ca>

Government of Canada (2000). *Government Online*, <http://www.ged-gol.gc.ca>

Government of Canada (2001). *Speech from the Throne*, <http://www.pco-bcp.gc.ca>

Industry Canada (2000). *Information and Communications Technologies (ICT) Statistical Overview*, Spectrum, Information Technologies and Telecommunications Sector. <http://strategis.ic.gc.ca>

Industry Canada and Statistics Canada (1996). *Measuring the Global Information Infrastructure for a Global Information Society*, September.

International Association for the Evaluation of Educational Achievement (1999). *ICT and the Emerging Paradigm for Life Long Learning: a Worldwide Educational Assessment of Infrastructure, Goals and Practices*, November.

Ministère de l'Économie des Finances et de l'Industrie (1999). *Information Technology and the Information Society*, Secrétariat d'Etat à l'Industrie, France.

National Statistics, U.K. (2000). *Internet access*, December, <http://www.statistics.gov.uk>

OECD (2000a). *Defining Electronic Commerce*.

OECD (2000b). *Measuring the ICT Sector*.

Statistics Canada (2000a). *Innovation Analysis Bulletin*, Science, Innovation and Electronic Information Division, Vol. 2. No. 1 & No. 2, Cat. No. 88-003-XIE.

Statistics Canada (2000b). *Spending Patterns in Canada, 1998*, Income Statistics Division, Cat. No. 62-202-XPE, August.

Statistics Denmark, Statistics Finland, Statistics Norway, Statistics Sweden (2001). *Use of ICT in Nordic enterprises, 1999/2000*, January, <http://www.ssb.no>

Statistics Finland (1999). *On the Road to the Finnish Information Society II*, May.

The Boston Consulting Group (Canada) (2001), *Fast Forward 2.0: Taking Canada to the Next Level*. Report of the Canadian E-Business Opportunities Roundtable, February.

The Conference Board of Canada (1999), *Improving Performance with Connectedness*, September.

The U.S. Department of Education, *National Center for Education Statistics* (2000), <http://www.ed.gov>

