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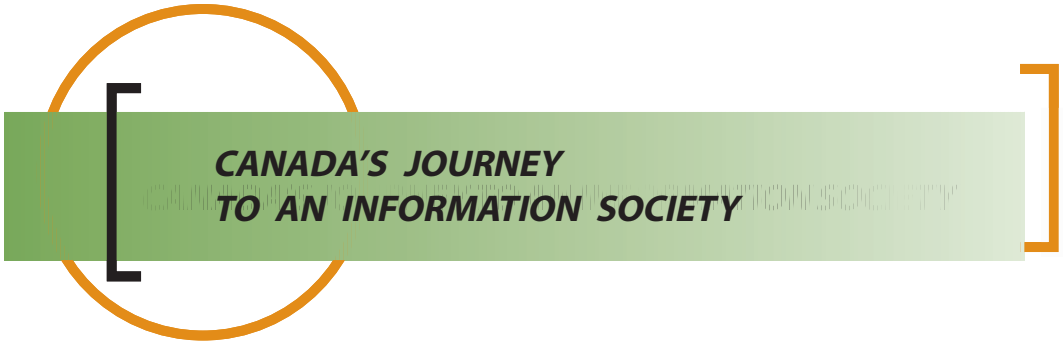

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CONTENTS

SYMBOLS

The following standard symbols are used in Statistics Canada publications:

. not available for any reference period

.. figures not available for a specific reference period

... not applicable

i intentions

p preliminary

r revised

x suppressed to meet the confidentiality requirements of the Statistics Act

E use with caution

F too unreliable to be published

( ) negative value

ABBREVIATIONS

CAGR	Compound Annual Growth Rate
CANSIM	Canadian Socio-Economic Information Management System
CA	Census Agglomeration
CMA	Census Metropolitan Area
EHR	Electronic Health Record
EU	European Union
G7	Group of Seven (industrial nations)
G8	Group of Eight (industrial nations)
GDP	Gross Domestic Product
GOL	Government Online
GSS	General Social Survey
HIUS	Household Internet Use Survey
ICT	Information and communications technologies
ISIC	International Standard Industrial Classification
ISP	Internet service provider
IT	Information technology
NAICS	North American Industry Classification System
OECD	Organization for Economic Co-operation and Development
PISA	Programme for International Student Assessment
R&D	Research and development
SECT	Survey of Electronic Commerce and Technology
SEPH	Survey of Employment, Payrolls and Hours
SHS	Survey of Household Spending
SME	Small and medium-size enterprises
WPIIS	Working Party on Indicators for the Information Society


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FROM THE EDITORS

Information in this age of technology moves faster than it can be processed. The Information Society is upon us. In a short period, by historical standards, information and communications technologies (ICTs) have made more than a dent in our daily lives, whether at home or at work. They have stamped their mark on our reality. We are now inundated with various means of communication, fast access to vast amounts of information, and new options for all our activities. While the economic and societal transformations of this evolution are far from being complete, and our current perceptions may well be challenged by what is yet to come, there is already enough to adapt to. Learning to live with the new comes with distinct advantages, but also with dangers for pitfalls. As always, our brainstorming, debating, reflecting and judging can benefit from information that helps put our comprehension of the underlying changes and their possibilities into perspective.

Statistics Canada has been actively monitoring these developments and, in recent years, has sought to illuminate several aspects of ICT-related phenomena from many angles. Whether it was the size, growth and significance of the ICT sector at issue, the penetration and use of ICTs by households and individuals, or business and government connectivity and engagement in e-commerce, efforts were made to shed light on them by way of sound quantification and analysis. As well, our first compendium publication, *Networked Canada: Beyond the Information Highway* was produced, while ongoing analytical activities are disseminated through the *Connectedness Series* studies and other publications. Much of our work in this area is shared internationally, in a quest for common knowledge and learning. Now, a substantial interest emanates from developing countries, particularly prompted by the upcoming World Summits on the Information Society in 2003 and 2005. The interest expressed in our work, in Canada and around the world, has encouraged us to continue.

The present volume advances our work one step further. It represents a comprehensive compilation of measurements and analyses from diverse areas across the Agency. It traces the evolution of our economy and highlights many facets of our societal transformation. From the use of ICTs in our farming communities to ICT sector occupations, from concentration in telecommunications markets to the workings of Internet service providers, and from broadband deployment to the digital divide, it offers an appreciation of just how widely spread the ramifications of ICTs are. It represents a truly collaborative effort among numerous parts of the Agency who have joined forces to deliver this product.

Part 1 contains a statistical profile of the ICT sector and examines the recent history of individual industries. Part 2 addresses economy-wide issues from a sectoral approach, covering households, business and governments – including education, health and justice. Part 3 offers a collection of thematic analyses focusing on topical issues of the Information Society. Part 4 presents contributions from policy departments to help situate Canada's role in the world, adding a valuable dimension to what our national context reveals. Exporting and sharing a successful connectedness model, with numbers to back it up, reflects well on Canada's position in global affairs.

Throughout, we compare Canada to other parts of the world. This is apt in a period of globalization and unsettled geopolitics, where communication, information and knowledge have also become competitive arenas. It is our hope that this volume brings some of the notions and ideas surrounding the Information Society closer to home, but in a way that demystifies and emphasizes their meaning. For the ultimate answer, however, we will all have to wait. Looking at ourselves with the added dimension of quantitative information helps establish a better perspective. It has been said that, "If you don't know where you are, a map won't help". We hope that this volume will serve as a piece of such a map, helping to pinpoint our new societal coordinates. It is only then that our future path can be chosen more confidently.

Heidi Ertl and George Sciadas
December, 2003

Introduction

THE ROAD TO THE INFORMATION AGE: HOW DID WE GET HERE?

THE ROAD TO THE INFORMATION AGE: HOW DID WE GET HERE?

At one time or another, many of us have come across stories of individuals who experience spectacular life-changing transformations and then go on to meet their destiny…and ours. Lately, much has also been said and written about radical transformations of firms, considered critical to ensuring their long-run survival and success. "Cannibalizing" one's business is now seen as an orthodox way of moving forward. For instance, NOKIA, one of the world's leading information and communications technology (ICT) firms, is still considered by some in Finland to be a lumber company. But what about the transformations of an entire country? Canada offers a good case study.

The transformation of a country

Over time the Canadian economy has been profoundly reshaped, from one based almost exclusively on natural resources to one striding with confidence into the knowledge-based era of technology and innovation. Canadians have been transformed from "hewers of wood and drawers of water" to a leading Information Society workforce. While natural resources will always be important for Canada, much has changed over the course of the last century. The country has a new make-up and a new outlook for the future. How did this happen?

"Canada has come a long way from the economic revolution sparked by the railway and the telegraph in the early 1800s" (Statistics Canada 2001).

From natural resources...

From its beginnings the Canadian economy relied heavily on natural resources. For generations the country's prosperity was based on harvesting the resources of the land and seas. This was the driving force behind early settlement and development. Other important milestones in the country's history, notably the completion of the Canadian Pacific railway from east to west towards the end of the 19th century, were related chiefly to the movement of natural resources and people.

The primary industries of *agriculture, fishing, mining* and *forestry* made up the original foundations of Canada's economy. Although a far cry from their relative significance in the beginning of the 20th century, as recently as the early 1960s they still contributed 11% to the country's gross domestic product (GDP). These four sectors now contribute only 5.8% to GDP (2002). In parallel, the number of Canadians working in primary industries represents a shrinking slice of the labour force (from 34% in 1911, to 15% in 1951 and only 4% in 1981). This transformation took place gradually, but prepared the ground for the profound changes that were to come at the sunset of the 20th century.

...through manufacturing and services...

In the early years of the 20th century, millions of settlers arrived in the prairies to begin a new life. These "wheat kings" intensified the existing agricultural tradition, but their presence was also the lifeblood behind the emergence of strong and growing manufacturing and transportation sectors in the east. Supplies had to be shipped to the prairies and other parts of the country in order to support the thriving agricultural, forestry and mining industries. In turn, these industries produced farm, forest and mineral products which were shipped back to the cities for further processing or consumption.

The export boom of the "roaring twenties" followed, as Americans, British and other Europeans bought Canadian farm, forest and mining products in large quantities. When demand for iron, wood and paper began to decline, however, mines and mills began to close. The effects were felt throughout the manufacturing and service sectors, signaling the start of the Great Depression.

Post-WWII construction and growth brought the Canadian economy back to vibrancy. The 1950s and 1960s were characterized by high employment and low inflation. Steady growth in personal incomes financed an expanding social safety net, including the Canada Pension Plan, generous unemployment insurance, inexpensive post-secondary education and universal health care (Statistics Canada 1999).

Of all the changes Canada's economy has undergone, the most dramatic has been the rise of the services sector. This was particularly the case for four large groups of services, namely *communications*, *transport and trade*; *government*; *finance, insurance and real estate*; and *community, business and personal services*. The rise of the services sector began in the early 20th century, as the first city dwellers – lacking the skills and time to do tasks that had been part of daily life on the farm – created work for tailors, shopkeepers, bakers, butchers and so on. By the end of WWI, the services sector already employed more people than primary industries and took over as lead contributor to GDP in the early 1920s.

But it was increasingly sophisticated services, rather than personal services, that continued to fuel this transformation over the next several decades. After WWII, economic boom and automation meant that workers left the factory floors for occupations in service industries. As baby boomers reached school-age, demand for education and teachers, and health care and health care workers mounted. This was accompanied by rapid growth in financial services and recreation. Business services were also growing remarkably and information and communications technologies (ICTs) started to become more and more prevalent.

The services sector has been growing steadily and has dominated the economy for some time; it now accounts for almost 70% of GDP and 75% of employment (2002). As a consequence, the relative importance of primary and secondary industries has been declining (Statistics Canada 1999). This is not to say that natural resources and manufacturing, particularly a strong automotive sector, will not always be important in the context of the Canadian economy. However, the chances that young workers entering the labour force will find themselves employed in natural resources or manufacturing are becoming smaller as time goes by.

While the 1970s were difficult years everywhere, with oil-price shocks, increasing prices and high unemployment pushing the economy into stagflation, the 1980s brought about change, both in the economy and in societal attitudes. Most importantly, the beginnings of the Information Society were revealed with the introduction of ICTs, particularly the computer and the cell phone. These and many other ICTs found their way into the lives of Canadians at home and at work. With the arrival of the commercial Internet in the 1990s, the stage was fully set. The movement took an enormous leap with the "irrational exuberance" of the late 1990s which, despite the eventual downturn, was accompanied by confidence, optimism, creativity and an emphasis on training and skilled work. Through

a combination of revitalized and emerging industries, a dynamic ICT sector (accounting for 8% of GDP) surfaced – including a strong manufacturing component. Although much manufacturing activity would shift to developing countries, as a trip to any retail establishment will reveal, part of its evolution involved a restructuring and compositional shift towards higher value-added products and processes. Coupled with trade liberalization, manufacturing generally took off until the recession of the early 1990s. By 1994, the manufacturing sector had recorded its strongest growth in 15 years, a turnaround due in part to the surge in demand for electrical and electronic products for computers and telecom equipment – part of the ICT sector.

But these changes are only the tip of the iceberg. While significant in their own right, they pale in comparison to the underlying economic and societal transformations that occurred from the moment ICTs were welcomed by Canadians – governments, business and consumers embraced connectedness with enthusiasm.

...to an information society

Canada depends on its communications networks to overcome geography and distance for the movement and management of people, goods, services and ideas. Just as the Trans-Canada highway connects all parts of the country, the information highway is revolutionizing the way in which we live, work and play. Instead of a highway built by cement and bridges, the information highway uses a network of wires, cables and satellites to connect computers, telephones and other technologies to overcome the challenge of distance.

ICTs have permeated every sector of the economy; they have taken down borders for trade and increased information traffic between Canada and the rest of the world. To varying degrees, every sector of the economy is adapting to ICTs in order to better deliver services, conduct business, and share information. Many museums, for instance, now use ICTs to showcase their collections, bringing Canadian culture to the world via online catalogues of virtual art work (Statistics Canada 2001).

Those industries supplying communications, such as telecommunications services and ICT manufactures, are continuously innovating to improve the range and quality of their products and services and are engaging in global competition. Moreover, convergence has increasingly blurred the distinctions between technologies and delivery of services.

Among their many applications, ICTs facilitate information sharing and knowledge management, key elements of the Information Society. We now view the transfer of information with a sense of speed and increasing immediacy. Advances in ICTs also create challenges. For example, digital technology allows consumers to download and record music free of charge from the Internet, causing a growing dilemma for the music industry. Many issues of a jurisdictional nature remain to be sorted out.

Author William Atkinson (2001) argues that the key to a strong economy today is to "harness the most renewable and widely available of all our resources – fresh thought." The flow of information fosters growth, productivity and efficiency. Canada currently boasts one of the most sophisticated communications networks in the world. With 31 million people "…spread out over 10 million square kilometers, it's fitting that Canada would be a world leader in communications" (Statistics Canada 1997).

Not only is there now a vibrant ICT sector, despite the recent economic slowdown, but most importantly, ICTs maintain an ubiquitous presence in our lives – for people, business and governments alike. Undoubtedly, applications will continue to evolve facilitated by such developments as broadband networks, which in Canada are among the most advanced in the world. In the meantime, new issues have opened up, including e-government, participatory democracy and e-commerce. In conjunction with the forces of globalization, a connected Canada is well positioned to enter the new era. The Information Society is upon us.

References and related publications

Atkinson, William (2001) *Prototype: How Canadian Innovation is Shaping the Future*, Thomas Allen Publishers, Toronto.

Statistics Canada (1997) *Canada Yearbook*, Catalogue No. 11-402.

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Part 1

A STATISTICAL PROFILE OF THE ICT SECTOR

Chapter 1 ICT SECTOR OVERVIEW

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Chapter 1
ICT SECTOR OVERVIEW

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'. Major progress was achieved in 1998 when countries within the Organization of Economic Cooperation 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 (OECD 2002).

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.

Due to data limitations, the electronic precision equipment repair and maintenance industry (NAICS 81121) is not included in the ICT sector totals presented in this publication.

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 (Statistics Canada 2000). The industry standard used in Canada is the North American Industry Classification System (NAICS). The revised NAICS Canada 2002 replaces NAICS Canada 1997. The statistical analysis presented here is largely based on NAICS Canada 1997, since not all of Statistics Canada's survey programs have made the transition to the revised NAICS Canada 2002. It should be noted that the revision is largely a restructuring of the information and cultural industries sector, meaning that some of the ICT sector industry codes will change, but there will be no significant change in terms of the industry definition or detail.[1]

1 *The most notable change is the introduction of a new industry for Web portals. Web portals are classified within a residual category (514199) in the 1997 version of NAICS. The new industry (518112) will be a component of the 2002-based ICT sector definition, as was the 1997 industry from which it was created.*

Figure 1.1.1 1997 NAICS-based ICT sector industries

Manufacturing

Commercial and service industry machinery	**33331**
Computer and peripheral equipment	**33411**
Telephone apparatus	**33421**
Radio and television broadcasting and wireless communications equipment	**33422**
Audio and video equipment	**33431**
Semiconductor and other electronic components	**33441**
Navigational, measuring, medical, and control instrumentation	**33451**
Communication and energy wire and cable	**33592**

Services

Software publishers	**51121**
Cable and other program distribution	**51322**
Telecommunications services	**5133**
Other information services	**51419**
Data processing services	**51421**
Computer, computer peripheral and pre-packaged software, wholesaler-distributors	**41731**
Electronic components, navigational and communications equipment and supplies, wholesaler-distributors	**41732**
Office and store machinery and equipment, wholesaler-distributors	**41791**
Office machinery and equipment rental and leasing	**53242**
Computer systems design and related services	**54151**
Electronic and precision equipment repair and maintenance	**81121**

The source of data for international comparisons is the OECD publication 'Measuring the Information Economy' (2002). 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. Data are for reference year 2000, except for trade data which refer to 2001.

Figure 1.1.2 2002 NAICS-based ICT sector industries

Manufacturing

Commercial and service industry machinery	**33331**
Computer and peripheral equipment	**33411**
Telephone apparatus	**33421**
Radio and television broadcasting and wireless communications equipment	**33422**
Audio and video equipment	**33431**
Semiconductor and other electronic components	**33441**
Navigational, measuring, medical, and control instrumentation	**33451**
Communication and energy wire and cable	**33592**

Services

Software publishers	**51121**
Wired telecommunications carriers	**51711**
Wireless telecommunications carriers (except satellite)	**51721**
Telecommunications resellers	**51731**
Satellite telecommunications	**51741**
Cable and other program distribution	**51751**
Other telecommunications	**51791**
Internet service providers, web search portals	**51811**
Data processing, hosting, and related	**51821**
Computer, computer peripheral and pre-packaged software, wholesalor-distributors	**41731**
Electronic components, navigational and communications equipment and supplies, wholesaler-distributors	**41732**
Office and store machinery and equipment, wholesaler-distributors	**41791**
Office machinery and equipment rental and leasing	**53242**
Computer systems design and related services	**54151**
Electronic and precision equipment repair and maintenance	**81121**

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OECD (2002) *Measuring the Information Economy*, Paris.

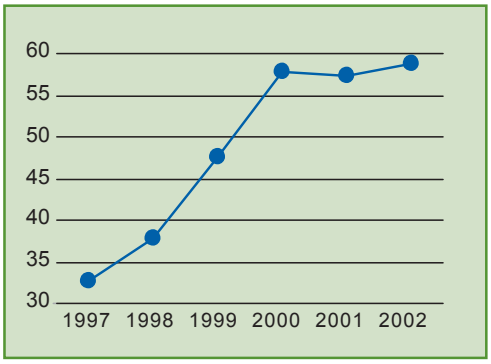
Statistics Canada (2000) *Innovation Analysis Bulletin*, Catalogue No. 88-003-XIE, Vol. 2, No. 1 and No. 2.

1.2 The ICT sector at a glance

- In 2002, the ICT sector contributed $58.7 billion (in 1997 chained dollars) to Canada's gross domestic product (GDP), accounting for 7.1% of business sector GDP, and 6.0% of total economy GDP. This was up slightly from the previous year when the sector's contribution to GDP stood at $57.2 billion.
- ICT sector growth over the 1997-2002 period was a remarkable 79.3%, substantially higher than business sector growth and more than four times the growth of the total economy. Following a modest dip in 2001, the ICT sector's GDP increased by 2.5% in 2002.
- In 2001, the ICT sector accounted for 4.1% of economy-wide employment. This was down slightly from the previous year due to the employment cuts in the computer, telephone and other electronic equipment manufacturing industries.
- Despite a drop in ICT manufacturing employment over the last year, ICT sector employment increased by 30.7% between 1997 and 2001, more than three times the growth rate of economy-wide employment (9.7%).
- Exports of ICT goods and services totaled $25.3 billion and imports $44.8 billion in 2002, falling for the second consecutive year. These represented 5.9% and 11.8% of total exports and imports, respectively.
- Canada's trade deficit was relatively unchanged, at $19.6 billion in 2002. Between 1997 and 2002, the deficit in ICT trade has grown by 16.2%.
- Following a substantial increase in 2000, ICT revenues fell to $136.6 billion in 2001, or 5.7% of total industry revenues.
- Investment spending in the ICT sector has been strong, but began to fall in recent years.
- The ICT sector accounts for a substantial share of total private sector research and development (R&D), a share quite disproportionate to its contribution to GDP and employment.
- The Canadian economy is more ICT-intensive than the average for OECD countries when measured in terms of employment and R&D expenditures.

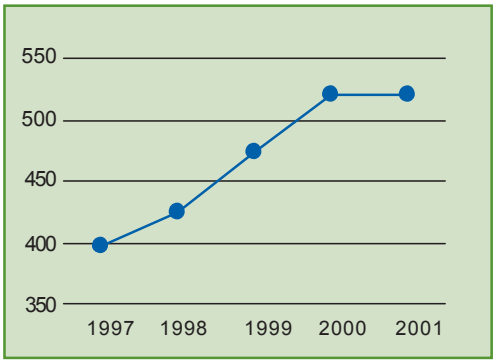
ICT sector GDP

billions of 1997 chained dollars



ICT sector employment

thousands of employees

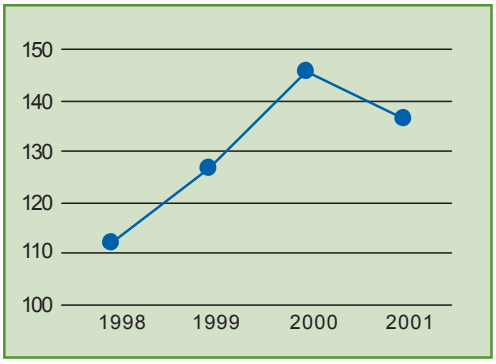


ICT exports and imports

$ billions

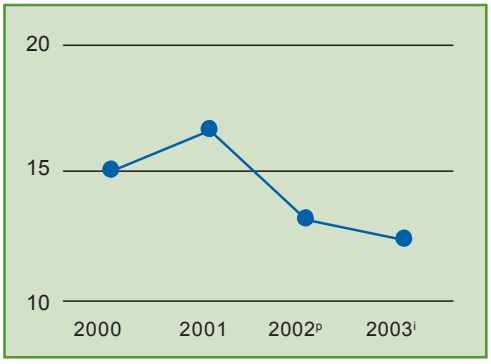
ICT sector revenues

$ billions



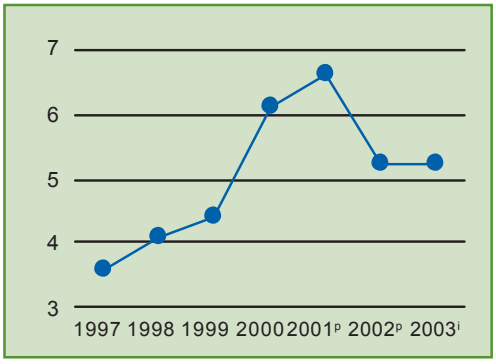
ICT sector capital expenditures

$ billions



ICT sector R&D

$ billions



Chapter 2 THE ICT SECTOR

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Chapter 2
THE ICT SECTOR

2.1 Production

Following a slight decline in 2001, the Canadian ICT sector continued to make a substantial contribution to economic growth in Canada. ICT industries contributed $58.7 billion (in 1997 chained dollars) to Canada's GDP in 2002, representing 7.1% of business sector GDP, and 6.0% of total economy GDP. This was up slightly (2.5%) from the previous year when the sector's contribution to GDP stood at $57.2 billion (1997 chained dollars).

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. See Notes, Methodologies and Data sources for more information (Gross Domestic Product by Industry, Industry Measures and Analysis Division, Statistics Canada).

Figure 2.1.1 ICT sector GDP, 1997-2002

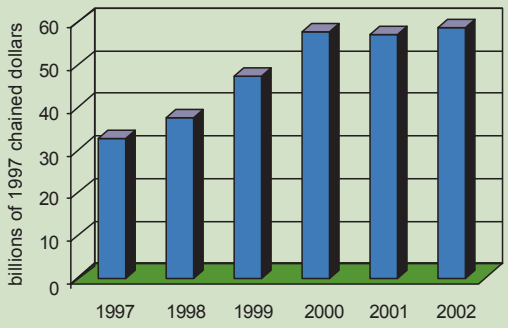
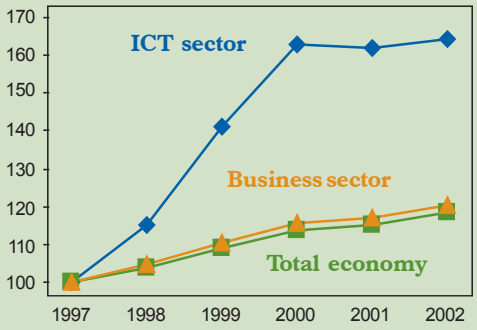
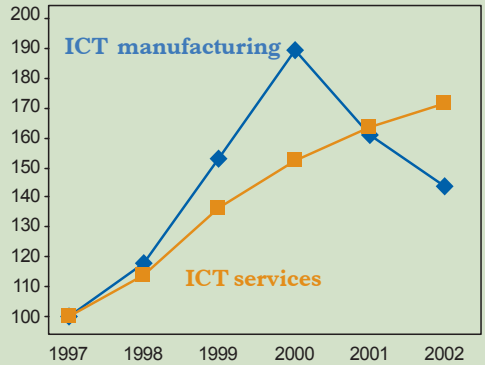


Figure 2.1.2 Indexed GDP, 1997-2002



Average annual compounded GDP growth for the ICT sector was 12.4% over the 1997-2002 period, as compared to business sector growth of 4.1%, and economy-wide growth of 3.7%. Over the same period, total growth for the ICT sector was a remarkable 79.3%, substantially higher than business sector growth (22.0%), and more than four times the growth of the total economy (19.7%). ICT manufacturing continued its downward slide, falling 17.0% in 2002 – this was much improved from the nearly 30% drop between 2000 and 2001. ICT services remained relatively strong, growing 8.1% over the previous year.

Figure 2.1.3 Indexed ICT sector GDP, 1997-2002



Between 1997 and 2002, GDP shares for ICT manufacturing and services industries have been somewhat variable, with ICT services generating the largest share. At its peak in 2000, ICT manufacturing accounted for 31.2% of total ICT sector GDP. Since then, it has declined substantially, settling at 18.1% in 2002. ICT manufacturing was hit hard by the downturn in the communications and telephone apparatus industries, as sluggish demand caused several permanent and temporary shutdowns. ICT services industries accounted for a decreasing share of ICT sector GDP between 1997 and 2000. As growth in ICT manufacturing slowed, ICT services began to boom. With the telecommunications services industry leading the way, the ICT services share of ICT sector GDP reached a high of 81.9% in 2002.

Canada's ICT share of business sector value added is lower than the OECD average but higher than the EU average. Ireland, Finland, Korea and the U.S. have the highest shares (OECD 2002).

Table 2.1.1 ICT sector GDP*, 1997-2002

	1997	1998	1999	2000	2001	2002	02/97	CAGR (02/97)
	billions of 1997 chained dollars						*%*	
Manufacturing	8.2	9.7	13.2	18.1	12.8	10.6	28.9	5.2
% of ICT	*25.2*	*25.8*	*27.7*	*31.2*	*22.3*	*18.1*	…	…
Services	24.5	28.0	34.3	39.9	44.5	48.1	96.3	14.4
% of ICT	*74.8*	*74.3*	*72.3*	*68.9*	*77.7*	*81.9*	…	…
Total ICT sector	**32.7**	**37.7**	**47.5**	**57.9**	**57.2**	**58.7**	**79.3**	**12.4**
Business sector	679.6	710.2	752.2	791.3	801.9	828.8	22.0	4.1
ICT as a %	*4.8*	*5.3*	*6.3*	*7.3*	*7.1*	*7.1*	…	…
Total economy	816.8	848.4	892.9	933.7	947.0	977.3	19.7	3.7
ICT as a %	*4.0*	*4.4*	*5.3*	*6.2*	*6.0*	*6.0*	…	…

Source: Industry Measures and Analysis Division, Statistics Canada.
** Includes estimates of the ICT portion of wholesale trade and rental and leasing.*

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 computer design and related industries (NAICS 51121, 51421, 54151, 51419), 1997 and 1998 employment figures include estimates for those who filed Canada Customs and Revenue Agency non-employer income tax forms for those years. See Notes, Methodologies and Data sources for more information.

2.2 Employment

The ICT sector was a major source of new jobs between 1997 and 2000, as its level of employment grew steadily by 30.9%. In 2000, nearly 521 thousand employees were working in the sector, accounting for 4.2% of economy-wide employment. Following record high employment levels, the sector suffered a major setback in 2001 – a saturated communications and telecom equipment manufacturing market could no longer be sustained, as supply far exceeded demand and the industry began to crumble. Cost-saving measures – such as reducing labour expenses – led to increasing employee layoffs and a shrinking ICT sector workforce. Employment in the sector dropped for the first time in a decade. Nevertheless, between 1997 and 2001, ICT sector employment grew by 30.7%, well surpassing economy-wide employment growth of 9.7%. Average annual employment growth over the period was 6.9% for the ICT sector, more than double the average economy-wide employment growth of 2.4% per year.

Despite the economic slowdown, employment in the services industries continued to expand by 36.0% over the reference period. Most of these employment gains occurred in the computer systems design and Internet service providers (ISP) industries, where the number of employees has grown by 82.8% since 1997. This fast-paced growth has led to an increasing share of employment for ICT sector services industries, accounting for more than three-quarters of total ICT sector employment in 2002. Employment in ICT sector manufacturing industries was hit the hardest, dropping from 119 thousand in 2000 to 114 thousand one year later. Employment in the ICT manufacturing industries grew only 14.8% over the 1997-2002 period and its share of total ICT sector employment has been declining steadily.

Canada's ICT share of business sector employment was higher than the OECD and EU averages, ranking third among OECD countries. Finland and Sweden had the highest shares of business sector employment (OECD 2002).

Figure 2.2.1 ICT sector employment, 1997-2001
thousands of employees

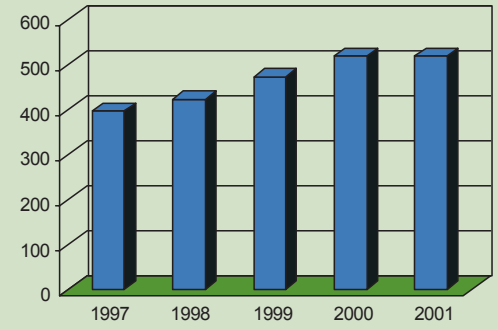


Figure 2.2.2 Indexed employment, 1997-2001

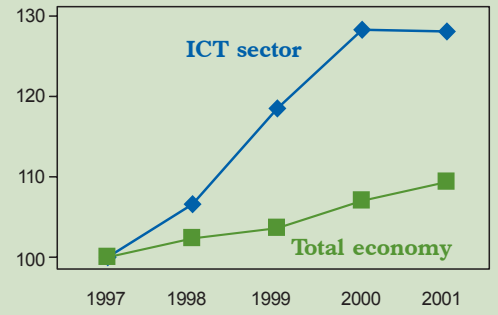


Figure 2.2.3 Indexed ICT sector employment, 1997-2001

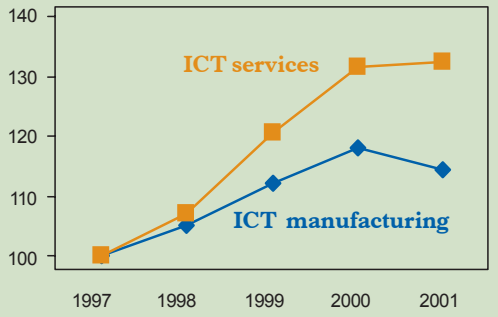


Table 2.2.1 ICT sector employment, 1997-2001

	1997	1998	1999	2000	2001	01/97	CAGR (01/97)
	thousands of employees					*%*	
Manufacturing	99.6	104.7	112.2	118.7	114.4	14.8	3.5
% of ICT	*25.0*	*24.7*	*23.6*	*22.8*	*22.0*	…	…
Services	298.3	319.2	362.2	402.1	405.7	36.0	8.0
% of ICT	*75.0*	*75.3*	*76.4*	*77.2*	*78.0*	…	…
Total ICT sector	**397.9**	**423.9**	**474.4**	**520.8**	**520.1**	**30.7**	**6.9**
Total economy	11,641.5	11,901.9	12,072.8	12,479.8	12,775.6	9.7	2.4
ICT as a %	*3.4*	*3.6*	*3.9*	*4.2*	*4.1*	…	…

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

Table 2.2.2 ICT sector employment by industry, 2001

NAICS Industries		*thousands of employees* 2001
Manufacturing		
3333	Commercial and Service Industry Machinery	13.3
3341	Computer and Peripheral Equipment	14.7
33421, 33422	Communications Equipment	20.4
3343	Audio and Video Equipment	1.5
3344	Semiconductor and Other Electronic Components	26.7
3345	Navigational, Measuring, and Control Devices	25.4
33592	Communication and Energy Wire and Cable	12.4
Services		
4173, 41791	ICT Wholesaling	78.2
51121, 51421, 54151, 518111*	Computer Systems Design and Related, Internet Services Providers	192.3
5133	Telecommunications	118.6
51322	Cable	14.7

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

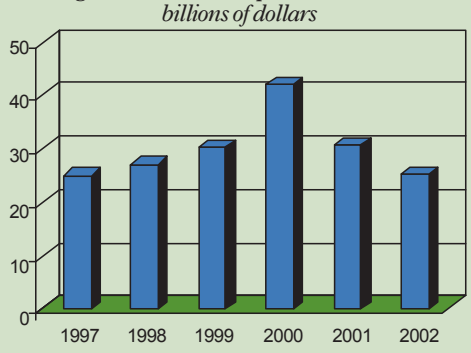
* *NAICS 518111 (2002) was formerly NAICS 51419 under the 1997 classification system. Data cover only Internet service providers. The office machinery and equipment rental and leasing industry (NAICS 53242) is suppressed.*

2.3 International trade

Merchandise trade data are captured as commodities. In an effort to produce industry trade data, Statistics Canada allocates the total trade of a commodity to its primary industry of production. Trade data for services are reported by product category. See Notes, Methodologies and Data Sources for more information.

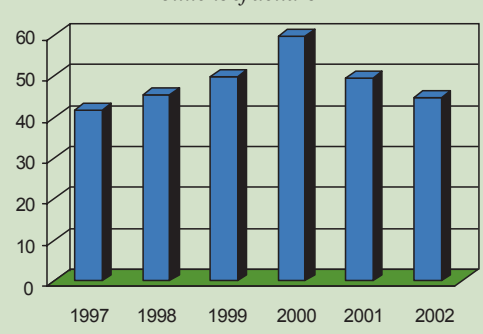
Following steady growth throughout much of the 1990s, Canadian ICT trade has been declining since 2001. ICT exports were valued at $25.3 billion in 2002, representing 5.9% of total Canadian exports. Imports of ICT stood at $44.8 billion or 11.8% of total Canadian imports. The unprecedented growth of total Canadian exports has also come to an end – they have grown at an average annual rate of only 5.9% between 1997 and 2002, while ICT exports grew at an average rate of only 0.2% annually. Over the same period, ICT imports grew at an average annual rate of 1.4%, while average annual growth for total imports was 5.1%.

Figure 2.3.1 ICT exports, 1997-2002
billions of dollars



Most ICT trade comes from the manufacturing sector. Following a sizeable drop in 2001, ICT merchandise exports continued to fall into 2002, resting at $20.9 billion. This accounted for 82.9% of ICT exports, 5.3% of total merchandise exports, and 5.9% of total exports. Imports of ICT goods represented 12.1% ($42.2 billion) of total merchandise imports, down from its share of 14.4% in 1997. Receipts for ICT services totaled $4.3 billion in 2002, while ICT services payments stood at $2.6 billion.

Figure 2.3.2 ICT imports, 1997-2002
billions of dollars

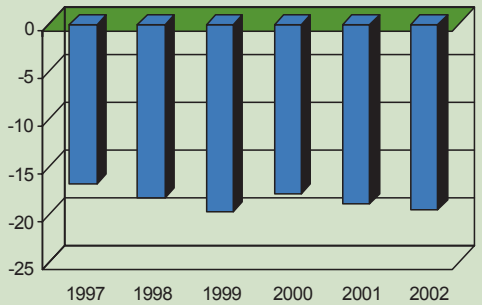


At 21.9%, exports of computer and peripheral equipment still represented the largest share of ICT manufacturing exports in 2002, down from 24.4% in 2001. Telephone equipment manufacturing followed closely at 20.4%, however its share has been steadily decreasing from 34.4% in 2000. Exports of wireless communications and audio and video equipment, and electronic components were valued at $6.3 billion in 2002, down substantially from the previous two years. Together, these ICT manufacturing industries represented 3.8% of total Canadian merchandise exports. Canada's ICT share of total merchandise exports is lower than the OECD and EU averages. Ireland has the highest share of ICT sector exports (OECD 2002).

Computer and peripheral equipment represented the largest share of ICT manufacturing imports (32.1%), while navigational, measuring and medical instrument imports were valued at $7.8 billion, or 18.6% of ICT manufacturing imports. Falling from the top were electronic component imports, which accounted for 33.3% of ICT manufacturing imports in 2000. Its share now stands at only 17.4%, as one of the industries hardest hit by the technology slowdown.

Exports of computer services were valued at $2.8 billion in 2002, followed by telecommunications carriers at $1.3 billion, and information services at $0.3 billion. Imports of telecommunications carriers were the highest ($1.3 billion) of the ICT services, accounting for nearly half (47.6%) of total ICT services payments.

Figure 2.3.3 ICT trade balance, 1997-2002
billions of dollars



The decrease in ICT imports (9.7%) was not enough to improve the trade deficit, since ICT exports fell by 17.9%. The ICT trade deficit has increased substantially, from $16.9 billion in 1997 to $19.6 billion in 2002, however it has remained relatively stable over the past two years. This is largely due to decreasing imports of electronic components. Canada has the ninth highest ICT sector trade deficit among OECD member countries (OECD 2002).

The U.S. continues to be our largest trading partner, with slightly more than 79% of ICT merchandise exports destined for that country. Canadian ICT merchandise exports also go to the U.K. (3.5%), China (1.5%), and Japan (1.3%). ICT imports are more diversified with 47% of the merchandise imports coming from the United States, while a significant portion of Canadian ICT merchandise imports also comes from China (8.3%), Japan (7.6%), and Mexico (7.5%).

Table 2.3.1 ICT merchandise exports, top 5 countries of destination, 1997-2002

	1997	1998	1999	2000	2001	2002	02/97
	billions of dollars						*%*
United States	17.7	19.3	21.5	31.3	21.2	16.6	-6.0
United Kingdom	0.7	0.7	0.9	1.8	1.2	0.7	8.4
China	0.3	0.2	0.2	0.1	0.3	0.3	19.7
Japan	0.2	0.2	0.2	0.3	0.2	0.3	26.0
Hong Kong	0.3	0.3	0.3	0.5	0.3	0.2	-7.3
Total ICT Exports (to all countries)	**22.1**	**23.6**	**25.8**	**37.3**	**26.0**	**20.9**	**-5.4**

Source: International Trade Division, Statistics Canada.
Note: Estimates have been rounded.

Table 2.3.2 ICT exports, 1997-2002

	1997	1998	1999	2000	2001	2002	02/97	CAGR (02/97)
	billions of dollars						*%*	
Merchandise	22.1	23.6	25.8	37.3	26.0	20.9	-5.4	-1.1
% of ICT	*88.6*	*86.9*	*85.6*	*88.9*	*84.6*	*82.9*	…	…
Services*	2.9	3.5	4.4	4.7	4.7	4.3	51.8	8.7
% of ICT	*11.4*	*13.1*	*14.4*	*11.1*	*15.4*	*17.1*	…	…
Total ICT exports	**25.0**	**27.1**	**30.2**	**41.9**	**30.8**	**25.3**	**1.1**	**0.2**
Total Merchandise Exports	298.1	318.4	355.4	413.2	404.0	396.1	32.9	5.9
ICT as a %	*7.4*	*7.4*	*7.3*	*9.0*	*6.4*	*5.3*	…	…
Total Commercial Services Receipts	21.9	25.9	27.5	30.0	30.6	29.3	33.7	6.0
ICT as a %	*13.0*	*13.7*	*15.9*	*15.6*	*15.5*	*14.8*	…	…
Total Exports	320.0	344.3	382.9	443.2	434.5	425.4	33.0	5.9
ICT as a %	*7.8*	*7.9*	*7.9*	*9.5*	*7.1*	*5.9*	…	…

Source: International Trade Division, Balance of Payments Division, Statistics Canada.
Total exports include all goods and commercial services.
** Includes telecommunications, computer and information services. Information services include news agency services, which are not part of ICT.*

Table 2.3.3 ICT exports*, 2002

	2002
	billions of dollars
Merchandise	
Commercial and Service Industry Machinery	2.4
Computer and Peripheral Equipment	4.6
Communications Equipment	6.4
Audio and Video Equipment	0.6
Semiconductor and Other Electronic Components	3.6
Navigational, Measuring, and Control Devices	3.1
Communication and Energy Wire and Cable	0.3
Services	
Telecommunications	1.3
Computer	2.8
Information	0.3

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 2.3.4 ICT imports, 1997-2002

	1997	1998	1999	2000	2001	2002	02/97	CAGR (02/97)
	billions of dollars						*%*	
Merchandise	39.3	42.7	47.2	57.2	47.1	42.2	7.4	1.4
% of ICT	*93.9*	*93.9*	*94.7*	*95.7*	*94.9*	*94.1*	…	…
Services*	2.6	2.8	2.6	2.6	2.6	2.6	3.6	0.7
% of ICT	*6.1*	*6.1*	*5.3*	*4.3*	*5.1*	*5.9*	…	…
Total ICT Imports	**41.8**	**45.5**	**49.9**	**59.8**	**49.7**	**44.8**	**7.2**	**1.4**
Total Merchandise Imports	272.9	298.4	320.4	356.9	343.1	348.6	27.7	5.0
ICT as a %	*14.4*	*14.3*	*14.7*	*16.0*	*13.7*	*12.1*	…	…
Total Commercial Services Imports	24.7	28.0	30.1	32.0	34.1	33.0	33.9	6.0
ICT as a %	*10.4*	*9.9*	*8.8*	*8.1*	*7.5*	*8.0*	…	…
Total Imports	297.6	326.4	350.5	388.9	377.2	381.6	28.2	5.1
ICT as a %	*14.1*	*13.9*	*14.2*	*15.4*	*13.2*	*11.8*	…	…

Source: International Trade Division, Balance of Payments Division, Statistics Canada.
Total imports include all goods and commercial services.
** Includes telecommunications, computer and information services. Information services include news agency services, which are not part of ICT.*

Table 2.3.5 ICT imports*, 2002

	2002
	billions of dollars
Merchandise	
Commercial and Service Industry Machinery	2.5
Computer and Peripheral Equipment	13.6
Communications Equipment	5.5
Audio and Video Equipment	4.9
Semiconductor and Other Electronic Components	7.3
Navigational, Measuring, and Control Devices	7.8
Communication and Energy Wire and Cable	0.6
Services	
Telecommunications	1.3
Computer	0.9
Information	0.5

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 imported commodities to industries.*

2.4 Revenues

ICT sector revenues fell by 6.1% in 2001, after strong and steady growth throughout much of the 1990s. The sector's $136.6 billion in revenue accounted for 5.7% of total industry revenue, down from its share of 6.3% in the previous year.

Between 1998 and 2001, annual average revenue growth for the ICT sector was 6.8%, while total revenue growth over the reference period stood at 21.7%.

Within the ICT services sector, ICT wholesaling generated the highest revenues ($36.9 billion), while telecommunications services followed closely with $32.8 billion. ICT sector services revenue has been increasing steadily since 1998 – its share of total industry revenue reached 75.1% in 2001. Revenue for ICT manufacturing peaked in 2000 at $44.7 billion. This represented 30.7% of total ICT sector revenue, which has since dropped to 24.9% or $34 billion. Communications equipment manufacturing was responsible for most of the decline – revenues fell by nearly 47.0% over the previous year.

Figure 2.4.1 ICT sector revenues, 1998-2001
billions of dollars

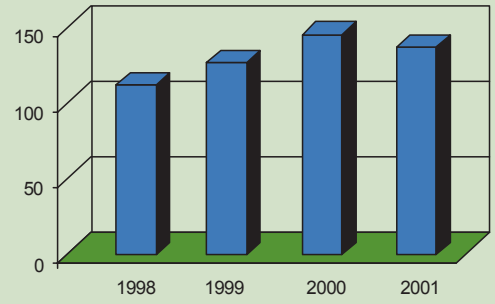


Figure 2.4.2 Indexed revenues, 1998-2001

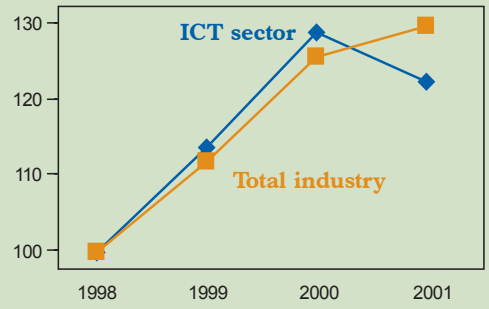


Figure 2.4.3 Indexed ICT sector revenues, 1998-2001

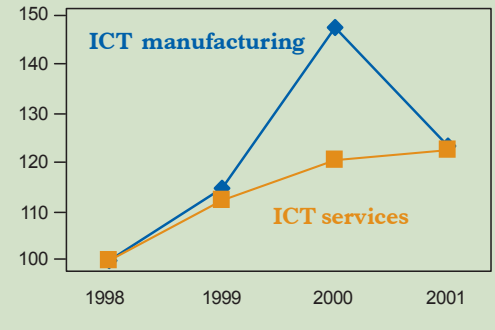


Table 2.4.1 ICT sector revenues, 1998-2001

	1998	1999	2000	2001	01/98	CAGR (01/98)
	billions of dollars				*%*	
Manufacturing	29.3	33.7	44.7	34.0	15.8	5.0
% of ICT	*26.1*	*26.5*	*30.7*	*24.9*	…	…
Services	82.9	93.2	100.7	102.6	23.8	7.4
% of ICT	*73.9*	*73.4*	*69.3*	*75.1*	…	…
Total ICT sector	**112.2**	**127.3**	**145.4**	**136.6**	**21.7**	**6.8**
Total Industry	1,835.7	2,043.8	2,315.5	2,403.0	30.9	9.4
ICT sector as a %	*6.1*	*6.2*	*6.3*	*5.7*	…	…

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

Table 2.4.2 ICT sector revenues by industry, 2001

NAICS Industries		2001
		billions of dollars
Manufacturing		
3333	Commercial and Service Industry Machinery	2.8
3341	Computer and Peripheral Equipment	5.2
33421, 33422	Communications Equipment	9.9
3343	Audio and Video Equipment	0.3
3344	Semiconductor and Other Electronic Components	7.2
3345	Navigational, Measuring, and Control Devices	4.5
33592	Communication and Energy Wire and Cable	4.1
Services		
4173, 41791	ICT Wholesaling	36.9
51121, 51421, 54151, 518111*	Computer Systems Design and Related, Internet Services Providers	27.4
5133	Telecommunications	32.8
51322	Cable	4.6

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

* *NAICS 518111 (2002) was formerly NAICS 51419 under the 1997 classification system. Data cover only Internet Service Providers. The office machinery and equipment rental and leasing industry (NAICS 53242) is suppressed.*

2.5 Capital expenditures

Following significant investments in the recent past, the ICT sector's share of total economy capital expenditures is expected to shrink from a high of 8.3% in 2001 to a low of 5.9% in 2003. This results from a 17.6% decline in ICT manufacturing and a 6.6% drop in ICT services since 2002. The anticipated decline in ICT sector investment would follow the previous year's decline of 20.0%.

Figure 2.5.1 ICT sector capital expenditures, 2000-2003

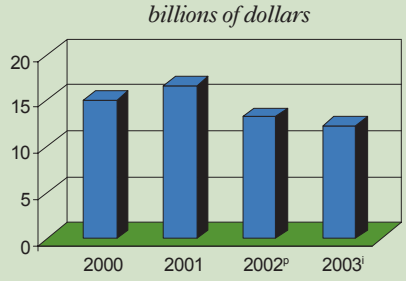


Figure 2.5.2 Indexed capital expenditures, 2000-2003

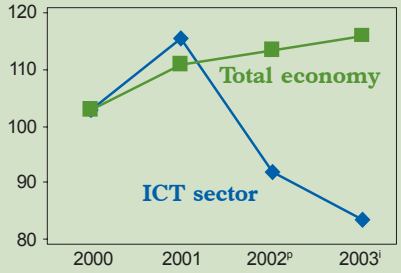


Table 2.5.1 ICT sector capital expenditures, 2000-2003

	2000	2001	2002[P]	2003[i]	03/00	CAGR (03/00)
	billions of dollars				*%*	
Manufacturing	1.9	1.8	0.9	0.8	-57.1	-27.8
% of ICT	*12.4*	*10.7*	*7.3*	*6.5*	…	…
Services	13.1	14.8	12.3	11.5	-12.5	-3.2
% of ICT	*87.6*	*89.3*	*92.7*	*93.5*	…	…
Total ICT sector	**15.0**	**16.6**	**13.2**	**12.3**	**-18.0**	**-5.9**
Total economy	187.4	199.7	203.9	208.3	11.2	4.3
ICT sector as a %	*8.0*	*8.3*	*6.5*	*5.9*	…	…

Source: Investment and Capital Stock Division, Statistics Canada.

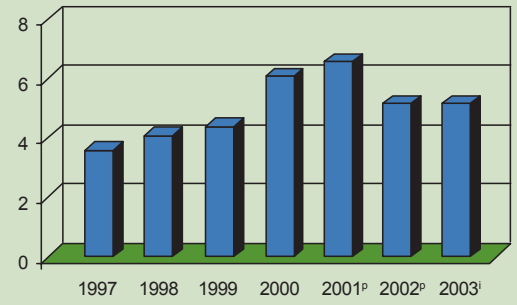
2.6 Research and development

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).

No other measure better captures the dynamism of the ICT sector than expenditures on R&D. In 2000 and 2001, the ICT sector accounted for 50.0% of total private sector R&D, quite disproportionate to its GDP and employment shares. Over the 1997-2002 period, the ICT sector has spent nearly $30 billion on R&D.

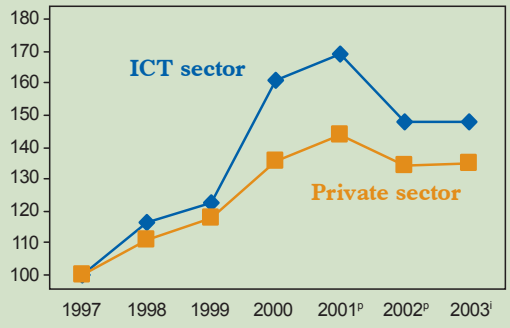
Following a period of strong and steady growth however, ICT sector expenditures on R&D dropped by a sharp 21.5%. They settled at $5.2 billion in 2002, accounting for 43.1% of total private sector R&D. This level of spending is expected to be maintained into 2003.

Figure 2.6.1 ICT sector R&D, 1997-2003
billions of dollars



ICT sector R&D expenditures grew at an annual average rate of 7.8% between 1997 and 2002 compared with an annual average of 6.5% for the private sector. Total ICT sector spending on R&D grew by 45.3% over this period.

Figure 2.6.2 Indexed R&D, 1997-2003



In 2002, ICT manufacturing industries spent $3.5 billion on R&D – less than two-thirds of total ICT sector R&D expenditures. This was down by a substantial 27.3% from the previous year's high. Telecommunications equipment

still accounts for the largest share of ICT R&D investment ($1.6 billion), despite a 41.1% decline in 2002. R&D spending by ICT services industries dropped slightly to $1.6 billion, but is expected to climb again in 2003 ($1.7 billion).

Canada's ICT share of business sector R&D is higher than the OECD and EU averages. In addition, Canada ranks fourth among OECD countries in its share of ICT manufacturing sector R&D (OECD 2002).

Figure 2.6.3 Indexed ICT sector R&D, 1997-2003

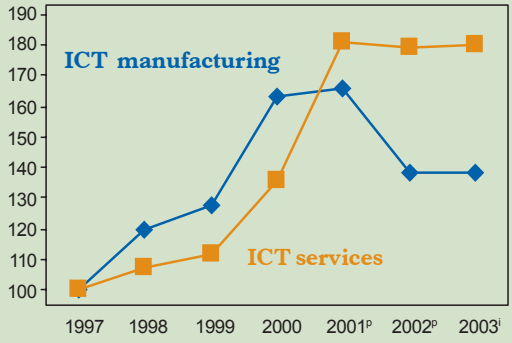


Table 2.6.1 ICT sector R&D expenditures, 1997-2003

	1997	1998	1999	2000	2001p	2002p	2003i	03/97	CAGR (03/97)
	billions of dollars							*%*	
Manufacturing	2.7	3.2	3.5	4.7	4.9	3.5	3.5	30.7	4.6
% of ICT	*75.8*	*78.2*	*78.9*	*77.5*	*73.7*	*68.3*	*68.0*	…	…
Services	0.9	0.9	0.9	1.4	1.7	1.6	1.7	92.9	11.6
% of ICT	*24.2*	*21.8*	*21.1*	*22.5*	*26.3*	*31.7*	*32.0*	…	…
Total ICT sector	**3.6**	**4.1**	**4.4**	**6.1**	**6.6**	**5.2**	**5.2**	**45.7**	**6.5**
Private sector	8.7	9.7	10.4	12.2	13.2	12.0	12.1	38.0	5.5
ICT sector as a %	40.7	42.7	42.4	50.0	50.0	43.1	43.0	…	…

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

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Chapter 3 CONVERGING ICT INDUSTRIES AND COMMODITIES

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Highlights

- In 2002, some ICT sector industries began to report positive signs of manufacturing activity, or at least had stabilized their levels of production, following several quarters of contraction and downsizing.

- The telecommunications services industry invested heavily in digitisation and reached record operating profits ($4.9 billion) by 2002. The wireless sector in particular experienced rapid growth.

- Challenged by intense competition from the wireless sector, cable operators have expanded their service offerings by investing in new services, including digital television, high-speed Internet and cable telephony.

- The computer systems design and related services industry experienced sharp revenue growth in recent years, climbing to $18.6 billion in 2001. Firms that were diversified generated the highest revenues.

- Many firms in the Internet service provider (ISP) industry priced their access services *at* or *near* cost in order to remain competitive, and have also diversified their service offerings (e.g. web site hosting, design and domain name registrations).

Chapter 3
CONVERGING ICT INDUSTRIES AND COMMODITIES

ICT industries develop, supply and support many of the products and services at the heart of the technology revolution. Some of these industries and commodities are examined here in order to identify key characteristics, trends and challenges for the future. Each of the following articles was authored by an ICT industry expert – an analyst who works closely with the industry surveys, respondents and data.

3.1 Trends in ICT sector manufacturing industries

Russell Kowaluk is an analyst in the Manufacturing, Construction and Energy Division, Statistics Canada. He profiles the ICT sector manufacturing industries through the recent boom and bust years.

As Canada entered the 21st century, an unprecedented demand for information and communications technologies (ICTs), including computers and telecommunications equipment, propelled manufacturing shipments of the ICT sector to new heights. Canada's new 'information society' had evolved into a hotbed for research, development and innovation. At the peak of the boom, manufacturing coffers brimmed over with seemingly endless contracts and orders, while new venture capital provided resources for infrastructure and people. By early 2001 however, the bubble had burst. Slumping demand coupled with persistently high inventories left many ICT sector manufacturing industries in a downward spiral.

Manufacturing shipments *are defined as the value of goods manufactured by manufacturing establishments that have been shipped to a customer. Shipments exclude any wholesaling activity and any revenues from the rental of equipment or the sale of electricity. Estimates of manufacturing shipments differ from the estimates of manufacturing shipments and other revenue presented in section 2.4, which include shipments of goods purchased for resale, rental and leasing revenue, operating subsidies from governments, and all other operating revenue (i.e. revenue from contracted shipping, royalties and franchise fees).*

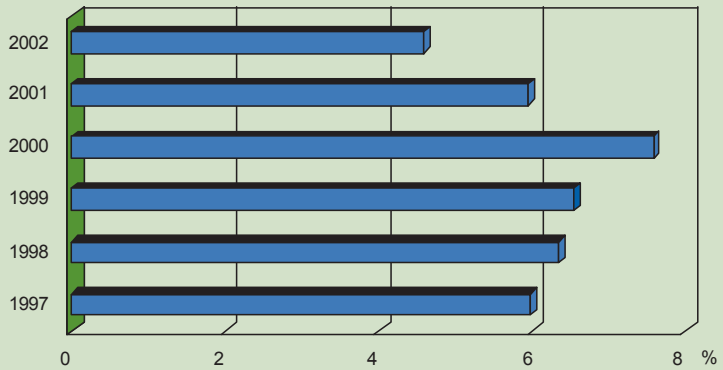
An overview of growth in ICT sector manufacturing

Technologies and trends evolve and dissipate over the years, due in part to the high degree of innovation and competition within the ICT sector. Success in the sector requires an acute ability to quickly adapt to the needs of the market and the climate of the economy. Products manufactured by ICT sector industries are used to fulfill information and electronic processing, as well as communications functions. These products include household items – digital cameras, computers, peripheral equipment, and microchips – as well as business equipment, such as fibre optic cables and space satellite systems.

In the early 1990s, most manufacturing industries in the ICT sector experienced moderate growth, as ICT manufacturing shipments increased 23.8% between 1990 and 1993. By 1994, the low valuation of the Canadian dollar and strong export demand from the United States contributed to double-digit growth in shipments and a boom for ICT industry manufacturing. Rapid expansion in the computer and peripheral equipment and the telephone apparatus industries contributed to large gains overall. By 1995, ICT sector manufacturing shipments had risen to $25 billion, an increase of 50% in just two years.

Following this expansionary period, shipments of ICT sector manufacturing equipment remained relatively constant during the latter half of the 1990s. But by 1999, demand for ICT sector products and services had exploded and the telecommunications boom had taken hold. In 2000, at the height of the boom, ICT sector manufactures reported shipments of $42.6 billion. Between 1997 and 2000, manufacturing shipments rose by an astounding 67.4%, compared to a 32.0% increase in total manufacturing shipments. ICT sector manufacturing accounted for 7.6% of Canada's total manufacturing activity in 2000 (Figure 3.1.1). This compared to an average share of 6.0% throughout much of the 1990s and an even smaller proportion in 2001 (5.9%) and 2002 (4.6%). The ICT sector had evolved into one of the largest and most important growth segments of the Canadian manufacturing sector.

Figure 3.1.1 Share of ICT sector manufacturing to total manufacturing (shipments), 1997-2002



This article uses data from the Annual Survey of Manufactures (ASM) and the Monthly Survey of Manufacturing (MSM). The ASM is a survey of the manufacturing industries of Canada conducted annually since 1917. This survey collects information for approximately 35,000 Canadian manufacturing establishments based on NAICS (North American Industrial Classification System). ASM data are available until 2001. In reference year 2000, major conceptual and methodological changes were incorporated into the ASM. The universe was expanded to cover all manufacturing units. In addition to the incorporated manufacturing businesses with over $30,000 in sales of manufactured goods and with employees, the new ASM also includes: i) all incorporated businesses under $30,000 that had employees; ii) all incorporated businesses that did not have any employees regardless of their annual sales values; and iii) all unincorporated businesses. The addition of these units added approximately 60,000 units to the ASM universe. Despite the tremendous increase in the number of establishments, the majority are relatively small. These units account for less than 5.0% of the total revenue from the sale of manufactured goods.

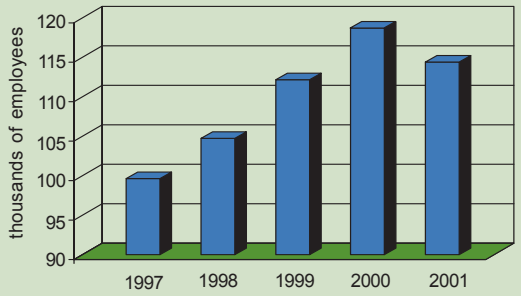
The MSM publishes statistical series for manufacturers including shipments, inventories, unfilled orders and new orders. The values of these characteristics represent current monthly estimates of the more complete ASM data. The MSM is a sample survey of approximately 11,000 Canadian manufacturing establishments, which are categorized into over 200 industries. Industries are classified according to the 1997 North American Industrial Classification System (NAICS). Data for 2002 are from the MSM.

Manufactures invested heavily in new technology, infrastructure and human capital as they tried to keep pace with a seemingly endless demand for computer, telecommunications and electronic products. The end of the twentieth century embraced an extraordinary thirst by consumers and business for state-of-the-art gadgets resulting in record-high sales and unmatched production activity. Accordingly, scores of 'high-technology' manufacturing companies flourished, as the number of ICT manufacturing establishments peaked at 2,367 in 2000. The ICT sector was also a major source of new jobs during this period, employing nearly 119 thousand workers – an increase of 19.1% over 1997 (Figure 3.1.2).

New orders *represent current demand for manufactured products. Estimates of new orders are derived from shipments and unfilled orders data. All shipments within a month result from either an order received during the month or at some earlier time. New orders can be calculated as the sum of shipments adjusted for the monthly change in unfilled orders.*

Unfilled orders *represent a backlog or stock of orders that will generate future shipments assuming that they are not cancelled.*

Figure 3.1.2 Total ICT sector manufacturing employment, 1997-2001



During the boom, ICT sector manufactures amassed significant inventories to meet the extraordinarily high demand. Total inventories of ICT manufactures reached $5.8 billion in 2000, and continued to climb in 2001. As well, unfilled orders skyrocketed to $7.4 billion in 2000, an increase in excess of 60.0% in just three years. Manufactures operated at near full-tilt and industrial capacity utilisation rates soared to new levels. In 2000, industrial capacity utilization rates for the computer and electronic products industry, which includes several ICT sector industries, hit 96.8%. But by 2001, as the economic slowdown gripped much of the manufacturing sector, the build up of inventories was more the result of slumping consumer demand and excess production capacity. Unable to clear stock, ICT manufacturing inventories peaked at $6.6 billion in 2001.

The ***industrial capacity utilization rate*** *is the ratio of an industry's actual output to its estimated potential output. Statistics Canada derives estimates of an industry's potential output from measures of its capital stock. In addition, since 1987 Statistics Canada has been surveying companies for their estimates of annual capacity use, in order to produce industry measures. A company's measure of its level of operation, as a percentage of potential, takes into account changes in the obsolescence of facilities, capital-to-labour ratios and other characteristics of production techniques (The surveyed rates anchor the calculated quarterly series).*

Measurement of component values of inventories is important for economic studies as well as for the derivation of production values. Respondents are asked to report their book values (at cost) of raw materials, goods in process and finished product inventories separately. In some cases, respondents estimate a total inventory figure, which is allocated on the basis of proportions reported on the ASM.

The downturn contributed to the implosion of many of the 'high-technology' industries. Production was slashed as spending on telecommunications infrastructure and electronic equipment dried up. Weakened demand resulted in the inability of ICT sector manufacturers to clear inventories. Extensive layoffs and other aggressive, cost-cutting measures were utilized in an attempt to reduce excess production and capacity.

Not all of the ICT sector industries experienced sharp declines, however. Although demand for telecommunications infrastructure had weakened substantially, this was counterbalanced by the encouraging sales to consumers, as described by technology reporter J. Glen in *The Dismal Scientist*: "As has been the case for several months, strength in chip sales is stemming entirely from consumer electronic equipment such as DVDs, video game consoles, digital cameras and cell phones, which is offsetting weak demand for chips used in computers and communications infrastructure equipment" (Glen 2002a).

By the end of 2002, many parts of the Canadian economy were recovering from the events of 2001. Canadians enjoyed near record-low interest rates, a healthy labour market and rising family incomes, all contributing to improved consumer confidence and booming business. Unfortunately, industries linked to information and communications technology remained depressed in both Canada and other parts of the world. In fact, manufacturers of telecommunications equipment continued to lose ground. According to *The Economist*, "The manufacturers of hardware have been hit the worst, with makers of telecom equipment in the most trouble because they pumped up the biggest bubble with generous customer-financing terms and overpriced acquisitions" (2001). Weak financial statements and ongoing job losses continued to underline the post-boom scenario.

The boom and bust of the ICT sector manufacturing industries

The following provides an overview of the boom and bust of individual ICT sector manufacturing industries, as well as the resulting impacts at the industry level.

Telephone apparatus

Manufacturing shipments of telephone apparatus hit $13.7 billion in 2000, by far the largest ICT manufacturing industry. Since 1997, soaring demand in Canada and abroad for routers, gateways and telephone sets, contributed to double-digit increases in shipments of telephone equipment. The industry accounted for 32.2% of total ICT sector manufacturing shipments in 2000, a substantial increase from its share of 25.3% in 1997. Meanwhile, inventory levels, which had been accumulating over the last few years, hit an all-time high of $2.3 billion in 2001. The telephone apparatus industry was among the first to weaken, as shipments plunged by 45.0% in 2001. Widespread cuts were essential as manufacturers tried to unload inventories, combat excess production and reduce labour and other costs. Shipments of telephone apparatus equipment dropped to $4.6 billion by 2002, a decline of 67.0% from their peak in 2000. The industry, which had been ranked number one in terms of shipment values among ICT sector manufacturing industries, fell to third place in 2002. By then, the telephone apparatus industry accounted for just 19.3% of total ICT sector manufacturing in Canada. At the end of 2002, the value of inventories had been reduced by 28.5%, but stubbornly weak demand and extreme cost cutting measures were not enough to avoid the bust. The industry's inventory-to-shipment ratio soared to 3.60 from its low of 1.34 in 2000.

*The **inventory-to-shipment ratio** is an indicator of the time that would be required in order to exhaust inventories if shipments were to remain at their current level. In periods of adverse market conditions, weak demand may contribute to manufacturers' inability to clear out their inventories, and subsequently they must cut production. The inventory-to-shipment ratio tends to rise during such times, reflecting higher inventories relative to weak shipments.*

Semiconductor and other electronic components

Shipments of semiconductors and electronic components soared to $9.7 billion in 2000, following three consecutive years of annual increases in excess of 10%. The industry expanded steadily during the 1990s, and was ranked second in terms of shipment values among ICT manufacturing industries in 2000. Semiconductor inventories also peaked in 2000 at $1.2 billion, doubling in just two years. In 2002, as a result of weakening demand and growing inventories, the industry's shipments dropped to $5 billion, a decrease of nearly 48.0% from 2000.

Computer and peripheral equipment

Shipments of the computer and peripheral equipment industry peaked at $7.2 billion in 1995, largely due to strong demand for computer-based products by the United States. Manufacturing activity fell back sharply in 1996 and 1997, before leveling off in the late 1990s. By 2000, at the height of the high-tech boom, the computer equipment industry rebounded, reporting shipments of $6.7 billion. Once the largest ICT sector manufacturing industry in terms of shipments during the mid-1990s, the computer and peripheral equipment industry has since been surpassed by the telephone apparatus and semiconductor and electronic components industries. Steep cuts in manufacturing activity in 2001 and 2002 contributed to a 30.0% decline in shipments, settling at $4.7 billion by the end of 2002. Despite the substantial decrease in the manufacturing of computer and peripheral equipment, largely due to lower infrastructure spending by businesses, this industry was less severely impacted by the downturn. Consumers maintained a healthy level of demand for computers and other electronic equipment.

Navigational, measuring, medical, and control instrumentation

Partly due to the large gamut of products manufactured, the navigational, measuring, medical and control instruments industry was less affected by the recent volatility of the high-tech boom and bust. Aeronautical and medical instruments, radar systems, and flight and navigation sensors are among the many products and equipment manufactured by the industry. Since the early 1990s, this industry has grown at a relatively constant pace. By 2000, at the apex of the boom, shipments reached $3.8 billion, but unlike most other ICT-based industries, the navigational, measuring, medical and control instruments industry continued to climb another 3.8% in 2001, until finally dropping off in 2002 (-10.0%). Meanwhile, industry employment remained relatively constant at approximately 25 thousand over the last couple of years. In addition, manufacturers have kept a close eye on their inventory levels. Whereas many of the ICT sector manufacturing industries witnessed a sharp build-up in their inventories to their detriment, manufacturers of the navigational and measuring instruments industries maintained control of their inventories. This permitted the sector to weather the recent economic storm a bit easier. Inventories ended the year 2002 at $754 million.

Communication and energy wire and cable

The communication and energy wire and cable industry is one of the principal suppliers of products and parts for other ICT sector industries. Rapid expansion by the ICT sector contributed to communication and energy wire shipments of $4 billion in 2000, more than doubling their level of three years ago. Unfilled orders also peaked in 2000 at $1.2 billion. The crash of the high-tech market in 2001 weakened the state of the computer, semiconductor and electronic, and telephone apparatus industries. Despite the decline of these industries, production levels of the communication and energy wire and cable industry remained strong. In 2001, the industry accounted for 12.3% of total ICT sector manufacturing shipments, compared to 7.1% in 1997. Inventories peaked at $800 million, having risen a staggering 275.0% since 1997. Ultimately, the downturn of 2001 hit the communication and energy wire and cable industry with a vengeance, albeit about one year later than the other ICT sector manufacturing industries. By 2002, shipments had plunged to $1.4 billion (6.1% of total ICT manufacturing shipments), as manufactures scrambled to tighten employment levels, realign their manufacturing capacity and sell or write-off inventories.

Other industries that comprise the ICT sector include the commercial and service industry machinery, and the radio and television broadcasting and wireless communications equipment industries. The first, a machinery-based industry which manufactures flight simulators, optical equipment and photocopiers, reported record shipments of $2.6 billion in 2001, following successive years of strong output. Shipments of the commercial and service industry machinery industry have since fallen back to $2.3 billion, or 9.6% of total ICT manufacturing shipments.

Shipments of the radio and television broadcasting and wireless communications equipment industry also peaked in 2001 at $2.1 billion, increasing 47.0% since 1997. Manufacturing activity contracted by almost 8.0% in 2002.

In terms of shipments, the smallest ICT-based manufacturing industry is the audio and video equipment industry. Shipments were $254.3 million in 2001, their highest level in five years. By 2002 however, manufacturing shipments had fallen back to $217.6 million, accounting for a slight 0.9% of total ICT sector manufacturing shipments.

Figure 3.1.3 Manufacturing shipments, selected ICT sector industries, 1997-2002

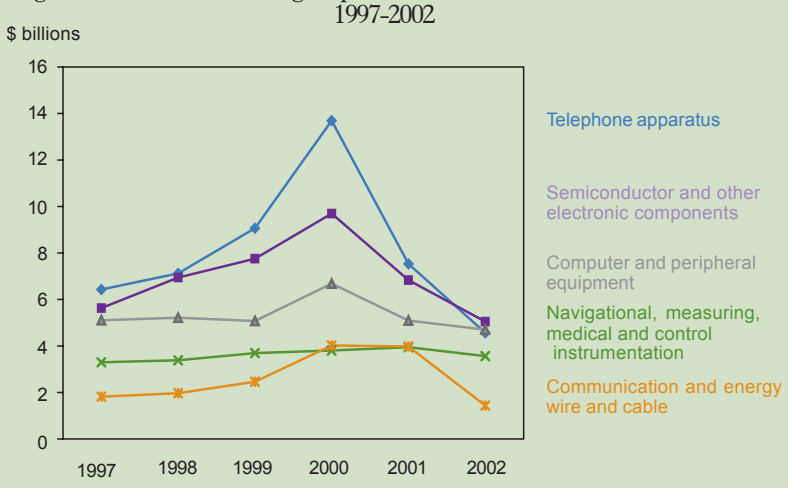


Figure 3.1.4 Shipment shares, ICT manufacturing industries, 2000

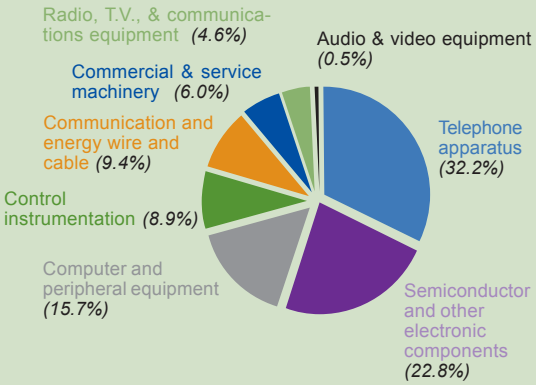
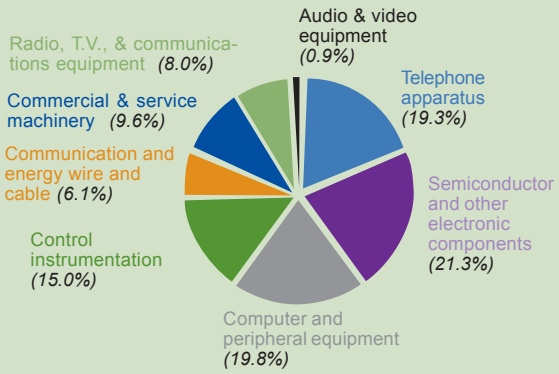


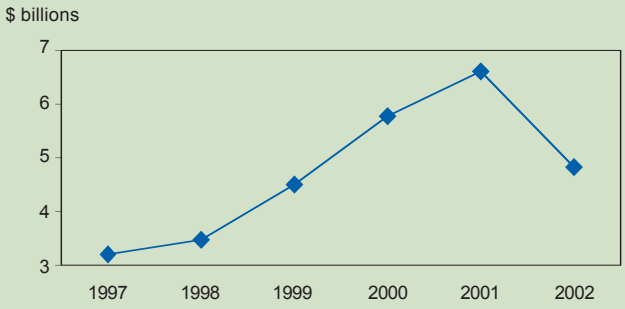
Figure 3.1.5 Shipment shares, ICT manufacturing industries, 2002



Inventories of the ICT sector

Inventories of ICT sector manufactures peaked at $6.6 billion in 2001, more than double their level in 1997 ($3.2 billion) (Figure 3.1.6). A measure of the health of the manufacturing sector is the manufacturers' ability to clear their finished-product inventories. As demand plunged in 2001, ICT-based manufacturers faced rising inventories. In 2001, finished-product inventories comprised 22.5% ($1.5 billion) of the total inventories held by the ICT-sector manufacturing industries compared to 20.7% in 2000. ICT sector finished-product inventories reported increases in excess of 20.0% in 1999, 2000 and 2001. Weakening demand and mounting inventories contributed to massive cuts in production and employment over the last two years. By 2002, manufactures had managed to reduce their finished-product inventories to $1.1 billion, a 27.6% decline since 2001, and positive news for a sector trying to regain some stability in a fragile market.

Figure 3.1.6 Inventories, ICT sector manufacturing, 1997-2002



The inventory-to-shipment ratio as an indicator of manufacturing performance

Through the 1990s, the annual average inventory-to-shipment ratio for ICT sector manufacturing was in the range of 1.32, compared to 1.43 for total manufacturing. The ratio for ICT manufactures remained relatively stable during the boom years of 1999 and 2000, when shipments and inventories increased at double-digit levels. In 2000, at the height of the boom, the ICT manufacturing inventory-to-shipment ratio was 1.36 (Table 3.1.1).

By 2001, as the high-tech slowdown gripped manufacturing, ICT sector inventories continued to accumulate, despite a 24.2% drop in the value of goods shipped. Consequently, the inventory-to-shipment ratio shot up to 2.05 from 1.36 in 2000, its highest level in over ten years. A higher ratio may indicate some difficulty by manufacturers to clear inventories due to diminished demand. In 2002, the ICT sector's ratio remained high at 2.03. Although ICT sector inventories declined sharply in 2002 (-27.0%), manufacturers continued to face additional cuts in output as demand receded. Despite significant reductions in shipments, input costs and labour over the last couple of years, production levels of ICT-based industries have been out of sync with demand for some time.

Table 3.1.1 Inventory-to-shipment ratios, ICT sector manufacturing industries, 1997-2002

	1997	1998	1999	2000	2001	2002
Commercial and other industry machinery	1.18	1.23	1.10	1.41	1.70	1.44
Computer and peripheral equipment	1.14	1.43	1.47	1.10	1.54	1.28
Telephone apparatus	1.54	1.15	1.92	1.34	3.05	3.60
Communications equipment	1.68	2.01	1.96	2.26	2.71	2.54
Audio and video equipment	1.66	1.98	1.87	2.33	2.07	2.51
Semiconductor and other electronic components	0.78	0.81	0.93	1.27	1.57	1.38
Navigational, measuring, medical and control	1.57	1.54	1.54	1.67	1.53	2.12
Communication and energy wire and cable	1.17	1.48	1.30	1.22	2.01	1.84
Total ICT sector manufacturing	**1.26**	**1.24**	**1.41**	**1.36**	**2.05**	**2.04**

Source: Annual Survey of Manufactures, Monthly Survey of Manufacturing, Manufacturing, Construction and Energy Division, Statistics Canada.

Summary

In 2002, some ICT sector industries began to report positive signs of manufacturing activity, or at least had stabilized their levels of production, following several quarters of contraction and downsizing. Regrettably, the prognosis for a widespread rebound by information and communications technology manufacturing industries anytime soon remains weak. Even modest growth among wireless technology industries could not offset the lagging performance of many ICT manufacturing industries.

Two of the key ingredients required for the revival of the sector – consumer confidence and business investment – remain uncertain: "Given the economic outlook, it is plausible that demand for telecom infrastructure equipment will not experience significant growth until 2004 or 2005, and is unlikely to hit the levels seen during the boom for years to come" (Glen 2002b). On an optimistic note, many ICT manufacturers have successfully scaled-down inventory levels in 2002. Aggressive cost-cutting measures reduced overhead and excess capacity, while the workforce was trimmed back significantly. At the same time, consumer confidence, globally and on the domestic front, remains apprehensive.

The next couple of years will be critical in determining how successful the recent rationalization and cutbacks by technology manufacturers have been for their bottom line and, ultimately, for the recovery of the information and communications technology sector. What is certain is that the ICT sector continues to innovate and develop the advanced technologies that have shaped Canada's information society.

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3.2 Digitisation of the telecommunications services industry

Cimeron McDonald is an analyst in the Science, Innovation and Electronic Information Division, Statistics Canada. This article examines the changing nature of the telecommunications services industry, from wired to wireless and analogue to digital.

From Innukshuks and the oral traditions of Canada's First Nations to caller-id, visual call-waiting and video cell phones, Canadians have helped develop, and are keen users of, some of the most advanced communications methods in the world. As a key component of the ICT sector, the telecommunications services industry has propelled Canada into place as one of the world leaders in ICT development and use. The increasing level of connectivity of Canadian households, businesses and governments would not have been possible without the upgrades to infrastructure and the launching of new services by this industry. This article traces the evolution and growth of telecommunications services, with particular emphasis on the digitisation of the telecommunications networks.

Overview of the telecommunications services industry

Digital service *is the transmission of binary digital signals, a continuous string of zeros and ones. In telecommunications it is the transmission of digitally encoded analogue signals in the wireline or wireless networks.*

Digitisation *is the movement from an analogue to digital telecommunications network. In the wireline telecommunications industry this refers to the connection of public switched telephone network (PSTN) lines to digital switches. In the wireless industry it refers to an increase in the number of digital cells and subscribers.*

The last few years have seen an evolution of the telecommunications services industry brought about by regulatory, technological and market changes. Many of these changes have taken place in the high-growth wireless sector, which has experienced positive profits and double-digit growth in subscribers over the last few years, while the relatively flat operating profits and growth in access paths of the wireline sector are characteristic of a more mature industry. The rapid transformation of global communications has led to impressive growth, on most fronts, in telecommunications services.

The industry's operating revenues have increased by 13.7% since 1997, reaching nearly $33 billion in 2002 (Table 3.2.1). Operating profits reached $4.5 billion in 2000 and fell only marginally to $4.2 billion the following year. By 2002, they had recovered to a record high of $4.9 billion. At the same time, telecommunications services contributed nearly $26 billion to Canada's GDP, accounting for 2.7% of total economy value added.

Employment in the industry, however, has been steadily decreasing, standing at just over 90 thousand in the fourth quarter of 2002.

While telecommunications services providers have been major investment spenders in recent years, capital expenditures by the industry were down 28.5% in 2002 from the previous year, for both the wireline and wireless segments. Capital spending accounted for 16.6% and 22.9% of wireline and wireless operating revenues, respectively.

The number of voice grade equivalent (VGE) access paths to the Public Switched Telephone Network (PSTN) exceeded 1 per person for the first time in 2002 and has continued to rise. Many Canadians can be reached at more than one telephone number, for example their home, office and mobile. In addition to an increase in the number of telephone connections there has been an increase in the quality and capacity of the telecommunications networks. Key among these improvements has been the movement to a digital network, which allows the provision of numerous value added services.

The statistics presented in this article are from the Quarterly and Annual Surveys of Telecommunications, covering establishments primarily engaged in the transmission of voice, data, text, image and video. The annual survey is a census of all telecommunications services providers. It captures all telecommunications activity under NAICS 5133. The quarterly survey includes the largest establishments – major wireline carriers and the wireless industry – with undercoverage estimates based on the annual survey for those units that make up the industry but are not included in the quarterly (resellers, satellite and small wireline and wireless service providers). GDP by industry data are also used.

Table 3.2.1 Telecommunications services, financial and operating indicators, 1999-2002

	1999	2000	2001	2002
		millions of dollars		
Service revenues				
Local	9,584	10,462	12,290	11,363
Long distance	6,781	6,560	6,114	4,885
Financial performance				
Total operating revenues	29,013	30,871	32,719	32,993
Total operating expenses	25,085	26,393	28,567	28,081
Operating profit	3,928	4,478	4,152	4,912
Labour costs	5,996	5,791	6,102	6,040
Capital expenditures	5,982	7,365	7,967	5,698
Access paths (fixed and mobile)				
Total voice-grade equivalents (VGE) (000s)	26,717	29,074	31,459	31,811
Teledensity(VGE per 100 inhabitants)	85.5	91.8	97.9	101.0
Gross domestic product (GDP $1997)	18,205	21,229	23,907	25,982

Source: Annual, Quarterly Surveys of Telecommunications, Science, Innovation and Electronic Information Division, Statistics Canada.
Note: Data for 2002 are based on quarterly estimates, except for GDP.

Wired telecommunications

Canada's telecommunications era began in 1874 when Alexander Graham Bell made the first telephone call from Brantford to Paris, Ontario. Since then we have moved through a series of advances that have seen telephone calls routed via operators and plug boards move to mechanical switches, as well as rotary phones replaced by digital switches and touch-tone. However wired telecommunications services have been struggling to maintain their place in the industry. Falling prices for long distance have led to decreased revenues and this, coupled with strong growth in wireless communications, has challenged the wireline sector in recent years.

The decline in wireline revenues is likely the origin of reduced profitability. Revenues in that sector were down 4.1% at the end of 2002 compared to the previous year. The effects of competition on wired long distance pricing, the loss of lines due to increased high-speed Internet penetration, and the apparent substitution of wireless for fixed access underlie this phenomenon. Local services continued to represent the largest share (27.8%) of fourth quarter 2002 wireline operating revenues, followed by long distance services (17.3%) and carrier services (10.2%). Data, high speed, non-switched and other telecommunications services accounted for 17.2% of wireline operating revenues.

Wireless telecommunications

Our wireless tradition started in 1901 when Guglielmo Marconi received the first transatlantic signal in Newfoundland at Signal Hill. Statistics Canada's information on the modern wireless communication system or cellular phone system extends back to 1985[2]. In 1987, cellular subscribers represented less than 1.0% of the population. In the intervening 15 years this has increased to over 37.0% of the population (fourth quarter of 2002).

The improved financial performance of the wireless sector is largely the result of continued strong growth in subscriptions and revenues. At $2 billion in the fourth quarter of 2002, wireless operating revenues are up 16.0% from what was reported one year ago. As with wireline carriers, local services are the wireless industry's major source of revenues, but account for nearly 60.0% of total fourth quarter 2002 wireless operating revenues.

Digitisation

The introduction of digital switches and other software have allowed more information to be carried along with the voice signal. For example, we can now see who is calling, not worry about having to keep the phone free, or even choose when and for whom we answer the phone. The availability of these services has almost become synonymous with basic phone service.

In addition to consumer benefits, telecommunications carriers also had reasons for switching to digital signals. Some of these include the ability to send multiple conversations over a single facility, send voice and data together and improve sound quality.

The digitisation of the wired network appears to have reached a stationary level in 2001, with 99.8% of all PSTN lines being digital. It also appears that carriers are replacing their analogue lines with digital as the overall growth in total PSTN lines (1.4%) is roughly equal to the growth in Digital PSTN lines (1.5%). The residential market accounts for more than two-thirds of the few remaining analogue lines.

Demand for mobile telephony has increased because of reduced costs, increased services, better quality and improved coverage. Some of these changes can be attributed to the investment and roll-out of a digital infrastructure. For example, a digital wireless system allows more subscribers to use a given cell at the same time, reducing the cost of servicing a new subscriber. The digital system also allows more information to be carried with the conversation, enabling more services. Improvements in quality can be directly attributable to the very nature of the digital signal.

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2 *However, prior to 1987 all data were suppressed to meet the confidentiality requirements of the Statistics Act.*

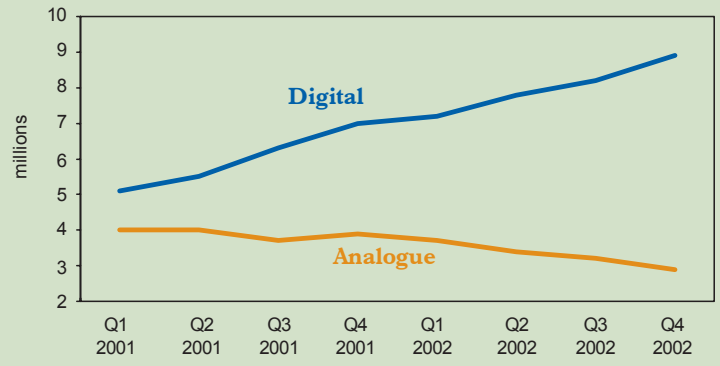
In 2001, total mobile subscribers increased by 22.0%. However, this was attributable to digital subscribers which increased by 69.0%. On the other hand, the number of analogue subscribers declined by almost 27.0%. Taken together these resulted in more than 70.0% of all mobile subscribers being digital, an increase of about 39.0% over 2000 (Table 3.2.2). Examination of more recent data confirms that this trend is continuing. For example in the fourth quarter of 2002 digital subscribers were up 28.7% over Q4 2001, and analogue subscribers were down 25.7% over the same period.

Table 3.2.2 Mobile access paths, 2000-2001

	2000	2001	% Change 01/00
Digital	4,444,031	7,509,895	69.0
Analogue	4,282,605	3,138,929	-26.7
Total - Mobile access	**8,726,636**	**10,648,824**	**22.0**
Digital access paths as a % of PSTN mobile access	50.9	70.5	38.5

Source: Annual Survey of Telecommunications, Science, Innovation and Electronic Information Division, Statistics Canada.

Figure 3.2.1 Mobile subscribers, 2001-2002



Not only has growth in wireless subscribers been sizeable, but the capabilities of the cellular network have also expanded from voice-only communication to electronic messaging and web browsing. In addition to the improvements in technology, there has been an increase in the number of cells. In other words, not only can you use your mobile phone to surf the Internet, but also to surf in many new locations.

Looking to the future

Some of the world's greatest minds have been stumped when it comes to predicting the future of technology. Examples include Thomas J. Watson's (Chairman of IBM) prediction for a maximum world market of five computers, Kenneth Olsen's (President of Digital Equipment Corporation 1977) prediction that no individual would need to have a computer in their home, or Lewis Strauss (U.S. Atomic Energy Commissioner 1954), who stated: "It is not too much to expect that our children will enjoy in their homes electric energy too cheap to meter".

Keeping these in mind we will not venture to predict absolute outcomes but rather the general tendency based on some accepted ideas and technology directions. In the wireless sector, manufacturers, governments and international standard bodies have stated that they will move towards a 3rd generation system that allows faster downloads, as well as better integration among the various existing technologies. Combined with the apparent need for speed and capabilities by existing and future users, this roll-out of new technologies seems to be a sure bet.

A possible detour around this outcome would be the leap-frogging to 3.5 or even 4th generation wireless by those companies that want to be first past the gate. However, while this leap-frogging would reduce or even eliminate the compatibility of all existing systems, it would allow for the introduction of more advanced capabilities sooner. For example, two-way synchronous wireless video calls allowing users to not only call friends from the ski-lift in Banff, but also show them the view.

Unfortunately, the picture for the wireline sector is not as bright. While advancements have occurred over the last few years and should continue in the future, the basic product has not changed as dramatically as the wireless system. In addition to the competition provided by the wireless system for both new and existing customers, the wireline industry is facing competition from the cable industry which has already rolled-out telecommunications service in Atlantic Canada.

Taken together these developments suggest that challenges to wireline operators will be in the form of revenue reductions caused by lost customers to other services. In addition, for those customers they keep, their profit margins on local and long distance services will shrink due to increasing competition in these areas.

But do not write off the wireline providers just yet, as they have a number of strengths that the others currently do not have. First among these is a physical connection to most, if not all, Canadian homes and businesses. This combined with their potentially unlimited bandwidth suggests that some of the more advanced smart-home capabilities may only be available to wired homes.

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3.3 The cable and satellite industry in the information age

Daniel April is Chief of Telecommunications and Broadcasting in the Science, Innovation and Electronic Information Division, Statistics Canada. In the article below, he analyzes how the cable television industry has been transformed by the emergence of ICTs and what challenges the industry faces for the future.

Information and communications technologies (ICTs) are changing the way individuals and organisations access, exchange and use information. The Internet puts a wealth of information and entertainment at its user's fingertips, wireless technologies allow communication and information exchange from almost anywhere at any time, and broadband networks pave the way for applications unheard of only a few years ago.

The statistics for Canada presented in this article are drawn from the following sources: ***Statistics Canada,*** *Annual Return of Broadcasting Distribution Licensees, Annual and Quarterly Surveys of Telecommunications, Survey of Household Spending, Survey of Household Internet Use (HIUS).* ***CRTC,*** *Status of Competition in Telecommunications Markets. The statistics for the United States are taken from various reports published by the* ***National Cable and Telecommunications Association*** *(http://www.ncta.com).*

The impact of ICTs on our daily activities is quite obvious, whether at home or at work. Perhaps less obvious to most is the impact these technologies are having on our industrial structure. New industries appear and new products and services become available. The emergence of the wireless telecommunications industry and the introduction of online newspapers are examples of such changes. Existing industries and products are also being transformed. The cable industry is a good example. This industry depends on its investments in ICTs and on its customers' propensity to use ICTs.

This article looks at some of the fundamental changes that have affected the cable industry in the recent past and examines some of the challenges and opportunities it faces in coming years.

Competition and technology are redefining the industry

The birth of the cable industry in Canada dates back to the early 1950s. The first systems were introduced in London, Vancouver and Montreal at a time when there were only 146 thousand television sets in Canada. Since then, television has become part of the daily life of almost all Canadian households and the cable industry has expanded its reach to more than 90.0% of them.

During much of the period since its inception, the industry functioned under stable market conditions and with the same basic technology. It consisted of territorial monopolies engaged in the delivery of analogue video programming services using a one-way broadcasting system. The growth of the industry was based on its ability to attract a growing number of customers and to supply a wider array of programming services.

The opening of the multi-channel video market to competition from wireless providers in the second half of the 1990s has changed this drastically. Cable operators were no longer the only game in town and wireless providers needed to build a critical mass of subscribers to ensure their financial viability.

In this new competitive environment where the loss of customers was unavoidable for cable operators, their financial viability depended largely on their capacity to generate more revenue per subscriber. In order to do so, they needed to offer new services. The one-way analogue-based cable network imposed serious limits on their ability to do so. Investment in new technology became necessary.

An expanding customer base

The arrival of new suppliers and increased programming choices[3] has led a growing number of Canadians to subscribe to multi-channel video programming services. The number of subscribers grew by 5.9% in 2001 to reach 9.5 million[4]. This was the largest yearly increase since 1986. Since 1998, the year in which the impact of wireless entrants became evident, growth in subscriptions has accelerated every year and has outpaced the growth in the number of households.

Wireless providers (satellite and MDS) are taking a greater than ever share of that growing market. They had captured 17.0% of the market at the end of August 2001, up significantly from 10.8% in 2000 and more than double their share of approximately 6.5% in 1999. The market share of Canadian wireless operators is approaching the level attained by operators in the United States (21.9% at the end of December 2001) despite the fact that they have been in operation for a shorter period of time.

Cable operators offering Internet access services and digital cable fared better in the new competitive environment. They maintained a higher penetra-

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3 *In 1996, the year prior to the introduction of competition, the average subscriber to multi-channel video services had access to 53 channels. In 2001, the same subscriber had access to 94 channels.*

4 *Subscribers to the services of cable, Direct-to-home (DTH) and Multipoint Distribution System (MDS).*

tion rate than those who did not provide these services (71.6% compared to 66.5%) and generated 17.0% more revenue per subscriber.

This period of market growth followed a period of stagnation. In the years leading to the introduction of competition, subscriptions to multi-channel video programming grew at a rate similar to the growth in the number of households. In 1996 and 1997, the yearly increase in subscriptions had fallen to about 1%.

Going digital [5]

The popularity of direct-to-home (DTH) satellite television and the recent introduction of digital cable are resulting in the gradual digitisation of the broadcasting distribution system. Despite its relatively recent introduction to the market, more than 25.0% of the 9.5 million subscribers to multi-channel video services were receiving their service in digital mode in 2001, up from 15.2% in 2000. Two out of three subscribers to digital television were clients of wireless operators.

Despite the strong growth in the adoption of digital television by Canadians, the transition to digital television lags behind that observed in the United States where approximately 35.0%[6] of customers to programming services received a digital package at the end of 2001. The longer history of satellite television and the higher penetration of digital cable (20.0% of cable customers compared to 10.0% in Canada) in the United States largely explains this gap.

Cable leading the transition to high-speed Internet

In reaction to the strong competition in their traditional market, cable operators first turned to high-speed Internet as a means to retain customers and generate additional revenue per subscriber.

The rate of Internet adoption by cable has progressed rapidly. Almost 15.0% of homes with access to cable Internet had adopted it as of August 31, 2001, up from 10.3% a year earlier. By comparison, the penetration rate in the United States had reached about 8.0% of homes capable of receiving the service by mid-year 2001.

The number of subscribers to Internet by cable surpassed 1.7 million at the end of 2001. Close to 65.0% of residential subscribers to high speed Internet had chosen cable Internet, most of the remaining subscribed to DSL services.

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5 *Digital technology allows cable and wireless operators to deliver 4 to 12 video signals in the space occupied by 1 analogue channel. It also opens the door to applications such as interactive program guides and parental controls not possible with analogue technology.*

6 *Direct Broadcast Service (DBS), Multichannel Multipoint Distribution Service (MMDS) and digital cable customers.*

Some wireless operators were offering high speed Internet access services in 2001. Their offering was at an early stage of development and market penetration was not yet material.

The introduction of high-speed Internet has had a significant impact on the results of cable operators. Revenues from these services accounted for 12.0% of the revenues of cable operators providing it in 2001.

Competition is creating a downward pressure on profits

The introduction of competition in an industry often results in a decline in profitability for incumbent firms and entrants often support losses until they have a critical mass of customers. Both phenomena can be observed in this industry.

The profit margin (before interest and taxes) of cable operators was 16.1% in 2001, down from 19.5% in 2000 and 21.7% in 1999. The significant expenses incurred to promote existing and new services partly explain the decline in profitability. In 2000 and 2001, sales and promotion expenses have grown three times faster than revenues. Those expenses represented 6.9 % of operating expenses in 2001, compared to 6.1 % and 5.2 % the previous two years.

Wireless operators sustained losses in those three years, but their losses are declining. In 2001, their loss (before interest and taxes) was $293 million or $182 per subscriber, considerably less than in 2000 when it was $393 million or $406 per subscriber. Wireless operators have also aggressively promoted their products. They have in fact spent more on promotion than cable operators in the last three years. However, the 10.9% decline in sales and promotion expenses in 2001 partly explains the lower losses incurred by this segment of the industry.

Challenges and opportunities

Canadians have an appetite for television and have shown a readiness to pay for the service. Cable or satellite television is already present in more than 86.0% of homes. This means that the potential for growth for this industry largely lies in its ability to convince existing customers to purchase a broader range of programming and non-programming services. In order to do so, the industry is attempting to change the way customers use their television and to build niches in non-traditional markets. Much of this depends on technological innovation.

While technological innovation provides opportunities for the industry, it also poses a threat. The use of satellite technology is difficult to control. The availability of non-authorised satellite dishes and decoding hardware and software

has led to the creation of sizeable grey and black markets[7]. Recapturing that market may well be the industry's most important challenge in the short term. The following sections examine some opportunities and challenges for the industry.

Changing the way consumers use their television

Digital and two-way communications capability can transform the television set into an interactive device. Today, some Canadians can use their television to send and receive e-mail, to surf the Web, to chat, to pay bills, to order goods and services, to access video programming of their choice at the time of their choice, and to participate in their favourite program. While these services are at an early stage of market development, most Canadians will likely be able to subscribe to them in a few years. The most promising interactive applications for the near future are video-on-demand (VOD) and TV-based web access.

VOD turns the television into a virtual video club. It enables a client to order video at their convenience and to pause, rewind or fast-forward as one would with their video or DVD player. The popularity of video rental provides an indication of the market potential for VOD. In 2001, 60.0 % of Canadian households rented videos and spent close to $1.2 billion on this service.

TV-based web access offers customers the opportunity to get a broadband connection to the Internet through their television set. The underlying conditions for this application to become an important offering of the industry are in place:

- 99.2 % of households have at least one television set in their home. By comparison, 59.9 % of households have a computer.
- More households are already connected to a broadband network through their television than through their computer; 68.3 % of households are connected to a cable network and 18.4 % to a satellite network. By comparison, 20.4 % of households have a computer connected to a broadband source (i.e. high-speed telephone connection or cable connection).

7 *The grey market refers to the situation where consumers obtain U.S. addresses that enable them to purchase U.S. satellite services not licensed to operate in Canada. The black market refers to the situation where consumers purchase electronic cards allowing them to obtain Canadian or U.S. satellite signals at no cost.*

Cable telephony

Despite many economic, technological and market challenges, telephony by cable is becoming a reality. This service is offered in parts of the Maritimes with some success, and market trials are underway or scheduled in other parts of the country.

Telephony provides cable operators an opportunity to become a player in a market twice the size of its current markets. The local access and related revenues of wireline telecommunications services providers exceeds $10 billion. About half of that revenue comes from the residential market, and cable operators already have a presence in seven out of ten homes.

The addition of telephony to the suite of available services would also provide the cable industry an opportunity to bundle telephony, Internet access and home entertainment services. Canadian households spent an average of $1,323 on these services in 2001, representing a total expenditure of $15.3 billion.

The grey and black markets

Technology is changing the industry and providing it with opportunities for growth. It also provides consumers the ability to opt for the black market. The exact magnitude of the grey and black market is unknown. By some estimates, there are between 565 and 715 thousand households using unauthorised satellite services (The Strategic Council 2002). Statistics on the use and supply of such services supports an estimate at the lower end of this range.

Whatever the magnitude, it is clear that this is not a trivial phenomenon. The potential annual loss of subscription revenues for the industry ranges from $275 to $345 million[8], or between 39.0% and 49.0% of the revenues generated by licensed wireless operators in 2001.

In reaction to this situation, a coalition of concerned broadcasters, content providers and distributors has engaged in public awareness, legal and lobbying activities intended to eliminate the illegal use of satellite signals. These efforts are crucial to the industry. In an address to the Broadcast Executive Society, the president of the Canadian Cable Television Association summarised what is at stake for the industry with the following words: "You can't compete with free" (CCTA 2002).

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8 *The Coalition against Satellite Signal Theft estimates the annual loss to the broadcasting system at $400 million. This includes losses incurred by programming undertakings and copyright holders as well as loss of subscription revenues by cable and satellite operators.*

Summary

Through time Canadians have adopted ICTs with enthusiasm. The telephone, radio, television, cable, computers, wireless communication devices and the Internet all became mass consumption items at different times in the last 100 years. The adoption of these technologies has changed the way people communicate, access information and spend their leisure time. It has also led to the creation of industries that create wealth and employ many thousands of Canadians.

There is little doubt that innovation in information and communications technologies and applications will continue to change our lives. In the short and medium terms, they may well revolutionise the way individuals shop, educate themselves and obtain health services.

Communication networks have played, and continue to play, a central role in bringing the benefits of these technologies to the mass market. Many of the newer applications work best with broadband networks. The cable and satellite industry is preparing to be part of that evolution.

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3.4 Building the perfect system: An analysis of the computer systems design and related services industry

Moreno Da Pont is an analyst in Service Industries Division, Statistics Canada. This article examines growth, employment, and trade characteristics by firm size, in the ICT sector's computer systems design and related services industry. The complete study can be found in Statistics Canada's Service Industries Analytical Paper Series.

During the past quarter-century, the computer systems design and related services industry has enjoyed tremendous growth. The widespread adoption of computers in business, government and households has created strong demand for information technology (IT) services. In today's knowledge-based economy, using computers as a means for storing, processing and transmitting data is pervasive. It would be difficult, if not impossible, for a business or government department to conduct its affairs without a sound IT system. Naturally, the ability to store information, access it quickly and transmit it from one user to another comes at a cost.

This article provides a snapshot of the computer systems design and related services industry. It describes the industry's recent financial performance and provides information on market share, revenues by type of service, employment characteristics and revenues earned from foreign markets. Prior to 1997, the computer services industry was broader in scope. It included software publishing firms, data processing firms and computer systems design firms, and formed the basis for three NAICS industries.

Throughout, the emphasis is placed on comparing large, medium-size and small firms. Data come primarily from the Annual Survey of Software Development and Computer Services, and are meant to supplement previously released survey data.

Businesses have poured large amounts of capital and human resources into developing the underpinnings of IT systems, as well as additional resources into maintaining them. Some firms have been successful at developing in-house IT systems, while others have not. But in attempting to meet their IT needs, many firms determined it would be more productive to focus efforts on their core business activities and to engage IT specialists for expert advice or to manage their entire IT systems. This ever increasing reliance by business and government on outside support has played an important role in shaping the extensive market for IT services in Canada and helps explain why the computer systems design and related services industry has achieved strong growth over time.

Firms in this industry offer an array of services, including computer systems consulting, customization of packaged software, network design and development and IT infrastructure management services. They are information

technology experts who develop and implement computer environment solutions for business and government. The types of contracts obtained by systems design firms are diverse. Some call for specialized work in areas such as customizing pre-packaged software to better fit client needs. Other contracts are multifaceted and range from determining IT requirements and designing appropriate systems, to maintaining newly developed systems and providing training for clients to manage their own systems.

Industry enjoyed solid growth before slowdown in 2001

The computer systems design industry posted strong growth rates over the 1998-2000 period, before slowing down in 2001. Between 1998 and 2000, the number of firms increased by 39%, revenues climbed by 50%, and the number of employees[9] jumped by 61% (Table 3.4.1).

In 2001, the boom years for high-technology halted abruptly. Revenues grew just 2.8% to $18.6 billion, while some of the employment gains from previous years were wiped out. Despite the slowdown, the strong growth rates posted as the 1990s wound down allowed the industry to outperform most others in the Canadian economy.

Amongst industries in the ICT sector, computer systems design ranked third in revenues generated for 2001, accounting for about 14% of total revenues earned.

Table 3.4.1 Major variables, computer systems design and related services industry, 1998-2001

	1998	1999	2000	2001
Number of firms	31,651	41,597	43,874	43,440
Number of paid employees	82,478	109,681	132,705	128,005
Total revenues *(millions)*	12,033	15,533	18,048	18,562
Total expenses *(millions)*	11,253	15,237	17,433	17,682
Profit margin	6.5%	1.9%	3.4%	4.7%

Source: Annual Survey of Software Development and Computer Services, Service Industries Division, Statistics Canada.

9 *Employees are defined as people for whom salaries or wages were paid and tax T4 slips were issued. Working owners and workers employed on a contract basis are not included.*

Large firms generate majority of revenues but small firms maintain a strong presence

Firms are categorized into one of three size classes: small firms, including non-employer firms, have fewer than 10 employees; medium-size firms have between 10 and 99 employees; and large firms have 100 or more employees.

In 2001, the vast majority of computer systems design firms (96%) were small, in terms of number of employees. Just over one-half of these small firms were, in fact, non-employers. In contrast, medium-size firms accounted for about 3.5% of the industry total, while large firms made up less than 1%.

Small firms gained market share in 1999 when work was abundant as a result of concerns over the Year 2000 (Y2K). In that year, the number of firms in the industry increased by 31%. Many of the new entrants were likely small start-ups specializing in providing specific Y2K system solutions. After establishing a presence, many entrants were able to continue operating, even after Y2K work subsided. According to an independent study of survival rates for new entrants into business service industries, 83% of entrants will survive their first year of operation and 68% will survive beyond two years (Baldwin et al. 2000).

Although large firms accounted for a small proportion of the industry's firms, they generated the bulk of industry revenues. In 2001, the largest firms accounted for almost one-half (48%) of revenues, compared with 29% for small firms, and 24% for medium-size firms (Table 3.4.2).

Table 3.4.2 Total revenues by firm size, 1998-2001 (millions of dollars)

	1998	1999	2000	2001
Small *(less than 10 employees)*	3,333	5,051	4,982	5,312
Medium *(10 to 99 employees)*	2,831	3,447	5,345	4,380
Large *(100 or more employees)*	5,870	7,035	7,722	8,870

Source: Annual Survey of Software Development and Computer Services, Service Industries Division, Statistics Canada.

Economic slowdown hit medium-size firms hard

In 2001, revenues for the computer systems design industry flattened, mirroring an economy-wide slowdown. That year, GDP grew at a rate of only 1.5%, down sharply from 4.5% the previous year[10]. As the rate of growth in corporate revenue slowed, many businesses sought to curb discretionary spending to maintain profitability and protect cash reserves. Unfortunately for firms in computer systems design, this cost-cutting exercise resulted in a deceleration of IT spending after years of strong growth.

10 *Expenditure-based estimates of GDP in current dollars, National Income and Expenditure Accounts, Statistics Canada.*

With the sluggish economy and the fallout from the events of September 11, 2001, businesses delayed orders for new computers and software, and put systems redevelopment plans on hold. This was a first step in cost-cutting exercises that later resulted in corporate restructuring and staff reductions. The dot-com sector was at the eye of the storm, suffering staggering losses.

In the computer systems design industry, medium-size firms were hit particularly hard, as revenues dropped by a substantial 18%. In contrast, revenues for large firms rose 15%, while small firms also fared well, posting a 7% year-over-year gain. The solid performance of large and small firms kept overall industry revenues from declining.

One explanation for the exceptional performance of large firms during the 2001 slowdown was the presence of long-term contracts on their books. Contractual commitments that run over a period of years act as a buffer against a worsening economic climate, at least in the short term.

The structure of certain contracts also benefited larger computer systems design firms. During difficult economic times, some companies find that outsourcing IT work is a good mechanism for infusing cash into their businesses. This is accomplished by selling their in-house IT infrastructure to a service provider, and entering into a long-term service provision contract. The business that contracts out can put cash from the sale of its infrastructure into core activities that will help sustain it until economic conditions improve.

Small firms recorded higher profit margins but this was largely attributable to their structure

Even though large firms in computer systems design generated the bulk of industry revenues, small firms recorded higher profits. In 2001, small firms recorded a 14% profit margin, compared with margins of less than 2% for both large and medium-size firms.

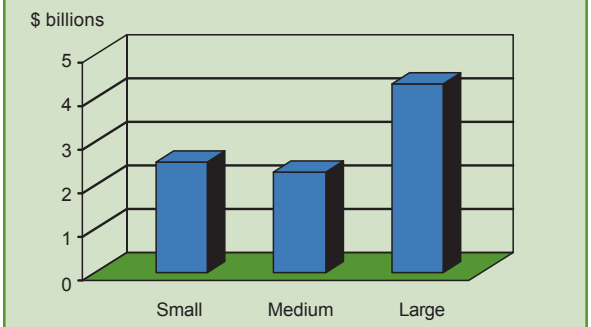
The structure of small firms is an important factor contributing to their high profit margins. The majority (51%) of the smallest firms in the computer systems design industry did not have salaried employees in 2001. For these non-employer firms, the income of owners or working proprietors is recorded as profit on their income statements. Since working proprietors provide many of the same capacities to their companies as would employees in other companies, a somewhat artificial difference is created when comparing profit margins.

Non-employer firms record higher margins when compared with firms whose employee salaries are expensed. But if working proprietors of non-employer firms expensed their time spent providing IT services to clients, the difference would be far smaller.

Large firms led the way in economic value added

In 2001, the computer systems design industry contributed over $9.1 billion in value added to the Canadian economy. Firms of all sizes made significant contributions, but large firms led the way. They amassed about $4.3 billion in value added, compared with $2.3 billion for medium-size firms and $2.5 billion for small firms. Large firms had by far the highest value added per firm. However, value added per employee was similar, regardless of firm size (Table 3.4.3).

Figure 3.4.1 Value added by firm size, 2001



Value added *is a standard measure of the economic value that is created by businesses as a direct result of the activities they conduct. The net sum of value added across all industries in the economy is GDP.*

Table 3.4.3 Value added per firm and employee, by firm size, 2001

	Value added per firm	Value added per employee*
Small *(less than 10 employees)*	60,520	69,905
Medium *(10 to 99 employees)*	1,514,906	66,620
Large *(100 or more employees)*	11,797,246	75,066

Source: Annual Survey of Software Development and Computer Services, Service Industries Division,Statistics Canada.

** Working proprietors are not counted as employees.*

The bulk of economic value added for most service industries can be attributed to workers' salaries. For the computer systems design industry, salaries were the single largest expense incurred by firms, accounting for 43% of operating expenses. If fees paid to contract workers – 9.5% of operating expenses – are added to the salary expense, then over half of the industry's operating expenses go towards paying for knowledge from human capital.

IT technical consulting is the main source of revenue

The largest source of revenues for firms in computer systems design was IT technical consulting services. This was especially true of the smallest firms, for which IT consulting accounted for 35 cents of every dollar in earned income. This compares to about 23 cents for medium-size firms and 21 cents for large firms. Other key sources of revenue included the design and development of computer systems, the development of customized applications and the customization of software.

The annual Survey of Software Development and Computer Services includes an extensive section for revenues earned by type of service provided. Survey respondents can choose to report revenues in 31 different revenue-by-type-of-service cells.

To facilitate analysis, this extensive list of revenue cells was utilized to construct a measure of the degree of specialization found in the industry. Firms were assigned to one of two categories based on the number of services for which they reported revenues. The categories are 'specialized' service providers and 'diversified' service providers. Firms who derived all their operating revenues from a maximum of two different services are defined as 'specialized' service providers. Firms who generated revenues from the provision of more than two services are defined as 'diversified' service providers. Data on the degree of specialization do not include information for firms which were too small to survey. These firms account for 52% of the firms in the industry, but just 6% of industry revenues.

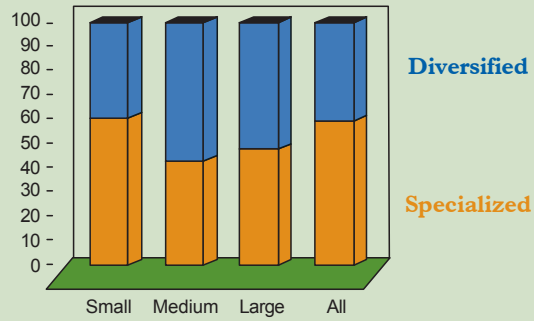
Large firms generate significant revenues from services not primarily associated with the industry

Small firms generated 84% of their revenues from services primarily associated with the industry, including IT technical consulting, database design and development, IT technical support, website design and development, customization and integration of software, and computer systems design, development and integration. In contrast, large firms earned just 61% of their revenues from computer systems design and related services. They also earned a significant proportion (10%) from the sale of purchased hardware and from IT infrastructure and network management services (11%).

Most firms are specialized, but diversified firms earn higher revenues

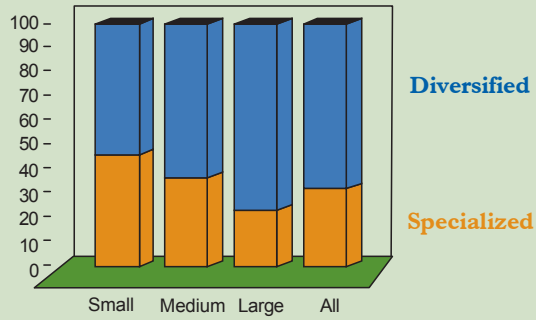
A comparison of firms by size and degree of specialization reveals that the majority are 'specialized' (Figure 3.4.2). This was particularly true for the smallest firms, among which six out of ten generated all their revenues by providing either one or, at most, two different services.

Figure 3.4.2 Percentage of firms by degree of specialization and firm size, 2001



This high degree of specialization for small firms is not unexpected. Small firms have fewer employees, and are less likely to have the resources required to obtain contracts where a broad range of IT services is mandated. Instead, they will bid on projects in selective areas where they can achieve a competitive advantage. However, being specialized was not just a small-firm phenomenon. Many medium-size and large firms also derived their entire revenues from just one or two services. In 2001, about 43% of medium-size firms and 48% of large firms were specialized (Figure 3.4.2).

Figure 3.4.3 Percentage of revenues by degree of specialization and firm size, 2001



Despite the fact that the majority of firms are specialized, it is diversified firms that earned the highest share of revenues (Figure 3.4.3). In total, diversified firms generated 68% of industry revenues in 2001. In the case of large firms, nearly 80% of revenues went to diversified firms. Diversified small and medium-size firms also had much larger revenue shares than might be expected, given their numbers. Only four in ten small firms were diversified, yet they earned 54% of small-firm revenues. In the case of medium-size firms, 57% were diversified, earning over 60% of revenues for that size class. It would appear – at least in this industry – that being able to offer clients a range of services plays an important role in a firm's ability to create additional business.

Table 3.4.4 Average revenues earned by degree of specialization and firm size, 2001

	Small	Medium	Large	All
Specialized	166,100	2,678,200	31,223,700	458,100
Diversified	299,200	3,467,100	94,571,300	1,415,900
Median revenues earned by degree of specialization and firm size, 2001				
Specialized	114,297	1,000,000	16,127,786	120,000
Diversified	139,190	2,385,595	21,943,866	153,914

Table 3.4.5 Revenues earned per employee by degree of specialization and firm size, 2001

Specialized	101,900	109,200	128,500	112,700
Diversified	156,600	139,600	164,400	156,400

Source: Annual Survey of Software Development and Computer Services, Service Industries Division, Statistics Canada.

Data showing average and median revenues support the finding that diversified firms earn higher revenues (Tables 3.4.4). For example, in 2001, median revenues for small firms that were diversified stood at $139,190 compared with median revenues of $114,297 among small firms that were specialized. Revenues earned per employee were also higher for diversified firms (Table 3.4.5).

*The **median** is the point at which half the firms earned more than the middle value, while the other half earned less.*

Not surprisingly, diversified firms also have more employees. There is obviously a relationship between the number of services a firm can provide to the market and the number of persons required to offer them. This is especially the case in service-oriented industries, where the knowledge of workers is the most important input in the production process.

While specialized small and medium-size firms focused primarily on IT consulting, the large firm specialists were more likely to design and develop applications or systems. Large diversified firms accounted for almost all of the IT infrastructure and network management service revenues generated by the industry.

Medium-size firms were successful in accessing foreign markets

Penetrating foreign markets is a challenging task. Before a business can become an exporter, it must gain an understanding of regulatory arrangements, pricing norms, strategic opportunities and customer servicing strategies that will be effective in the target country.

Firms in the computer systems design industry have successfully entered foreign markets (Figure 3.4.4). In 2001, 15% of industry revenues came from exports. Large firms accounted for the lion's share of the market (49%), but medium-size firms also fared extremely well. In fact, medium-size firms earned a higher proportion of overall revenues (27%) from exports than did large firms (16%). About 62% of large firms were exporters, compared with 41% of medium-size firms and just 4% of small firms. The United States is the industry's largest foreign market, with more than $1.9 billion in purchased services. Europe ranks a distant second at $521 million. Both large and medium-size firms have been successful in establishing business ties in both American and European markets.

As might be expected, small firms are not important players in the export field. Their export share is far smaller than their revenue share (Figure 3.4.5). Clearly, they have not tapped into foreign markets to the same extent as their large and medium-size counterparts.

Larger firms probably hold a competitive advantage when targeting foreign markets. They have in-house marketing departments in which their employees can concentrate on marketing their firm's services to clients abroad.

Figure 3.4.4 Export revenues by firm size, 1999-2001

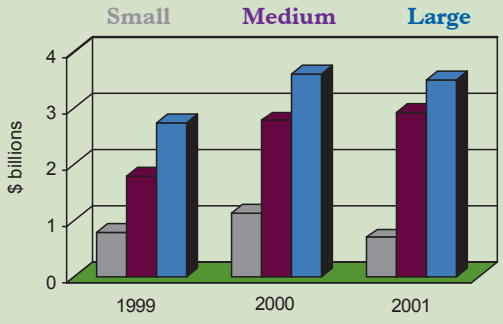
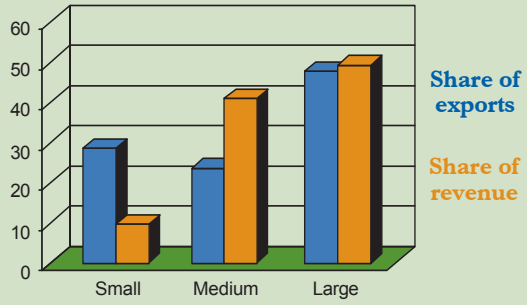


Figure 3.4.5 Percentage of revenues and exports by firm size, 2001



Also, they may find it easier to enter into partnering agreements with foreign firms, thus gaining immediate access to their partner's clients.

Employment: Small firms show biggest proportional gains during past four years

Employment in computer systems design expanded rapidly between 1998 and 2000, before easing off in 2001 (Table 3.4.6). Employment peaked at nearly 133 thousand in 2000, a 61% increase over 1998. A year later, it had declined 3.5% to just over 128 thousand. This level was still 55% higher than in 1998.

Growth between 1998 and 2000 was more or less evenly distributed across firms of all sizes. But this was not the case during the decline in 2001, when employment among medium-size firms declined 22%, employment levels among large firms were unchanged, whereas employment among small firms actually rose 15%.

Overall, the number of firms in the industry remained relatively constant in 2001 (Table 3.4.1). As a result, it is likely that a large portion of the gains in employment among small firms occurred because medium-size firms trimmed their employment to fewer than 10 employees, becoming small firms in the process.

Proportionally, small firms made the biggest gains during the four-year period. In 2001, they accounted for 28% of total employment, compared with 26% in 1998. Large firms accounted for 45% in 2001, up marginally from 44% in 1998, while medium-size firms represented 27%, down from 30% in 1998.

Table 3.4.6 Number of employees by firm size, 1998-2001

	1998	1999	2000	2001
Small	21,350	29,164	31,371	35,975
Medium	25,070	28,130	44,070	34,585
Large	36,058	52,387	57,264	57,445
All firms	82,478	109,681	132,705	128,005

Source: Annual Survey of Software Development and Computer Services, Service Industries Division, Statistics Canada.

Summary

Computer systems design and related services is an important industry in the Canadian services sector. Its firms employ more than 128 thousand people and revenues have increased sharply over the past several years, reaching $18.6 billion in 2001. The industry is comprised of some very large firms, but the vast majority are small firms that employ fewer than ten people. In fact, over one-half of the 43,400 firms in the industry do not have any employees at all. Large firms represent less than 1% of the industry, but they employ almost half of the industry's workforce, and generate about 48% of total revenues earned. Diversified firms - those offering clients an array of services – generate the highest revenues in all firm sizes. Small firms are most likely to specialize in only one or two different services.

Exports are a key source of revenues accounting for 15% of total revenues earned. Medium-size firms (those with between 10 and 99 employees) have fared quite well in the export market, with about 27% of their revenues earned from exports. Firms of all sizes are important participants in the industry's labour market. In 2001, large firms employed 45% of the workers in the industry, compared to 28% for small firms and 27% for medium-size firms.

References and related publications

Baldwin, John, Lin Bian, Richard Dupuy and Guy Gellatly (2000) *Failure Rates for New Canadian Firms: New Perspectives on Entry and Exit*, Statistics Canada, Catalogue No. 61-526-XPE, February.

Da Pont, Moreno (2003) "Building the perfect system: An analysis of the computer systems design and related services industry", *Analytical Paper Series – Service Industries Division*, Statistics Canada, Catalogue No. 63F0002XIE, no. 45, August.

3.5 Struggling to remain competitive: A study of factors impeding growth for Canadian Internet service providers

Heather Archibald is an analyst in the Service Industries Division, Statistics Canada.
This article takes a look at perceived barriers to growth in the ISP industry. It also highlights some of the distinguishing characteristics between small, medium and large firms. The entire study can be found in Statistics Canada's Service Industries Analytical Paper Series.

Today, the terms "fierce competition" and "Internet access provision" are synonymous. The vastly changing Internet access market is no longer the domain of its original pioneers – the so called "traditional" Internet service providers[11]. As cable firms, telecommunications carriers and, more recently, wireless carriers flood the market, the business challenges facing ISP firms continue to mount.

Using data from the 2001 Annual Survey of Internet Service Providers and Related Services, this article examines some of the industry's challenges by exploring various industry characteristics, in conjunction with important issues for future growth. The primary focus of the analysis revolves around the industry's perception of factors that impede growth of their business and highlights the significant distinguishing characteristics between small, medium and large size firms. Examination of responses from firms revealed five principal obstacles to growth:

(1) Competition;
(2) Cost-related impediments revolving around both ends of the ISP business – their links to consumers and their links to the Internet;
(3) Delays in obtaining facilities from suppliers;
(4) Access to financing and;
(5) Access to Markets.

Background information on the demand and supply side of the Internet access market, financial performance analysis and structure of the ISP industry are also presented.

The Annual Survey of Internet Service Providers and Related Services, 2001 is directed at firms whose main activity is the provision of Internet access services as defined by the North American Industrial Classification System (NAICS). It is important to note that firms in the cable and telephone sector who provide Internet access services as a secondary activity are not covered by this survey.

11 *Firms classified to the Internet service provider industry as defined by the North American Industry Classification System (NAICS 2002). These include only those companies whose main activity is the provision of Internet services, as defined by NAICS 2002. The information presented here, based on an estimated 256 ISPs, does not include Internet services provided by telecommunications carriers, cable operators or other enterprises not classified as an ISP, and therefore does not represent the entire ISP industry.*

Overview

The worldwide market for Internet services exploded during the late 1990s. Today, Internet use has become a daily routine for many Canadian households and businesses. In 2001, roughly 71% of Canadian businesses (Statistics Canada 2001a) used the Internet, and more than 5.8 million Canadian households had at least one member that regularly used the Internet from home (Statistics Canada 2001b).

Internet service providers (ISPs) forged the way for Internet access services in the early 1990s, and they continue to play an important role in connecting Canadians to the Internet. They have the equipment and telecommunications network access required for a point-of-presence on the Internet.

In the Internet supply chain, ISPs act as the intermediary between the owners of the transmission networks over which Internet traffic flows and the growing number of business and residential Internet users. The core of the ISP business is based on providing this access along with value added services that are largely dependent on the infrastructure offered by large telecommunications companies.

To access the Internet, a user pays a connection fee to the ISP. The vast majority of ISPs charge a flat monthly rate, and some impose a per-hour charge above a certain monthly threshold. In this intensely competitive market, ISPs can lose their customer base if they charge more for services that other firms provide more cheaply. In fact, many Canadians are not inclined to remain loyal to one ISP. A recent study conducted by Ekos Research Associates indicated that about "one in five subscribers is now on a third or fourth ISP since first obtaining home Internet access" (Ekos 2002).

Although the ISP industry is still relatively young, survey results are already indicating signs of maturity. The strong year-over-year growth in operating revenues achieved in the late 1990s and into the new millennium is beginning to slow. Operating revenues increased 27% to $1.3 billion in 2001, only about half the 42% gain achieved between 1999 and 2000. This is not surprising since the rate of increase in Internet adoption at the household level also slowed considerably in 2001 (Statistics Canada 2001b).

Despite significant increase in revenues from broadband access (38% of revenues in 2001, compared with 26% in 2000), dial-up Internet access – though on the decline – remained a central part of the ISP business, generating 49% of total ISP revenues in 2001.

Technologies such as DSL (digital subscriber line) and Internet over cable networks enable Internet users to transmit information at a much faster speed. There are two main reasons why high-speed is so attractive to users. Information can be transferred many times faster than with traditional dial-up access, in an always-on connection. Furthermore, high-speed service does not tie up telephone lines so there is no need to invest in a second line. However, dial-up still has its advantages: it is less expensive than DSL or cable, it is much more accessible (DSL and cable are not accessible everywhere across the country), users can dial-up anywhere (hotels etc.) and benefit from increased mobility and portability.

Despite this growth in operating revenues, Canadian ISPs are struggling to turn a profit. About 46% of all ISPs surveyed reported a loss in 2001. Some of the contributing factors included intense competition, a slowdown in Internet adoption rates, and significant infrastructure investment (since the introduction of high-speed access).

The high volumes of acquisitions and mergers in this industry have directly contributed to the decrease in the total number of ISP firms in 2001 (9.0%). Many of the small ISPs have quietly exited the market. Today, there are 256 firms classified to the Internet service provider industry[12]. Table 3.5.1 provides a closer look at the players in this industry.

Table 3.5.1 Major variables, Internet service providers and related services industry, 2000-2001

	2000	2001
Number of establishments	281	256
Number of paid employees	6,488	7,357
Employees per establishment	23	29
Total operating revenue *(millions)*	997.8	1,268.3
Total operating expenses *(millions)*	1,136.3	1,550.0
Operating margin	-13.9	-22.2

Source: Annual Survey of Internet Service Providers and Related Services, Service Industries Division, Statistics Canada.

[12] *This number represents the surveyed portion of establishments.*

Industry structure

Three different industry suppliers dominate the Internet access market today, generating just over $2 billion in Internet access revenues in 2001 (Statistics Canada 2002). In one arena are cable access providers, the first to offer high-speed Internet services to the residential access market. The rate of adoption of cable Internet has progressed rapidly since 2000 (76.5 %) as a result of the growing demand for high-speed Internet access. This market is predominantly the domain of cable operators, with only a small percentage of ISPs reselling cable access. Cable Internet providers are increasingly capturing a greater share of Canada's Internet access market. In 2001, they generated just over $429 million in high-speed access revenues (Statistics Canada 2001c).

In another arena are large telecommunications carriers, commonly referred to as 'telcos'. These firms provide the network infrastructure to ISPs. In the beginning of the Internet age, these firms were slow to compete directly in the business and residential access markets. They largely played the role of "suppliers" in the Internet access chain. These days they are capturing an ever increasing share of the market and compete directly with the very firms they supply – firms classified to the ISP industry. Telecommunications carriers clearly have the financial and capital resources along with the technical know-how to be successful in this industry. These firms generated just over $325 million in access revenues in 2001 (Statistics Canada 2001d).

Finally, there are the traditional ISPs or the "independents", as they are more commonly known. These ISPs are covered by the *Annual Survey of Internet Service Providers and Related Services* and their characteristics are described in this article.

Firm size [13]- an important distinguishing trait of ISPs

Firm size is an important distinguishing characteristic of Canadian ISPs. For the purpose of this article, firm size is measured in terms of total operating revenues, as illustrated in the following table:

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[13] *Some firms may have more than one establishment. Comparisons of firm size are based on the responses of 242 ISP firms.*

Table 3.5.2 Operating revenues by firm size, 2001

ISP revenue group	Total operating revenues	Percentage of total surveyed firms
Small	Less than $1 million	65
Medium	$1 to $10 million	31
Large	More than $10 million	4

Source: Annual Survey of Internet Service Providers and Related Services, Service Industries Division, Statistics Canada.

Large firms generate the bulk of revenues

Although the ISP industry is predominantly made up of small and medium-size firms, it is the larger players who dominate the business. Together, small and medium-size firms represented about 96% of the survey population (Figure 3.5.1), but generated only 21.0% of industry operating revenues. Large firms, though small in numbers (4% of the surveyed population), contributed a whopping 79% of total operating revenues in 2001 (Figure 3.5.2).

Figure 3.5.1 Distribution of ISPs by firm size, 2001 (total number of establisments)

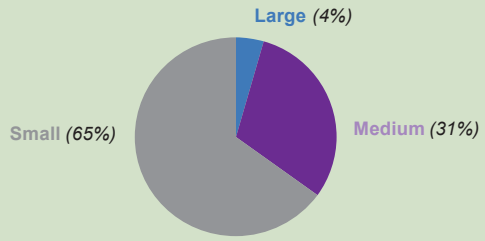
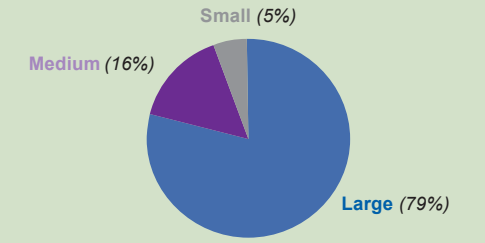


Figure 3.5.2 Distribution of ISPs by firm size, 2001 (total operating revenues)



Small and medium-size firms achieve higher margins

Although larger firms generate the bulk of industry revenues, small-and-medium-size firms tend to be more profitable. Roughly 60% of small and medium-size firms recorded a profit in 2001, compared with only 9% of large firms. This may be due in part to the fact that small and medium ISPs appear to have greater scope at differentiating their operations and diversifying their services, thus generating revenues from a greater variety of services than do their larger counterparts. Nearly 90% of small and medium-size firms generated revenues from services in addition to Internet access. In fact, these firms generated revenues from an average of between five to ten services other than Internet provision.

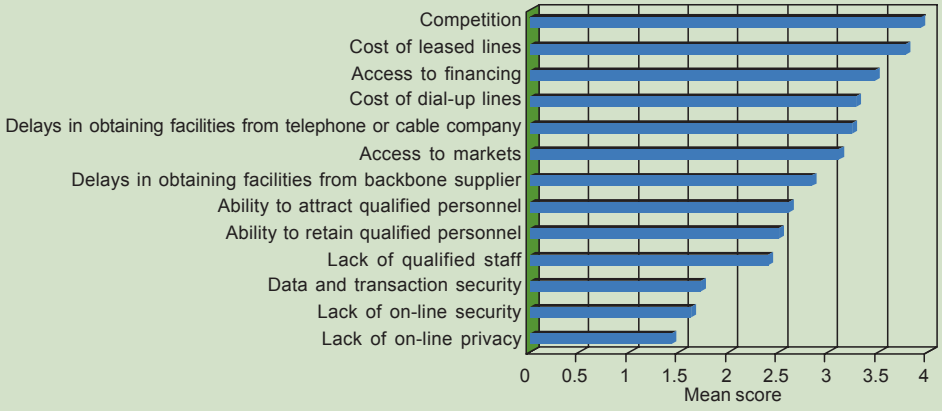
Access alone counted for 87% of ISP industry revenues in 2001. But only 10% of all ISPs generated all of their revenues from the provision of Internet access. Most firms (about 90%) generated revenues from other services in addition to Internet access.

Factors impeding growth

ISPs were asked to rate to what extent various factors impede the growth of their Internet services. There were 14 potential factors from which to choose, plus an "other" category in which respondents could specify in writing any other particular growth impediments facing their organization. Respondents rated each factor on a scale of one to five, with one representing a low impediment to growth and five representing a high impediment. The main factor impeding growth was competition, followed by cost-related factors (Figure 3.5.3). The following sections elaborate on each of the factors below.

For the purpose of this analysis, responses were based on the following scale of 1-5:
1 or 2 = ***Low impediment*** *3 =* ***Medium*** *4 or 5 =* ***High Impediment***

Figure 3.5.3 Factors impeding growth for ISPs, 2001



High barriers to growth

Competition

The most frequently cited high impediment to growth in this industry was competition, with 60% of all ISPs rating it as either 4 or 5. All the large firms (those with revenues of $10 million or more) reported this to be their greatest barrier to growth. Also significant was that two-thirds (65%) of medium-size firms and 56% of small firms also stated that competition was their greatest impediment.

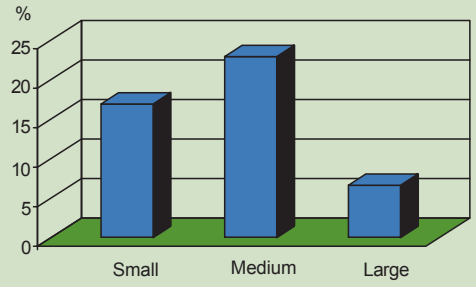
The structure of the ISP industry in Canada has changed dramatically in the last few years. The number of access providers has shrunk and large players such as telecommunications and cable companies have entered the market creating an environment of intense competition and a battle for subscribers. One of the strategies that has been used to lure subscribers from competitors is pricing access services *at* or *near* the cost of providing these services. This is one reason that the industry continues to post operating losses, and helps explain why ISPs rate competition as their chief impediment to growth.

Cost-related impediments

As can be expected, cost-related impediments were the second most highly-rated barrier. After competition, the two principal areas of concern for ISPs revolved around costs at both ends of the ISP business – their links to consumers and their links to the Internet.

ISPs have steadily sustained worsening operating margins over the past few years, due in large part to high expenditures associated with providing Internet access services. Industry operating expenses grew to $1.6 billion in 2001, a 36% increase from 2000, and significantly more than the 27% increase in operating revenues. A large proportion of ISP expenditures stem from the cost of leased lines. In 2001, telecommunications expenses, including dial-up line charges, equipment charges, and leased line charges from upstream providers represented about 31% of industry expenses.

Figure 3.5.4 Leased line charges from upstream providers as a percentage of total expenses, by firm size, 2001



About 53% of all respondents reported that the cost of leased lines from upstream providers was a significant barrier (Figure 3.5.4). Small ISPs in particular perceived this to be their highest impediment to growth, rating it slightly higher than competition.

The cost of dial-up lines was equally concerning, as 42% of all ISPs reported it as an overall high barrier to growth. Small and medium firms were most likely to perceive it as a high barrier. The data seem to suggest that larger firms appear better able to absorb these costs.

Contrary to many other industries, there is very little regulation within the ISP industry. This is an environment that fosters universal access, growth and competition. In May 1999, the Canadian Radio-Television and Telecommunications Commission (CRTC) decided that it would not regulate any portion of the Internet (Crombie and Sistovaris 1999).

Delays in obtaining facilities from suppliers

The term "facilities" refers to the dial-up access servers or switches that are owned by either facilities-based ISPs or telcos. Many of the ISPs surveyed are not facilities-based, that is, they do not own any dial-up access servers or switches. Instead, they are completely reliant on someone else to deliver the access service that they, in turn, resell to their business or residential consumers.

Delays in obtaining facilities from suppliers appeared to be a relatively high area of concern for many of the small and medium ISPs in 2001. More than half of all medium-size firms reported delays in obtaining facilities from telephone or cable companies as a high impediment.

Access to financing

The fourth most frequently selected factor impeding growth was access to financing. Interestingly, size class had no bearing on how this factor was rated. About 42% of each size group rated this as an overall significant obstacle to growth. The majority of the remainder rated it as a medium-range impediment.

Traditionally, institutional capital in the ISP sector has gone to national networks and consolidators (Stevenson 1999). Generally speaking, it appears that most venture capitalists focus their Internet access-related investments in mid- to large-size companies, and the majority of such investments are acquisition related. This leaves the majority of ISP firms struggling to grow and prosper without the help of financing. Coupled with the fact that the Canadian economy exhibited a strong trend towards cost cutting and a cautious approach to capi-

tal investment in 2001, it was not surprising to see access to financing rated as a relatively high barrier.

Access to markets

Access to markets was selected by 41% of the respondents as a high area of concern. It was interesting to note that large firms (67%) were most likely to rate this as a high barrier, while 43% of small firms rated access to markets as a high barrier to growth. It appears that smaller firms tend to rely more heavily on the residential dial-up market than their larger counterparts, and experience difficulties entering the broadband market. In fact, the inability to provide high-speed access was frequently cited as an obstacle to growth in the comments section of the questionnaire. As a relatively new technology, high-speed access is considerably more expensive to roll-out as it requires significant infrastructure investment.

Expanding the Internet market certainly appears to be more difficult than it was in the past. The larger ISPs often own their own networks or facilities and tend to be the leaders in new technologies. Small and-medium-size firms, the majority of which are resellers, must often play catch-up with the rest of the market (high-speed is a perfect example). Despite their struggles, small and medium-size firms appear more likely to provide a more personal and customized service to their clients, something which allows them to create niche markets.

Low barriers to growth

Ability to attract and retain qualified personnel

In the past, the ability to draw highly skilled personnel at a reasonable cost was a major issue in the information and communications technology (ICT) sector of the economy. This does not appear to have been the case in 2001, with most ISPs concerned but not overly worried about this factor impeding the growth of their business.

Today's ISP industry employs 7,357 people, up 13% from 2000. Firms spend an average of $1.9 million on employee salaries, wages and benefits, totaling $454 million for the industry overall (representing 29% of total operating expenses) in 2001. The average salary for the industry climbed 27% to $61,700.

Large firms differed from their medium and small counterparts in their ability to attract and retain staff. More than half of all ISPs (54%) rated lack of qualified staff as an overall low impediment to growth. Larger firms are able to pay their employees higher salaries than their smaller counterparts. Even so, 44% of these large firms considered this issue a medium barrier to growth, showing more concern than small and medium-size firms.

Ability to attract qualified staff was ranked further down the list of barriers for small and medium-size firms. However, 44% of the large firms considered this to be a medium-range barrier. Of the large firms, 56% also considered the ability to retain qualified personnel a medium-range barrier to growth, while 63% of the medium-size firms and 40% of the small considered it to be an overall low impediment.

Table 3.5.3 Impediments to growth by firm size, 2001

	Considered High Impediments *(ranked as 4 or 5)*			
	All firms	**Small**	**Medium**	**Large**
		less than $1 million	*$1 million-$10 million*	*more than $10 million*
		%		
Competition	60	56	65	100
Cost of leased lines from upstream providers	53	57	47	44
Cost of dial-up lines	42	46	33	33
Access to financing	42	42	42	44
Delays in obtaining facilities from telephone or cable companies	43	36	55	43
Access to markets	41	43	32	67
Delays in obtaining facilities from backbone suppliers	24	23	25	22
Ability to attract qualified personnel	24	22	31	11
Ability to retain qualified personnel	17	19	12	11
Lack of qualified staff	19	21	19	0
Data and transaction security	7	8	5	0
Lack of on-line security	4	6	1	0
Lack of on-line privacy	2	2	1	0

Source: Annual Survey of Internet Service Providers and Related Services, Service Industries Division, Statistics Canada.

Data and transaction security

This factor was given an average score of 1.7 for the overall industry, which is quite low. Only 7% of ISPs considered this factor a high impediment to growth, while roughly 70% of all ISPs considered this an overall-low barrier to growth. It appears that in today's market, ISPs feel they take the necessary precautions and implement the appropriate tools and technology to ensure the safe exchange of data and transactions over their networks.

Security and privacy issues

Only 4% of the survey population considered on-line security as a high barrier to growth. The few firms that did cite it as a concern tended to be very small ISPs. Lack of online privacy was even less of an issue with a mere 2% of those surveyed rating it as a high barrier. This is not to suggest that ISPs do not regard the protection of personal information and online privacy as highly important. Instead, it may indicate that ISPs have access to adequate technologies for protecting the security of their clientele. Table 3.5.3 summarizes these findings.

Summary

Though facing a myriad challenges, Internet service providers continue to meet the changing and sophisticated needs of Canada's Internet users. Expanding the Internet market is more difficult than it was in the past, due to intense competition, cost-related impediments and access to markets. Expectations for future growth are mixed, with slightly more than half of the firms surveyed predicting revenue growth for 2002. In an attempt to increase market share and subscriber base, ISPs have learned to diversify themselves by offering an array of services. Some of the most common services offered include website hosting, web page design, and domain name registrations services.

In 2001, smaller firms tended to rely more heavily on the residential dial-up market than their larger counterparts and generated the lion's share of their revenues from dial-up access. Only 40% of smaller firms provide high-speed access. While the market for high-speed Internet access is still at an early stage of development, it grows fast and independent ISPs will have to move quickly if they hope to capture a piece of this market from their larger rivals in the telecommunications and cable industries.

Differentiation and financial performance will become increasingly important. The key to survival for small and medium-size ISPs in this highly competitive environment will be their ability to continue innovating in technology and services, and to move quickly in identifying and exploiting new market opportunities before their larger rivals (Dargan 1999).

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Part 2

A SECTORAL VIEW OF ICT ACCESS AND USE

Introduction

The amount of investment in ICT and the resulting diffusion and uptake of ICTs by individuals, businesses and governments is the best starting point in understanding impacts and outcomes. The extent of the penetration and use of ICTs, in conjunction with their rates of growth over time, will be critical in determining future developments.

In Part 2 of this compendium, we step outside the confines of the ICT sector and look at individual ICTs as *commodities* – goods and services – to examine their sectoral penetration and use. This approach complements the previous analysis of the ICT sector by expanding the horizon in order to comprehend the profound changes brought about by ICTs as they permeate all facets of our economy and society. With available data, Part 2 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 – individuals, households, business and governments.

Chapter 4 profiles ICT use by **individuals**, including socio-demographic characteristics of computer and Internet users, as well as type and purpose of use. Data are drawn from Statistics Canada's General Social Survey (GSS) on access to and use of ICTs, conducted for reference year 2000. Chapter 5 examines 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. Data from the Household Internet Use Survey (HIUS) and the Survey of Household Spending (SHS) are used to gain insight into household use of ICTs, with their effects on time use, personal, family and community relationships, and the like.

Chapter 6 presents the most recent information from the Survey of Electronic Commerce and Technology (SECT) on connectivity in **business**. 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 makes possible 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 trans-

formations. Moreover, they can be used for all-important international comparisons, to the extent that comparable data are 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 content of Chapter 7 – ICTs in **government**. 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 prosperity 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**, **health**, and **justice**, 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.

Part 2 is frequently referred to as the *demand* for ICT. 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. Indeed, more than demand is reflected in the following pages.

> *"Connectedness provides Canadians with options previously only dreamed of…communications with peers on the other side of the globe; access to volumes of information almost instantaneously. Connectedness enhances innovation through networking. It can be the source of increased productivity in business and organizational processes. Connectedness can improve the performance of our social, educational, and health systems. This power of connectedness is just starting to be tapped" (The Conference Board of Canada 2002).*

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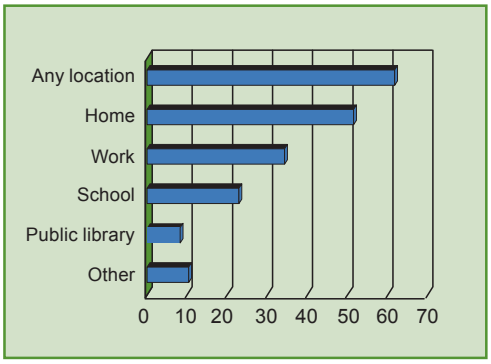
Highlights

- Nearly 53% of Canadian **individuals** aged 15 and over had used the Internet in 2000 and a large proportion (42%) had an Internet connection at home.
- Canadian **households** are embracing the Internet in growing numbers. In 2002, 62% contained at least one *regular* Internet user, up from 29% in 1997. Home-use (51%) surpassed use from work (34%), followed by use from school (23%), other locations (10%), and public libraries (8%).
- In 2001, 19% of all households (over 2.2 million) engaged in Internet shopping from various locations, placing 13.4 million orders worth nearly $2 billion. On average, each household placed almost 6 orders and committed $880 to Internet purchases.
- Households that use the Internet are more likely to be higher income families with children, headed by someone less than 35 years of age, and having higher levels of education than non-users. As penetration continues to increase, though, the profile of Internet users starts to resemble that of the population as a whole.
- In 2002, 86% of **enterprises** used computers, while 76% used the Internet, 32% had a website and 8% actually used the Internet to sell goods or services. Over 52% of employees in the private sector had access to the Internet.
- The value of orders received over the Internet, albeit small, increases over time. In 2002, it was estimated at $13.3 billion, representing 0.6% of total economic activity. Manufacturers received orders worth about $2 billion, while retailers received $1.7 billion, accounting for 0.3% and 0.5% of their total operating revenues, respectively.
- In 2002, nearly all federal and provincial **government** institutions were using personal computers and the Internet, while 95% had a website. As well, 90% of their employees had access to computers, 88% to e-mail and 85% to the Internet.
- In 2001, 53% of regular home-use households used the Internet to search for government information.
- Computerization was widespread and Internet connectivity nearly complete among **schools.**
- In 2002, two-thirds of public sector **health** care and social assistance employees had direct access to personal computers, while only 51% had direct access to the Internet.

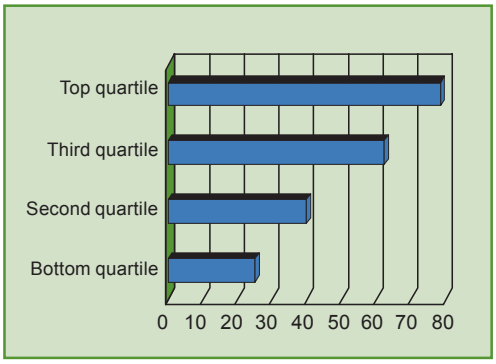
Household Internet use, by location, 2002

%



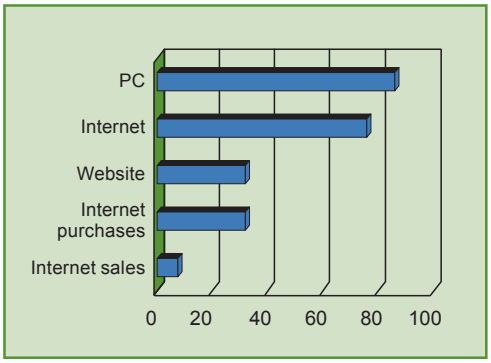
Internet use from home, by household income, 2002

%



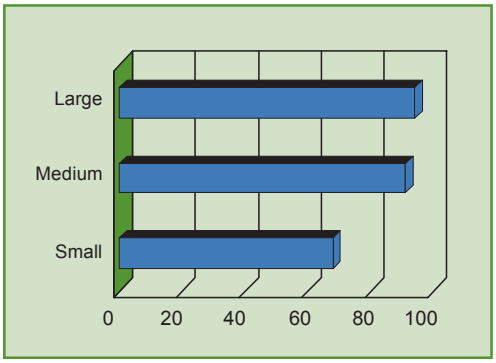
Business use of ICTs, 2002

%



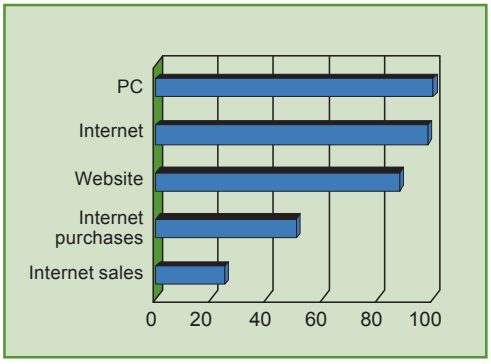
Business Internet use, by size, 2002

%



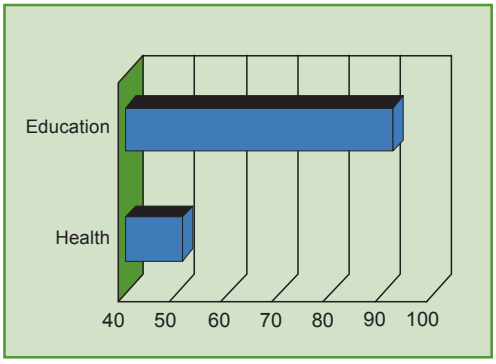
Federal and provincial government institutions using ICTs, 2002

%



Public sector health and education employees with direct access to the Internet, 2002

%



Chapter 4 CONNECTING CANADIANS

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Chapter 4
CONNECTING CANADIANS

As individuals, Canadians have access to many information and communications technologies (ICTs), and display a keen interest in using them. By directly measuring their use of these technologies, we begin to better understand the significance of ICTs in Canadians' day-to-day lives. We can also identify factors influencing individuals' access to a particular technology, and understand whether there are certain groups of individuals who, when speaking of potential benefits of particular ICTs, may risk being left behind.

This article begins by examining patterns of individual use for several ICTs, using data from *Cycle 14* of Statistics Canada's *General Social Survey: Access to and Use of Information Communication Technology*. The remaining sections of the article focus on individuals' use of the Internet in particular, an ICT that has had perhaps the most significant impact on Canadians' lives in recent years.

Statistics Canada's General Social Survey (GSS), Cycle 14: Access to and Use of Information Communication Technology is the primary data source used in this article. The survey was a representative telephone sample of 25,090 respondents aged 15 and over, covering all provinces and conducted between January and December 2000. Respondents were identified as "Internet users" if they had used the Internet at least once in the 12 months preceding the survey. The GSS marks the first time that Statistics Canada collected detailed information on technology use at the individual level.

4.1 Use of ICTs by individuals

The use of personal computers (PCs), which grew immensely through the 1990s, has profoundly changed the ways in which people communicate. While not everyone has access to a computer at home, the ability to use one at other locations such as work or school, means that almost two-thirds (65.3%) of Canadians had access to this technology at some location (Table 4.1.1).

Computers are an enabling technology, in that the use of other ICTs (such as the Internet) typically becomes possible once the use of a computer is acquired. Over half (52.8%) of Canadian individuals had used the Internet in 2000 and many (42.2%) had an Internet connection at home. Based on indications from other sources, such as HIUS, these numbers are certainly much higher today. The use of computers in conjunction with the Internet means that many Canadians can participate in activities that once required considerably greater investment in time and in some cases, money. For example, the ability to communicate instantly with family, gather health information, shop for consumer goods and services and look for work can now be achieved over a desktop computer. These and other purposes of computer and Internet use will be discussed in more detail in section 4.4 of this paper.

Table 4.1.1 Percentage of the population aged 15 and over using selected ICTs, Canada and provinces, 2000

	Total Population	Internet	Internet connection at home*	E-mail	Computer	Fax machine	Cell phone	Automated Teller Machine
	thousands			*%*				
Canada	**24,566**	**52.8**	**42.2**	**46.7**	**65.3**	**50.3**	**51.8**	**78.2**
Newfoundland and Labrador	441	43.5	30.7	36.7	55.3	42.3	46.9	76.5
Prince Edward Island	110	48.2	34.4	42.0	60.2	45.6	48.8	77.9
Nova Scotia	762	52.0	40.7	46.4	63.4	43.6	51.9	79.0
New Brunswick	612	44.5	32.7	37.5	59.0	40.5	51.5	74.7
Quebec	5,975	45.6	33.8	38.2	60.6	49.4	41.1	80.9
Ontario	9,333	54.7	46.7	49.3	66.3	48.4	53.3	75.8
Manitoba	895	46.0	32.4	39.3	60.9	43.7	48.9	75.0
Saskatchewan	790	50.1	34.3	41.9	63.1	45.2	57.0	73.8
Alberta	2,353	60.3	47.7	54.2	71.5	57.5	64.4	81.0
British Columbia	3,296	61.2	49.6	55.7	71.4	59.8	58.1	81.0

Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.

* *Individual has Internet connection at home but may not use it. Totals exclude 'Not stated'.*

Just over one-half of Canadians aged 15 and over also used cellular phones (51.8%) in 2000, another technology that helps individuals become more connected by allowing people to be reached any time, and virtually any place. About one-half (50.3%) also used a fax machine.

British Columbia and Alberta boast the greatest proportion of individuals connected to ICTs. In fact, these two provinces had the highest proportion of technology users for every ICT listed in Table 4.1.1. Most notable was the high rate of computer use (about 71% for both provinces). Ontario ranked third in computer use at 66.3% of individuals. Other provinces had computer use rates closer to 60.0%, with the exception of Newfoundland and Labrador where 55.3% of individuals had used a computer. British Columbia and Alberta also ranked considerably higher than the other provinces in Internet use (over 60.0% for both provinces).

4.2 Urban and rural patterns of ICT use

In most urban centres in Canada, people have access to a wide range of ICTs, whether at home, work, school or other locations. Calgary and Vancouver stand out as some of the leading Census Metropolitan Areas (CMAs) in ICT use by individuals. In 2000, Calgary lead the way in Internet and e-mail use, while Vancouver had the highest rates of fax machine and cellular phone use (Table 4.2.1). This comes as little surprise since the provinces where these cities are located are also provincial leaders in ICT use. Internet use was also popular in Halifax, Ottawa-Gatineau, Saskatoon and Victoria, CMAs which also registered high levels of computer use.

Table 4.2.1 Percentage of the population aged 15 and over using selected ICTs, Canada and CMAs, 2000

	Total Population	Internet	Internet connection at home*	E-mail	Computer	Fax machine	Cell phone	Automated Teller Machine
	thousands			*%*				
Canada	**24,566**	**52.8**	**42.2**	**46.7**	**65.3**	**50.3**	**51.8**	**78.2**
St. John's	141	59.7	43.6	52.2	69.0	51.9	59.2	85.2
Halifax	288	65.4	51.2	59.9	74.3	56.8	62.6	87.9
Saint John	102	54.7	40.0	45.5	64.5	43.3	53.1	81.6
Québec	540	46.8	37.3	40.3	60.3	48.5	38.2	82.6
Montréal	2,767	51.0	39.3	44.0	65.7	55.5	45.8	82.5
Ottawa-Gatineau	866	62.7	52.7	58.6	74.7	57.2	56.9	81.7
Toronto	3,832	55.8	48.7	50.7	67.0	53.2	56.2	75.4
Hamilton	556	55.5	50.6	47.2	69.5	47.4	56.4	77.4
Winnipeg	534	49.4	35.3	43.2	62.3	42.9	47.3	78.9
Regina	143	58.9	40.3	51.6	72.5	50.6	56.8	82.6
Saskatoon	187	64.0	49.8	59.0	77.2	52.0	56.9	84.3
Calgary	752	67.4	55.0	63.6	76.8	61.7	63.8	85.1
Edmonton	753	59.9	48.8	53.2	71.5	54.8	62.2	80.8
Vancouver	1,662	63.2	53.7	58.6	73.4	63.3	64.5	81.0
Victoria	289	63.5	48.0	58.2	70.7	57.5	52.2	79.4

Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division,Statistics Canada.

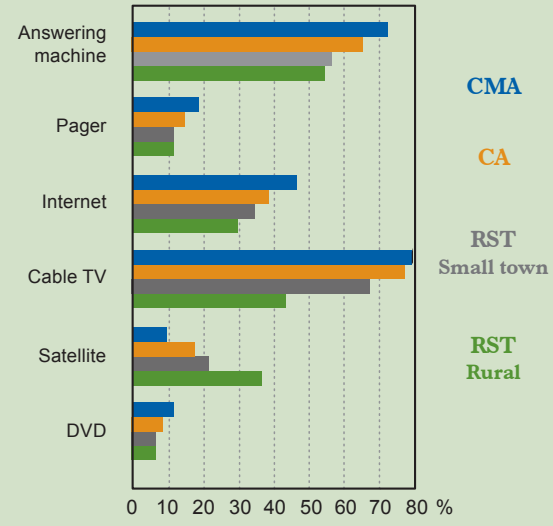
* *Individual has Internet connection at home but may not use it. Totals exclude 'Not stated'.*

Quebec displayed lower levels of use for many ICTs. For example, Quebec had the lowest use rates of computers, Internet, e-mail and cellular phones among all CMAs. Lack of French content on the Internet, when compared to the widespread availability of English web sites, may be one of the factors which discourage francophones from using the Internet and associated services. For example, while almost all anglophone young adult users (aged 15 to 24) are satisfied that there is enough English content on the Internet, only 59.0% of young francophone users feel that there is sufficient material in French (Rotermann 2001).

With only a few exceptions, differences in ICT use by CMA are slight. When comparing CMAs and other urban areas with rural parts of Canada, more substantial differences in ICT use are evident.

Figure 4.2.1 compares use rates of selected ICTs across four defined types of urban-rural zones. For each ICT listed, with the exception of satellites, use rates drop appreciably moving from urban centres to rural areas. Residents of small rural areas may perceive certain ICTs, such as answering machines, pagers or DVD players, as being too expensive or simply not needed. However, with respect to other ICTs, rural residents may not have any choice. Cable television, for instance, is widely available to Canadians living in urban areas but due to the high costs of deploying cable infrastructure, it is unavailable in some smaller rural communities and outlying areas. The drop in cable television use is particularly evident among individuals living in rural areas (outside towns with a population of 1,000 or more – for more detailed definitions of urban-rural zones , see section 5.7), where fewer than half of individuals use cable television. This helps explain the popularity of satellite technology in these areas. In the absence of a cable option, many rural residents require satellite systems to deliver television programming.

Figure 4.2.1 Percentage of individuals aged 15 and over using selected ICTs, urban and rural zones, 2000



Note: Rural and small town (RST) is further classified as either rural or small town.

It should be noted that the data shown are for 2000 and in more recent years, satellite companies have aggressively marketed their services in an effort to compete with cable in large urban centres.

Satellite may also be a source of high-speed Internet access in rural areas. High-speed access by other methods found in urban centres, such as cable modems and Digital Subscriber Lines (DSL), is often unavailable in rural areas (Industry Canada 2003).

4.3 Characteristics of Internet users

Identifying the social and demographic characteristics of individuals using the Internet can help shed light on some of the factors affecting whether an individual is online. Table 4.3.1 suggests that individuals who are young, highly-educated, with high household incomes, and who speak English and live in urban areas are more likely to have Internet access at home. The table also identifies that a slightly higher proportion of males than females are online.

In some cases an individual may choose not to have an Internet connection, but sometimes the degree of choice is limited depending on other factors, such as income and availability of Internet access. The sharp declines in Internet use among individuals in the lowest income groups and, to a lesser extent, in rural areas speak to these factors.

The age of individuals is also strongly related to their use of the Internet. Use is by far the highest among the youngest age group (15 to 24), and declines markedly among individuals aged 55 and over. It comes as little surprise that among young individuals, those in British Columbia, Nova Scotia, Ontario and Alberta were most likely to be connected to the Internet (Table 4.3.2); these are the four leading provinces in Internet use overall.

The relationship between level of education and Internet use among individuals is also especially strong (Table 4.3.3). Education is also related to employment and income, meaning that many individuals who are highly-educated can often afford Internet access. Those with some university or college education were more likely to use the Internet than individuals who had completed college, but less likely than those who held a university degree. Interestingly, although those with less than high school education were significantly less likely to use the Internet, almost half of these individuals (44.0%) in British Columbia were online in 2000.

Other studies have identified that the presence of children is another factor encouraging Internet use. Teenagers and young adults, particularly those aged 15 to 24, are very active Internet surfers. Thus parents of teenage children are also quite likely to have access to an Internet connection themselves - although they may not use it as often as their children (Clark 2001).

Table 4.3.1 Percentage of Internet users aged 15 and over, by selected socio-demographic characteristics, 2000

	Total population 15 and over			Internet users		
	Total	Male	Female	Total	Male	Female
	thousands			*%*		
Canada	**24,566**	**12,093**	**12,473**	**52.8**	**56.1**	**49.6**
Age group						
15 to 24	4,134	2,113	2,021	84.5	85.6	83.4
25 to 34	4,376	2,206	2,171	66.1	68.2	63.9
35 to 44	5,292	2,654	2,638	60.3	62.2	58.4
45 to 54	4,348	2,164	2,184	50.7	52.5	48.8
55 and over	6,416	2,956	3,460	18.7	23.4	14.8
Education						
University degree	4,466	2,349	2,117	79.3	83.1	75.1
College diploma/certificate	5,607	2,732	2,876	57.5	59.8	55.4
Some university or college	3,503	1,674	1,829	69.4	71.2	67.7
High school diploma	4,399	2,068	2,330	41.2	44.7	38.1
Less than high school	6,120	3,056	3,064	30.9	34.3	27.4
Household Income						
Less than $30,000	3,834	1,618	2,216	32.8	33.4	32.4
$30,000 to $49,999	4,002	2,014	1,988	49.9	50.0	49.8
$50,000 to $79,999	4,469	2,489	1,980	65.5	65.1	66.1
$80,000 or more	3,675	2,211	1,465	80.5	80.6	80.4
Language						
English only	16,007	7,810	8,196	58.5	61.8	55.3
French only	5,380	2,668	2,712	43.9	47.4	40.4
Other language	2,982	1,532	1,450	40.0	43.6	36.1
Urban/rural						
Urban	19,380	9,513	9,867	55.0	59.3	50.7
Rural	5,186	2,581	2,606	44.9	44.4	45.5

Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.

Note: Totals exclude 'Not stated'.

Table 4.3.2 Percentage of Internet users aged 15 and over, by sex and age group, Canada and provinces, 2000

		Sex		Age group				
	Total population 15 and over	Male	Female	15-24	25-34	35-44	45-54	55+
	thousands	*%*				*%*		
Canada	**24,566**	**56.1**	**49.6**	**84.5**	**66.1**	**60.3**	**50.7**	**18.7**
Newfoundland and Labrador	441	44.9	42.1	80.2	56.6	47.8	38.5	8.0[E]
Prince Edward Island	110	46.9	49.5	78.0	59.2	59.0	50.7	11.9[E]
Nova Scotia	762	55.2	49.0	89.2	68.8	65.4	44.9	13.3
New Brunswick	612	45.9	43.1	81.8	49.8	51.5	44.3	12.2[E]
Quebec	5,975	49.5	41.8	77.3	59.6	51.2	43.7	14.3
Ontario	9,333	57.7	51.7	87.3	67.0	63.7	51.4	20.2
Manitoba	895	47.8	44.2	79.5	62.7	50.1	40.4	13.8
Saskatchewan	790	51.9	48.3	76.8	64.7	61.0	50.8	14.9
Alberta	2,353	63.2	57.3	86.6	73.4	65.2	59.0	21.7
British Columbia	3,296	65.7	56.8	91.6	73.7	68.2	62.5	27.5

Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.
Note: Totals exclude 'Not stated'.

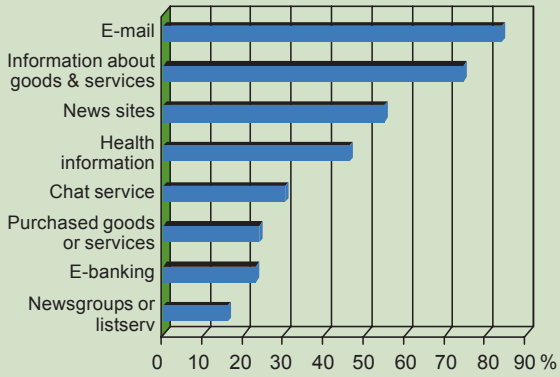
Table 4.3.3 Percentage of Internet users aged 15 and over, by education level, Canada and provinces, 2000

	Total population 15 and over	University degree	College/ Diploma certificate	Some university or college	High school diploma	Less than high school
	thousands			*%*		
Canada	**24,095**	**79.3**	**57.5**	**69.4**	**41.2**	**30.9**
Newfoundland and Labrador	439	78.4	52.7	69.5	32.8	21.1
Prince Edward Island	110	75.0	53.4	62.6	37.1	29.4
Nova Scotia	758	79.7	55.5	70.2	43.1	29.4
New Brunswick	608	77.3	46.3	68.8	34.6	26.7
Quebec	5,953	74.8	51.6	64.2	33.8	21.5
Ontario	9,069	79.8	59.5	70.7	41.3	34.7
Manitoba	875	73.1	52.0	64.1	39.7	26.5
Saskatchewan	777	78.4	62.2	62.2	45.5	29.2
Alberta	2,302	87.4	65.2	72.6	50.6	37.8
British Columbia	3,202	81.9	61.6	74.4	47.3	44.0

Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.
Note: Totals exclude 'Not stated'.

4.4 Why go online?

Figure 4.4.1 Online activities among Internet users, Canada, 2000



Purposes of using the Internet are almost as wide and varied as the people who use it. However, e-mail (83.6%) continues to stand out as the most popular reason for going online (Figure 4.4.1). The prevalence of e-mail has a lot to do with its design and convenience, but it also has to do with its versatility: people can use e-mail to communicate quickly with family and friends, but they can also use it to carry out research, exchange information, contact new people, or make inquiries to merchants or government officials.

Gathering information about goods and services was also a very popular Internet activity (74.3%). While many people go online to get this type of information, however, few people actually engage in online purchases (23.7%). This is not surprising given that individuals often like to research or compare products online, but are sometimes more likely to buy products in person. The lower proportion of people purchasing online may also be partly attributed to customer concerns about the security and privacy of their online transactions (for more on Internet commerce, see Chapter 6).

Going to news sites and searching for health information were also relatively popular activities, engaged in by about one half of Internet users aged 15 and over. Other services, such as online chat services, e-banking, and newsgroups or listserv (where users subscribe to an electronic mailing list on a particular subject) were less popular.

Data from the GSS show that e-mail, chat services and playing games are the most popular activities among teenagers aged 15-17. E-mail use is also popular among individuals in their late teens and early twenties, but in this age group chat services become less popular and the number of individuals using the Internet to search for information about goods and services, engage in purchases, online banking, reading the news and corresponding with government departments increases (Rotermann 2001). Older surfers aged 60 and over also tended to use the web to search for information on goods and services (travel, and arts, entertainment or sports information were most popular). Reading the news and searching for health information were also common, but activities that were more popular among the young, such as subscribing to newsgroups and using chat services were seldom of interest among the older population (Silver 2001).

Purposes of Internet use are strikingly similar by province (Table 4.4.1). Generally, Internet users in British Columbia, Alberta, Ontario and Nova Scotia, the leading provinces in Internet use, also tended to use the Internet for purposes such as e-mail, e-banking, gathering information about goods and services and making purchases more often than users in other provinces. One regional trend evident from that data is that users in the Atlantic provinces of Newfoundland and Labrador, Prince Edward Island, and Nova Scotia tended to search for health information more often than users in the rest of Canada.

Table 4.4.1 Percentage of Internet users aged 15 and over, by selected Internet activities, Canada and provinces, 2000*

	Total users 15 and over	E-mail	E-banking	Purchased goods/ services	Info. about goods/ services	Health info	Chat service	New-groups/ listserv	News sites
	thousands				*%*				
Canada	**12,981**	**83.6**	**22.7**	**23.7**	**74.3**	**45.9**	**30.0**	**15.7**	**54.7**
Newfoundland and Labrador	192	81.3	17.4	19.6	73.5	56.8	35.7	16.4	52.9
Prince Edward Island	53	82.3	16.9	18.2	71.5	55.5	28.1	16.9	46.5
Nova Scotia	396	85.9	23.6	23.4	74.8	54.0	33.8	19.2	55.0
New Brunswick	272	78.8	16.6	19.3	72.2	49.2	33.3	14.6	53.5
Quebec	2,723	78.2	21.9	19.3	73.9	40.4	34.0	11.6	55.7
Ontario	5,103	84.5	23.6	25.6	73.1	46.7	29.2	16.8	56.9
Manitoba	412	78.7	16.6	19.8	71.2	46.6	30.2	12.8	51.5
Saskatchewan	396	81.1	16.3	20.3	73.4	45.2	26.2	13.5	44.8
Alberta	1,418	86.9	23.4	25.9	78.2	43.6	30.5	16.1	53.0
British Columbia	2,016	87.8	25.1	26.2	76.2	49.2	25.1	18.5	51.9

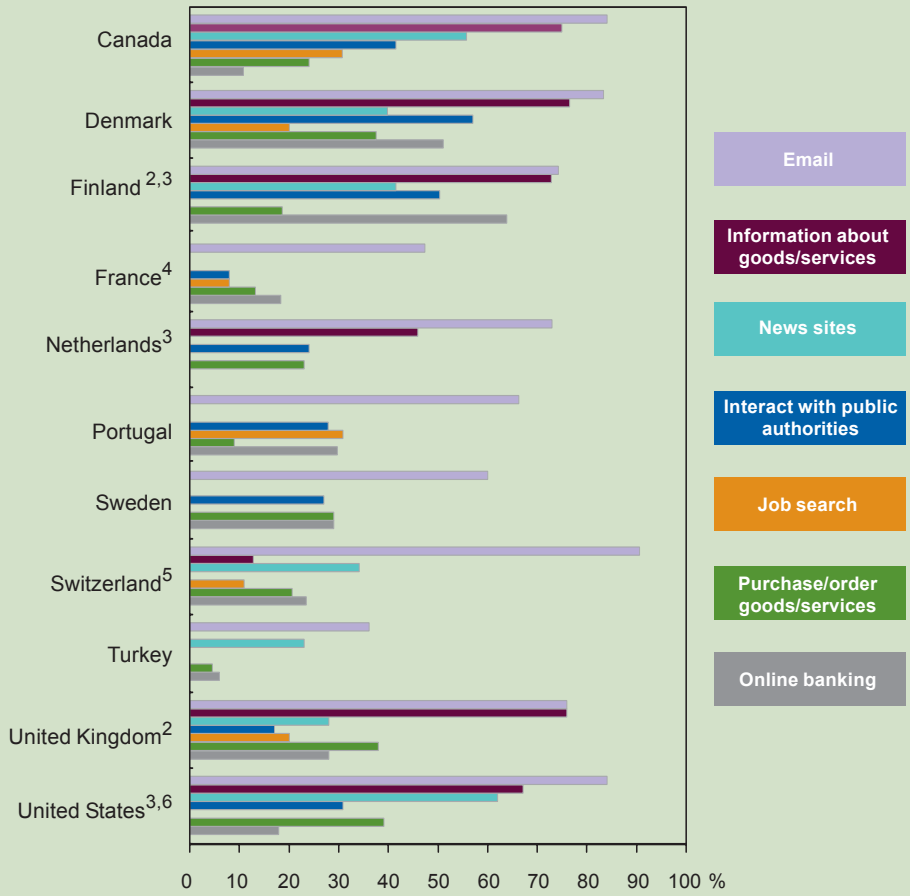
Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.

* *Percentage that has ever used the Internet for these activities. For e-mail, data refer to use in the past 12 months.*

Note: Totals exclude 'Not stated'.

Available international figures suggest that Canadians are leaders in the use of the Internet to search for news (second only to the United States), as well as to browse for employment opportunities online (Figure 4.4.2). Canadians are also active users of the web to search for government information and interact with public officials. Canada's Government Online (GOL) initiatives are designed to encourage such use by establishing websites for the delivery of many public services.

Figure 4.4.2 International comparisons, Internet use by type of activity (2001 or latest available year[1])



Source: OECD, ICT database, August 2002.

[1] *2000 for Canada, Sweden and Turkey. Beginning of 2002 for Denmark, Finland and the United Kingdom.*
[2] *Purchasing/ordering goods/services excludes shares/financial services.*
[3] *Obtaining information from public authorities' websites only instead of interacting with public authorities.*
[4] *Downloading official forms only instead of interacting with public authorities.*
[5] *Only sending emails instead of sending and receiving emails.*
[6] *News sites also includes downloading movies.*

Canadians tend to use the Internet to order goods and services and to engage in online banking less frequently than some other countries. Individuals' concern about Internet privacy and security may be partly responsible, but steps are being taken to promote consumer confidence in online shopping and transactions. This includes the use of security technologies (such as encryption and authentication software), privacy policies and legislation to protect customer confidentiality (Ellison and Clark 2001).

4.5 Canadian ICT use: A time of change

Computer communications, the Internet and associated technologies have been steadily evolving in recent years, and so too has the market for such products. Canadians own and use many ICTs, and when new products or applications become available, they are often greeted with interest. However, some Canadians still do not have the desire, and in some cases, opportunity, to participate in these new developments, because products may be unaffordable or simply unavailable to some individuals.

For instance, the vast majority of Canadians (97%) have access to dial-up Internet service over regular telephone lines at local rates. Recent developments in the Internet access market have included the widespread installation and marketing of high-speed Internet by broadband, the technology of choice for many applications. However, 14% of Canadians currently live in remote and rural areas where these high-speed services continue to be unavailable (Industry Canada 2003). In addition, those living in areas where such services are available may not be able to afford them. Recognizing potential applications of this technology in the economy as well as in health, education, social and other arenas, the Canadian government established the goal of ensuring that all Canadian communities have access to broadband Internet by 2005 (Government of Canada 2002).

The consequences of the gap between technology 'haves' and 'have-nots' have recently been the subject of considerable attention in Canada and abroad. Measuring changes in the size and nature of this gap, including the relative "digital divide" between different population sub-groups within countries, as well as large-scale cross-country measures, have all been areas of particular focus (Sciadas 2002a, 2002b and OECD 2001).

There are also some socio-demographic factors that influence the likelihood that an individual will use, or be able to use, certain technologies. The 2000 GSS identified that it is often Canadians who have low personal income or who are in older age groups that often do not use certain ICTs, such as the Internet. It is not merely a question of access; in some cases, individuals may have the opportunity to purchase ICTs, such as a computer and Internet connection, but may not be familiar with the technology or may not have the resources (such as help from family or co-workers) to fully

take advantage of their use. ICTs are also unique in their characteristics and applications, that is, their diffusion must be studied in light of specific characteristics of individual ICTs (such as price, functionality and so on) (Sciadas 2002b). Building a more complete understanding of the reasons why some individuals do not use specific ICTs would help identify factors that need to be addressed if particular ICTs are to be enjoyed by Canadians on a wider scale.

4.6 ICTs and the Aboriginal Peoples Survey

An additional data source for technology use is the post-censal 2001 Aboriginal Peoples Survey (APS). The primary objective of the survey is to provide a profile of the social and economic conditions of Aboriginal peoples in Canada, in order to identify needs, facilitate research, and provide information for policy making. The APS was designed and implemented by Statistics Canada, in partnership with several Aboriginal organizations. Data were collected on a range of issues, including employment, health, schooling, language and income. For the first time, additional information on access and use of information and communications technology (ICT) is also available. Specifically, the questionnaire asked respondents about the use of selected ICTs, including satellite, cable, cellular phones, computers and the Internet. The location of computer and Internet use by Aboriginal peoples was also of interest, whether from home, work, school, library, home of friend/relative, or community centre.

The Aboriginal Peoples Survey (APS) collection was conducted from October 2001 to June 2002. The target population includes Aboriginal individuals residing in First Nations/ reserves, Metis settlements, Inuit communities, urban centres and rural areas across Canada. The sample includes over 120,000 adults and children.

Dissemination of APS data will take place through basic tables and data files, custom tabulations, research articles and analytical products. At the time this publication was prepared, information on ICT access and use from the APS had not yet been released. For more information, please refer to **http://www.statcan.ca** (Statistics Canada 2003).

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Chapter 5 HOUSEHOLDS IN THE INFORMATION AGE

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Chapter 5
HOUSEHOLDS IN THE INFORMATION AGE

Many Canadian households have a wide range of information and communications technologies (ICTs) at their disposal and are using these technologies more than they ever have in the past. While the penetration of telephones, colour television and VCRs is nearly universal, several other technologies are also becoming an important part of day-to-day life in Canada. The use of personal computers, the Internet and cellular telephones has increased most rapidly in recent years. By 2001, 59.9% of Canadian households had a home computer, 47.6% possessed at least one cell phone, and 60.2% used the Internet regularly from some location. In addition, several new technologies have recently become available in the marketplace and Canadian households show an avid interest in becoming further "connected".

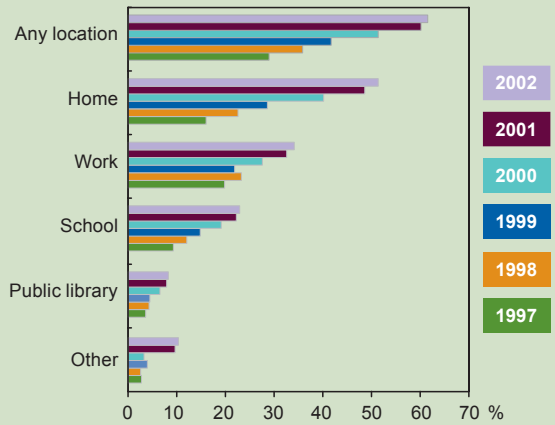
5.1. Use of ICTs by households

The number of Canadian households using the Internet continues to rise – both from home and other locations, including work and school. Information from Statistics Canada's Household Internet Use Survey (HIUS) revealed a turning point in 1999 – for the first time, Canadians were more likely to connect to the Internet from home than from work, where the Internet had first established a foothold. Use at home has continued to surpass use at work, and by 2002 more than half of Canadian households (51.4%) had at least one member that regularly connected to the Internet from home. Home use was followed by use from work (34.2%), school (22.9%) and other locations, such as Internet cafés and the homes of friends or relatives (10.4 %), while use from public libraries stood at 8.2 %. Overall, about 7.5 million households (61.6%) used the Internet regularly from any location (Figure 5.1.1). After surging between 1997 and 2001, growth in Internet penetration by Canadian households has begun to level off. Since many households are already using the Internet, the capacity to sustain high growth rates is much reduced (Statistics Canada 2003).

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 has been repeated each year since. The HIUS collects information from one household member about the Internet activities of the entire household. For 2002, over 31,000 respondents in private households were interviewed. 'Regular use' refers to at least one person in the household who uses the Internet during a typical month, whether at home, work, school, a public library or other location.

On an international scale, household Internet access is highest in Northern Europe (Denmark, Sweden, and the Netherlands) and North America, where penetration rates in 2001 ranged between 40.0% and 60.0%. Household Internet access continued to soar everywhere, particularly in Portugal and the United Kingdom, where penetration more than doubled between 2000 and 2001.

Figure 5.1.1 Household Internet use, by location, 1997-2002



High-speed Internet by broadband, once the domain of large business and public sector networks, is now becoming increasingly common in Canadian households. Compared to traditional methods of Internet access such as dial-up connections, broadband provides Canadian households with higher performance, as well as improved versions of many of the applications currently available on the Internet (Veenhof, Neogi and van Tol 2003).

Internet access rates also more than doubled in Mexico between 1999 and 2001. Despite this increase, only 6.2% of households had Internet access in 2001 (OECD 2002).

Canadian households have not only embraced the Internet but, according to the latest data, they want to get information from the Internet even more quickly than before. Among households that were regular home Internet users, nearly half (48.7%) used a high-speed technology, typically cable modems or Digital Subscriber Lines (DSL) to connect to the Internet in 2001. In 2002 the number of households with high-speed cable modem service reached 2.2 million (34.9%), up from almost 1.8 million one year earlier.

Other emerging technologies have also captured the attention of Canadian households. While the penetration of telephones, television, and CD players appears to have levelled, households have started purchasing DVD players and CD writers – technologies that have attracted widespread use over the last few years. Canadians have not been shy to try alternative sources of television programming either – satellite TV, for example, is staking a strong competitive position in an attempt to lure Canadian households away from cablevision. Table 5.1.1 shows the most recent data available for these newer technologies, and also illustrates the strong rela-

tionship that exists between use of the Internet and other ICTs generally. Canadian households that access the Internet are more likely to make use of these technologies than those without Internet access.

There remains a substantial gap among countries in the number of households with a computer. Among OECD countries, nearly 60.0% of households in Canada, Korea and the U.S. had access to a home computer in 2001. In Denmark, Switzerland and Sweden, more than 60.0% of households have a computer, while only 11.6% of households in Mexico do so. Households in France, Italy and Spain fall in the mid-range with an average computer penetration rate of about 30.0% (OECD 2002).

Table 5.1.1 Household penetration of selected ICTs, 1999-2001

	Household with Internet access			Household without Internet access			All households		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
	%								
Telephone									
1	10.4	12.1	12.9	28.0	27.8	29.0	23.0	21.9	21.6
2	27.4	26.9	28.7	38.1	39.9	39.3	34.4	34.4	33.9
3 or more	62.1	60.8	58.0	31.5	28.8	27.3	40.8	41.5	41.9
Cellular phone	50.8	59.9	64.2	22.8	28.5	31.1	31.9	41.8	47.6
CD player	91.0	91.5	87.0	59.7	61.2	54.5	70.2	74.1	70.9
CD writer	..	..	..	..	..	..	..	..	19.3
DVD player	..	..	..	..	..	..	..	..	19.8
Cablevision	77.4	77.3	71.6	71.9	69.1	65.4	73.3	72.4	68.3
Satellite dish	..	..	..	..	..	..	..	..	18.4
VCR									
1	52.8	52.4	53.3	63.9	63.1	65.7	60.5	58.9	59.8
2 or more	44.8	45.5	44.4	20.7	21.5	20.1	28.1	31.1	31.7
Home computer	100.0	100.0	99.3	25.1	22.0	20.5	49.8	54.9	59.9
Colour television									
1	29.7	28.8	27.7	47.1	48.6	50.7	42.3	41.0	40.1
2	39.1	38.1	39.3	36.3	35.9	35.3	36.6	36.5	36.8
3 or more	30.6	32.6	32.7	15.4	14.1	12.7	20.0	21.4	22.3

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

Note: Data cover the 10 provinces in 2000, but also include the territories in 1999 and 2001.

5.2 Household spending on ICTs

Data in this section come from "reporting households" – that is, those households reporting expenditure on specific goods or services. Households that did not report any expenditure on specific items were excluded from the calculation of average expenditures.

Between 1999 and 2001, spending on ICTs by reporting households totalled roughly $12,000, or about $4,000 per year (Table 5.2.1). While the proportion of money spent on different products and services is largely unchanged, there are some notable exceptions. Canadians are spending less money on computer equipment and supplies, and are increasing their share of expenditure on Internet services. This may be attributable in part to recent declines in the price of common pieces of computer hardware, and the shift away from dial-up Internet access to more expensive high-speed Internet packages. Those using standard dial-up connections spent an average of $240 in 2001 on Internet services, while households with high-speed connections spent in excess of $400 on average.

Table 5.2.1 Household expenditures on selected ICTs, 1999-2001

	Average expenditure per household reporting			Percentage of total expenditures on ICT		
	1999	2000	2001	1999	2000	2001
				%		
Telephone equipment and services	732	754	747	18.6	18.6	18.3
Cellular services	459	483	475	11.7	11.9	11.6
Home entertainment equipment and services	618	630	689	15.7	15.6	16.9
Cablevision and satellite services	450	482	515	11.4	11.9	12.6
Computer equipment and supplies	915	911	793	23.2	22.5	19.4
Recreation (electronic games & parts, video game rental)	301	307	326	7.6	7.6	8.0
Internet Services	262	280	317	6.7	6.9	7.8
Photographic goods and services	199	203	219	5.1	5.0	5.4
Total expenditure on selected ICTs ($)	3,936	4,050	4,081	100.0	100.0	100.0
Total expenditure ($)	53,474	55,834	57,742	…	…	…
Selected ICTs as % of total expenditure	**7.4**	**7.3**	**7.1**			

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

Canadians also continue to spend slightly more on home entertainment, cablevision and satellite services. More and more households have also been purchasing cellular telephone services, but their share of expenditure has remained relatively stable.

Analysis of expenditures by household income reveals a number of important trends. For all types of ICTs, the highest income quintile was most likely to report expenditures, and the incidence of expenditure declined with each income group moving from highest to lowest (Table 5.2.2). For example, approximately twice as many households in the 2nd quintile reported expenditure in 2001 on computer equipment and supplies, Internet services, cellular services and electronic games and parts than households in the lowest income group. The relative gap for each of the selected ICTs was considerable. Even with telephone equipment and services, where penetration is nearly universal, a gap still exists between households in the lowest income quintile and all other households.

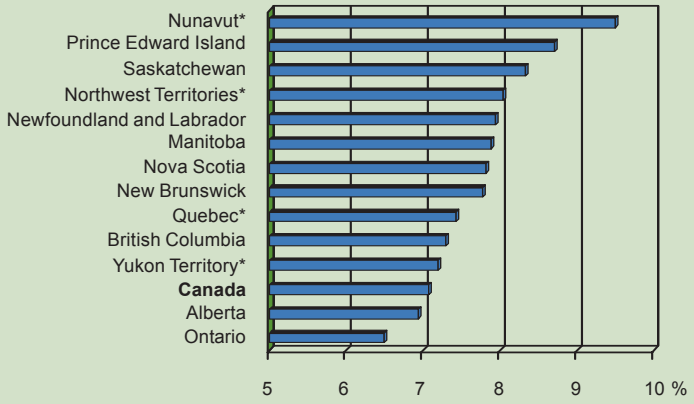
Table 5.2.2 Household expenditures on selected ICTs, by income quintile, 2001

	Households reporting expenditures on ICT by income quintile					
	All	Lowest	2nd	3rd	4th	Highest
	%					
Telephone equipment and services	97.9	92.8	97.7	99.3	99.5	99.9
Cellular services	43.0	15.5	31.2	45.6	57.0	65.7
Home entertainment equipment and services	82.7	56.7	75.8	88.7	94.9	97.2
Cablevision and satellite services	77.3	60.2	73.1	79.6	84.2	89.2
Computer equipment and supplies	44.5	15.6	30.6	47.4	57.7	71.1
Recreation (electronic games & parts, video game rental)	20.7	6.9	13.6	19.9	27.4	35.6
Internet Services	40.1	13.0	26.0	41.6	53.8	66.1
Photographic goods and services	71.7	40.0	64.6	76.2	87.0	90.8

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

Households were grouped into quintiles according to their household incomes – the highest quintile represents the 20% of households with the highest incomes, the lowest quintile represents the 20% of households with the lowest incomes.

Figure 5.2.1 Selected ICTs as a percentage of total household expenditures, by province, 2001



* *Note: Expenditures on cellular telephone services in Yukon Territory and Nunavut and video game rental in the Northwest Territories and Nunavut are excluded from the calculation due to low reliability of sample estimates. Estimates of recreation (NL, PE, QC, YT, NT, NU), cellular telephone services (YT, NT), Internet services (NU), computer equipment and supplies (YT, NU) and photographic goods and services (NU) are subject to lower quality as they have a coefficient of variation between 16.6% and 33.3%. These estimates did however contribute to the calculation of the overall share of ICTs as a percentage of total expenditure.*

There are also geographic dimensions to patterns of ICT expenditure in Canada. Overall, the selected ICTs accounted for an average of 7.1% of total expenditure among the households that reported them in 2001. Smaller provinces have higher spending in relative terms than the four provinces with the largest household populations, Ontario, Quebec, British Columbia and Alberta (Figure 5.2.1). The figures are lowest for Ontario (6.5%) and Alberta (6.9%). These provinces are home to some of the largest urban centres in Canada, where certain ICT goods and services may be available more readily and, in some cases, more cheaply than in rural and remote parts of Canada. As well, a high level of competition between those companies providing ICT goods and services (e.g. computer stores, Internet service providers) is often encountered in urban areas, where the potential customer base is largest. Consequently, consumers may have a high degree of choice regarding ICT purchases and may spend less than those households situated in areas where choice may be more limited.

In some of the provinces and territories located in remote parts of the country and with smaller populations, spending on ICTs as a share of total expenditure tends to be higher. Nunavut had the highest share of total expenditure on ICTs. The Northwest Territories also had expenditures slightly above the national average. It should be noted that reliable estimates of expenditures for two types of ICTs contributing to the overall estimate (cellular services and video game rental) could not be produced for Nunavut, the Yukon and Northwest Territories. Therefore, the total share of expenditure on ICTs in the three territories is even higher than reported here. Prince Edward Island and Saskatchewan also reported high expenditures on ICTs relative to total expenditure.

One feature of the predominantly rural landscape found in these provinces and territories is that many ICT goods and services, such as computer equipment, supplies and Internet services may sometimes not be readily accessible. In addition, the cost of provisioning these services may be higher. Households in Nunavut, the Northwest Territories, Yukon Territory and Prince Edward Island all spent in excess of $1,000 on computer equipment and supplies, exceeding the national average of $793 among reporting households. And while the average expenditure in Canada for Internet services was $317, reporting households in Yukon Territory, the Northwest Territories and Nunavut spent more on these services as well ($372, $422 and $509[E], respectively). The cost of providing Internet services in remote areas is typically higher (Veenhof, Neogi and van Tol 2003), but sometimes so too is demand, since the Internet may be an important source of information for households situated in areas where other media (e.g., local radio, newspapers) are generally not available. Taken together, these factors may help account for both the higher price of these services as well as households' willingness to pay for them. The same may also be said for cable and satellite television, as households in the Northwest Territories and Nunavut spent more on these services than households in any other province in Canada ($753 and $745, respectively).

5.3 Frequency, intensity and type of Internet use

Not only are more and more Canadians accessing the Internet, but the amount of time households spend online is also rising. By 2002, three quarters of regular-use households were making daily connections to the Internet on average, and nearly two-thirds used the Internet for 20 hours or more each month.

With more time online, Canadians are also diversifying their Internet use. In 2002, about nine out of every ten households that used the Internet from home used it for e-mail (95.2%) and general browsing (89.6%). Almost two-thirds (63.9%) used the Internet to search for medical or health information, the third most popular activity. But the popularity of the Internet is also having an impact on the use of more traditional technologies. Activities such as viewing the news,

finding travel information and listening to the radio, once reserved for other media, are common uses in some households. Other activities include searching for employment, and participating in formal education or training. At least one member in nearly half of all households regularly using the Internet went online for training or educational purposes in each year from 2000 to 2002. Although many activities did not jump substantially from 2001 to 2002, electronic banking continued to rise, up from 44.4% to 51.0% (Table 5.3.1).

Table 5.3.1 Proportion of households using the Internet from home, by type of use, 1997-2002

	All households						Regular home-use households					
	1997	1998	1999	2000	2001	2002	1997	1998	1999	2000	2001	2002
	%											
E-mail	13.3	19.3	26.3	37.4	46.1	48.9	83.1	85.6	91.7	93.3	94.7	95.2
Electronic banking	3.1	5.2	8.0	14.7	21.6	26.2	19.7	22.9	27.7	36.6	44.4	51.0
Purchasing goods/services	1.5	2.5	5.5	9.6	12.7	15.7	9.2	10.9	19.0	23.8	26.0	30.5
Medical/health information	..	9.6	15.6	22.9	30.1	32.8	..	42.5	54.2	57.1	61.8	63.9
Formal education/training	..	6.8	9.2	19.0	22.9	24.3	..	29.9	32.0	47.3	47.0	47.3
Government information	..	8.2	12.7	18.9	25.6	29.2	..	36.4	44.1	47.1	52.5	56.7
Search for employment	..	..	..	12.2	16.2	18.0	..	..	..	30.5	33.2	35.0
General browsing	13.6	17.6	24.3	36.2	44.3	46.1	84.7	78.1	84.7	90.1	91.0	89.6
Playing games	..	7.8	12.3	18.2	24.4	25.7	..	34.3	42.7	45.3	50.1	50.0
Chat groups	..	5.7	7.5	11.0	13.7	14.0	..	25.4	26.2	27.4	28.0	27.2
Obtaining/saving music	..	..	7.8	17.8	23.3	24.3	..	..	27.1	44.3	47.9	47.3
Listening to radio	..	..	5.0	9.3	12.3	12.3	..	..	17.5	23.2	25.3	24.0
Find sports related information	..	..	..	17.3	22.1	23.8	..	..	..	43.2	45.3	46.3
Financial information	..	..	..	18.5	22.8	23.5	..	..	..	46.1	46.8	45.7
View the news	..	..	..	20.4	26.2	27.2	..	..	..	50.8	53.8	52.9
Travel information/ arrangements	..	..	..	21.9	30.4	27.4	..	..	..	54.6	56.3	59.1
Other Internet services	2.2	2.6	10.0	17.7	21.1	24.8	13.7	11.6	34.7	44.1	43.3	48.1

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

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

As with other ICTs, use of the Internet, regardless of location, is closely related to household income. In 2002, the vast majority (87.9%) of households in the highest income quartile used the Internet from any location compared with only 33.0% in the lowest quartile (Table 5.4.1). Over three-quarters (78.4%) of households in the highest income quartile also used the Internet at home, compared with only one-quarter (25.1%) in the lowest quartile. But penetration rates have been increasing in every income quartile, meaning that more households in each group are connected to the Internet from year to year. This growth has generally been fastest in the lower income groups – by 2001 the home penetration rates in the bottom two quartiles were over four times the rates of 1997. By 2002 however, penetration in the second quartile had levelled at around 40.0%.

Table 5.4.1 Internet use by household characteristics, 1997-2002

	Home						Any location					
	1997	1998	1999	2000	2001	2002	1997	1998	1999	2000	2001	2002
	%											
Household income												
All households	**16.0**	**22.6**	**28.7**	**40.1**	**48.7**	**51.4**	**29.0**	**35.9**	**41.8**	**51.3**	**60.2**	**61.6**
Lowest quartile	5.5	7.1	10.9	16.5	22.6	25.1	12.2	13.1	18.8	23.9	31.6	33.0
Second quartile	8.9	13.7	18.0	31.2	40.0	39.9	18.0	23.8	29.2	42.8	51.8	50.9
Third quartile	17.1	24.6	32.4	47.4	56.4	62.3	32.3	41.6	48.1	60.6	70.1	74.7
Top quartile	32.5	44.9	53.5	65.4	75.8	78.4	53.5	65.0	71.2	77.9	87.3	87.9
Education level of household head												
Less than high school	3.9	6.6	9.6	16.1	22.8	24.3	8.9	12.6	16.1	22.4	29.9	30.2
High school or college	16.0	23.1	29.6	42.8	51.3	54.0	30.6	37.4	44.4	55.2	64.6	65.7
University degree	37.6	46.7	52.4	65.1	74.2	75.9	59.2	68.1	70.1	79.1	85.8	86.8
Age of household head												
Less than 35	19.1	26.1	32.8	46.8	56.8	56.2	37.3	45.3	53.0	66.3	76.2	75.4
35 to 54	21.6	30.1	38.0	52.2	60.6	64.3	38.5	46.9	54.9	65.7	74.1	75.5
55 to 64	12.0	18.2	24.6	35.3	44.6	48.9	20.7	27.5	32.7	42.4	52.5	56.3
65 and over	3.4	5.3	8.2	12.2	17.3	19.9	5.3	7.2	10.1	13.9	19.3	21.6
Family type												
One-person household	7.1	10.5	12.6	19.0	25.3	26.2	16.4	20.4	22.1	27.9	36.2	37.5
Single-family, no children under 18	15.5	22.5	28.3	37.8	46.5	51.1	27.2	34.2	38.7	46.7	55.6	58.9
Single-family, children under 18	21.7	31.0	40.6	57.0	66.5	69.7	37.9	47.6	59.0	71.2	80.5	81.2

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

Although relative growth has occurred most quickly in the bottom quartiles, a significant gap in Internet use between lower- and higher-income households remains. Table 5.4.2 illustrates that the strong relationship between income and Internet use observed in Canada is also evident elsewhere.

Table 5.4.2 Households with home Internet access by income level[1] (2001 or latest available year)

	Households with Internet access	Bottom income quartile	Top income quartile	Difference (% points)
		%		
United Kingdom 2001-2002	40.0	11.0	80.0	69.0
United States 2000	41.5	14.0	77.0	63.0
Canada	**48.7**	**22.6**	**75.8**	**53.2**
Finland	39.5	20.0	69.4	49.4
Australia 2000	33.0	9.0	58.0	49.0
Germany	27.0	14.0	55.0	41.0
New Zealand	37.0	33.3	71.7	38.4
Netherlands 1999	26.5	20.0	57.0	37.0
Switzerland 2000	36.5	11.2	46.8	35.6
France	17.8	7.0	34.0	27.0
Turkey 2000[2]	6.9	0.1	21.4	21.3
Denmark	52.0	37.0	53.0	16.0

Source: OECD 2002.

1 *For the United Kingdom, first and last deciles instead of quartiles, for Germany and New Zealand, first and last income brackets.*

2 *Households in urban areas only.*

Households were grouped into quartiles according to household incomes. The top quartile corresponds to the 25.0% of households with the highest incomes, while the bottom quartile represents the 25.0% of households with the lowest incomes.

While growth in the lowest quartile in Canada appears to be substantial, the gap between the very low income deciles and the highest income decile (highest 10.0%) is widening (Sciadas 2002). Developing ways to measure the gap between those who have access to the Internet and other ICTs and those who do not – and the consequences of such a gap - are concerns of many national and international governing bodies.

Education is also correlated with Internet use among Canadian households. While a large majority of households (86.8%) headed by a member who held a university degree used the Internet, only about three in ten households (30.2%) whose heads had not completed high school used the Internet in 2002. However, increases across all education levels are continuing to occur over time (Table 5.4.1).

Although older Canadians tend to use the Internet less than the younger population, Internet use grew fastest for households with maintainers 65 years of age and older. While penetration rates among younger household maintainers (54 or younger) in 2002 were about twice the rate of 1997, penetration among the oldest age group (65 years and over) was over four times the rate from 1997 (see also Silver 2001).

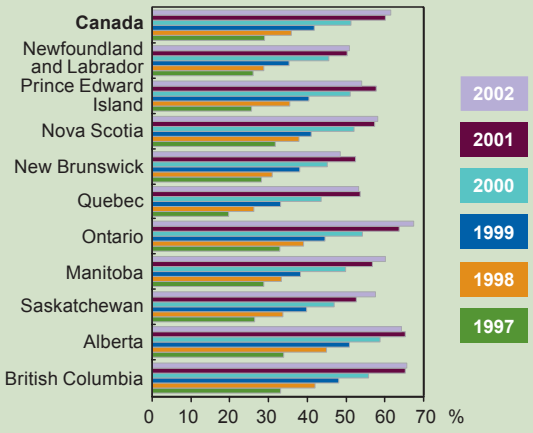
Demographic factors, including age and family type are also closely linked to Internet use patterns. Households with older household maintainers are significantly less likely to use the Internet than those with younger maintainers. The presence of family, and particularly younger children, has a strong positive relationship with the incidence of use. This pattern may be due in part to the higher rate of use from school for households with children under the age of 18. Single person households were much less likely to use the Internet. Although growth slowed in 2002, Internet use increased each year between 1997 and 2001 across all age groups and family types.

In 2002, approximately 3.8 million Canadian households had never used the Internet. Most of the households in this group (85%) were either families without children or one-person households. As well, many of these non-users earned below-average household income, as 47% ranked in the lowest income quartile. Among those who had a computer at home but have never accessed the Internet (477,000), just over 40% indicated that they had no need or use for the Internet. Some also felt that Internet access was too costly (16%) or indicated that their computer was too old or broken (10%).

5.5 Use of the Internet by province and by CMA

Ontario, British Columbia and Alberta have the highest Internet penetration rates for use from any location (Figure 5.5.1). These three provinces were also the only provinces where Internet use exceeded the national average (61.6%). Internet use rates increased in every province in each year from 1997 to 2001, but

Figure 5.5.1 Internet use, any location, by province, 1997-2002



in some provinces levelled or even decreased slightly in 2002. The biggest increases in 2002 occurred in Ontario, Manitoba and Saskatchewan.

British Columbia, Ontario and Alberta were the only provinces where the majority of households accessed the Internet regularly from home, exceeding the national rate for home use in 2002 (51.4%).

There remains considerable variability across Census Metropolitan Areas (CMAs) (Table 5.5.1). Ottawa, Toronto and Regina led all CMAs with household Internet penetration rates exceeding 70.0% of households in 2002, ranking well above the national average (61.6%). Windsor boasted the largest percentage increase, up from 25.5% in 1997 to 62.9% in 2002.

Table 5.5.1 Internet penetration rates from any location, by CMA, 1997-2002

	1997	1998	1999	2000	2001	2002
				%		
Canada	**29.0**	**35.9**	**41.8**	**51.3**	**60.2**	**61.6**
St. John's	..	..	..	..	64.4	66.6
Halifax	38.8	50.2	52.4	64.1	68.6	69.8
Saint John	..	..	..	..	63.0	62.6 E
Quebec	23.6	28.6	33.9	50.3	55.0	56.0
Montreal	24.0	31.6	39.1	46.6	60.1	56.1 E
Ottawa*	55.4	55.3	60.7	65.2	77.6	75.3 E
Oshawa	..	..	..	..	65.6	67.1
Toronto	37.6	42.0	48.5	57.9	67.0	71.3
Kitchener-Waterloo	34.8	42.4	43.7	52.7	59.7	64.8
Hamilton	30.4	41.2	43.1	54.9	57.8	64.7
St. Catherines-Niagara	26.0	29.3	34.4	46.0	59.2	58.9 E
London	31.7	40.4	45.9	59.2	71.4	68.0 E
Windsor	25.5	26.8	33.6	47.5	54.9	62.9
Winnipeg	33.0	37.9	42.1	53.9	61.8	65.8
Regina	..	..	..	..	69.2	71.0
Saskatoon	..	..	..	..	61.5	65.7
Calgary	40.3	52.8	60.1	65.2	70.9	68.2 E
Edmonton	35.7	43.9	48.8	59.5	68.3	66.1 E
Vancouver	35.5	45.7	49.7	60.0	69.1	69.4
Victoria	39.5	48.5	56.4	59.1	68.0	67.4 E

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

** Ottawa excludes the Gatineau component of the Ottawa-Gatineau CMA. The penetration rate for the entire Ottawa-Gatineau CMA was 56.7% in 1999, 62.2% in 2000, 73.3% in 2001 and 72.5% in 2002.*

5.6 Household e-commerce

The number of Canadian households using the Internet to purchase goods and services continues to rise. Over 2.2 million Canadian households, or 18.7% of all households, spent nearly $2 billion on 13.4 million online orders in 2001. Moreover, more than half (55.0%) of regular Internet use households participated in at least one aspect of Internet shopping, either ordering goods online ("e-commerce") or browsing the characteristics and prices of various products and services ("window-shopping"). In total, nearly 4 million Canadian households either placed orders for purchases online or went 'window-shopping'.

"Internet shopper households" are those households that engaged in either window-shopping or e-commerce. "Window-shoppers" are those households where all members reported to have only browsed for goods and services using the Internet. "E-commerce households" are those that ordered goods or services using the Internet for at least one transaction, regardless of whether or not they paid online.

For the first time in 2001, the HIUS captured e-commerce transactions for households that regularly used the Internet from various locations, as long as the purchases were for household purposes. In previous years, Internet shopping was captured only if it was conducted from home.

While the amount spent by Canadians online is growing every year, household e-commerce still accounts for a very small fraction (0.3%) of overall consumer spending, which stood at $621 billion in 2001. Nevertheless, 56.5% of Internet shopper households engaged in e-commerce in 2001, placing an average of nearly 6 online orders[14] and committing $880 per household to Internet purchases. The average value for one order stood at $148.

The value of orders placed to Canadian firms also appears to be increasing. Only 35.0% of e-commerce dollars went to foreign websites, down from 1999 when non-Canadian websites attracted about 40.0% of the Canadian e-commerce market. Exchange rates and import duties, as well as the availability, cost and speed of delivery are some of the factors which may encourage Canadian households to spend their e-commerce dollars within Canada.

Table 5.6.1 Number and proportion of regular-use households accessing the Internet from any location, 2001

	,000		*%*		
All households	**12,007**	**100.0**			
Internet use, any location	7,228	60.2	100.0		
Internet shopper	3,976	33.1	55.0	100.0	
Window shopper only	1,731	14.4	24.0	43.5	
e-commerce	2,244	18.7	31.0	56.5	100.0
e-payment	1,778	14.8	24.6	44.7	79.2

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

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

Table 5.6.2 Types of products and services ordered, any location, 2001

	E-commerce Households		Window Shopper Households		Internet Shopper Households	
	%	Rank	%	Rank	%	Rank
Books, magazines & newspapers	28.1	1	15.9	6	24.8	2
Travel arrangements	16.2	3	16.3	5	19.9	4
Computer software	13.8	5	10.7	9	14.7	8
Automotive products	2.6	18	21.2	4	18.5	6
Music (CDs, tapes, mp3)	11.8	6	10.7	9	13.8	9
Clothing, jewellery & accessories	18.2	2	25.6	2	27.2	1
Computer hardware	6.4	9	12.2	7	12.4	10
Consumer electronics	6.7	8	21.6	3	19.9	4
Other entertainment (e.g. tickets)	10.6	7	5.1	16	9.5	12
Housewares (furniture & appliances)	5.6	11	26.4	1	23.5	3
Videos, Digital Video Discs (DVDs)	5.0	14	6.3	13	7.5	14
Hobbies	3.6	16	2.2	19	3.7	18
Food, condiments & beverages	2.9	17	2.5	18	3.3	19
Toys and games	6.1	10	8.1	12	9.1	13
Real estate	0.4[E]	19	5.6	15	4.8	17
Health, beauty, vitamins	5.1	13	5.7	14	7.0	15
Flowers, gifts	4.8	15	4.1	17	5.6	16
Sports equipment	5.5	12	9.0	11	9.7	11
Other	14.8	4	11.1	8	16.2	7

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

Despite continued concerns about privacy and the security of their online transactions, a large majority (79.2%) of households ordering online paid directly over the Internet for their purchases (e-payment).

Decisions to purchase online are often based not only on price but also on other factors such as the convenience of product delivery and the size of the purchase. Canadian households often used the Internet to research and browse for large purchases, such as housewares (e.g. furniture and appliances), consumer electronics and automotive products, but seldom actually ordered these types of products online. Instead, they often window-shopped for these items over the Internet,

perhaps with the intention to follow up their online research with in-store visits. Less bulky and less expensive items, such as books, magazines and newspapers, tended to be more popular items for online purchase.

5.6.1 Digital delivery

The purchase of digitally delivered products is an emerging trend in e-commerce. These products include computer software, MP3 music files, on-line newspapers, videos and other entertainment products that are delivered in digital format directly to a computer, meaning there is no need for product handling or shipment.

Digital delivery *includes all products delivered in a digital format over the Internet regardless of method of payment.*

Overall, 4.5% of regular-use households purchased digitally delivered products in 2001. This represents approximately 327,900 Canadian households. Over two-thirds of these households purchased computer software, the most popular of the digitally delivered products that were purchased. Not surprisingly, purchases were most common among Canadian households with higher incomes. Nearly 7.0% of households in the highest income quartile purchased digitally delivered products, compared with only 4.5% of regular-use households overall.

Digitally delivered products were also slightly more popular among one-person households (6.2%) than they were among Canadian families (3.9% for family households with children and 4.6% for families without children).

5.6.2 Music downloads

Nearly half (47.3%) of all regular-use households went online to obtain music in 2002. This represents a total of about 3.0 million Canadian households.

Although the number of Canadians downloading music increased over the five-year period, the rate slowed considerably between 2000 and 2002. Table 5.6.2.1 shows that previously, the number of households downloading more than doubled from about 0.9 million in 1999 to over 2.1 million in 2000. The bulk of these downloads occurred free of charge, as this was also a period when peer-to-peer music file sharing programs (such as Napster) gained widespread popularity. In 2001, the growth was much slower, with close to 2.8 million households representing a 33.0% increase from the previous year. By 2002 this growth had halted as the proportion of households obtaining music online nearly matched the previous year.

Table 5.6.2.1 shows that music downloads were most common among young, single families with children. These families were more likely to obtain music on the Internet than families without children or one-person households. The highest proportion of households downloading music was headed by individuals less than 35 years of age (55.9%). Families headed by someone aged 55 or older were much less likely to be involved in these activities.

The relative ease of exchanging MP3 music files over peer-to-peer networks on the Internet has had an enormous impact on the music industry in Canada and abroad. Many websites operate programs that allow visitors to search for music as well as upload files to share freely with others. The use of the Internet to disseminate copyrighted music has sparked legal issues and controversy in many countries.

One interesting finding was that, among the group of regular Internet users, little relationship exists between income and the proportion of households downloading music. This may be partly explained by the fact that most online music transfers occur free of charge. In 2001, the percentage of regular-use households obtaining and saving music online fell in the 47-49% range across all four income groups. While income is an important factor in use of the Internet generally, these results suggest that among regular Internet users the incidence of downloading music occurs equally, regardless of income.

Websites, including those of some musicians, are emerging that charge a small fee for the right to download copyrighted music. While these websites are currently few in number, they represent what may be a growing trend in e-commerce in the years ahead.

Table 5.6.2.1 Percentage of regular home-use households that use the Internet to obtain and save music in a typical month, 1999-2001

	Regular home-use households		
	1999	2000	2001
		%	
Age of Household Head			
Less than 35	31.4	51.3	55.9
35-54	28.6	47.4	51.6
55-64	19.1	30.5	33.5
65 or higher	13.2	19.3	20.0
Household Type			
Single family with unmarried children under 18	32.3	52.4	56.9
Single family without unmarried children under 18	23.0	36.4	39.0
One person	18.1	31.7	36.5
Multi-family	29.8	51.6	57.4
Household Income			
Lowest quartile	30.6	45.3	48.9
Second quartile	29.6	44.6	47.8
Third quartile	25.8	43.4	47.1
Highest quartile	26.4	44.6	48.2
All Regular Home-User households	**27.1**	**44.3**	**47.9**
		total households	
Total households saving music from home	**905,700**	**2,105,000**	**2,799,200**

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

Summary

Over the last several years Canadian households have not only started to use a greater number of ICTs, but have expanded both the purposes and intensity of their use. Much of the change has centred around the Internet, where Canadians communicate regularly and have transferred some of the activities that have traditionally occurred through other avenues (e.g. viewing the news, electronic banking, purchasing goods and services, obtaining music). In addition, Canadian households are using technologies such as high-speed Internet delivered by broadband networks to accomplish these tasks more quickly.

Internet use is closely linked to patterns of household income, education, age, and family type. Characteristics such as the presence of children, and a young household maintainer with a high level of education and income all exert some influence on Internet use. Although slowing somewhat in 2002, Internet use increased across all household types over the 1997-2001 period. This, together with the high intensity and range of uses, reflects the emergence of the Internet as an important social, recreational and economic resource in many Canadian households.

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5.7 Rural Canadian households in the information age

Verna Mitura is an analyst in Agriculture Division, Statistics Canada. Her analysis focuses on access and use of ICTs by residents of rural households.

Rural Canadians are increasingly adopting new and sophisticated information and communication technologies (ICTs) for communication and information sharing, management of information systems and business applications. Computers, the Internet, cellular phones, and satellite dishes are helping to bridge distance and knowledge gaps, not only between rural and urban Canada, but also between rural Canada and the rest of the world. ICTs will be critical to the future competitiveness of rural Canada in the 21st Century, as technology takes on a new role of networking supply chains, creating expert knowledge systems, and developing new business solutions.

Rural and small town *(RST) refers to the population living outside the commuting zones of larger urban centres – specifically, outside Census Metropolitan Areas (CMAs) and Census Agglomerations (CAs). RST areas have a population of 1 - 9,999 where less than 50.0% of the employed individuals commute to a CMA/CA and less than 25.0% commute from a CMA/CA.*

A ***CMA*** *has an urban core of 100,000 or over and includes all neighbouring municipalities where 50 percent or more of the labour force commutes into the urban core. A* ***CA*** *is an urban core of 10,000 to 99,999 and abides by the same commuting rule as CMAs.*

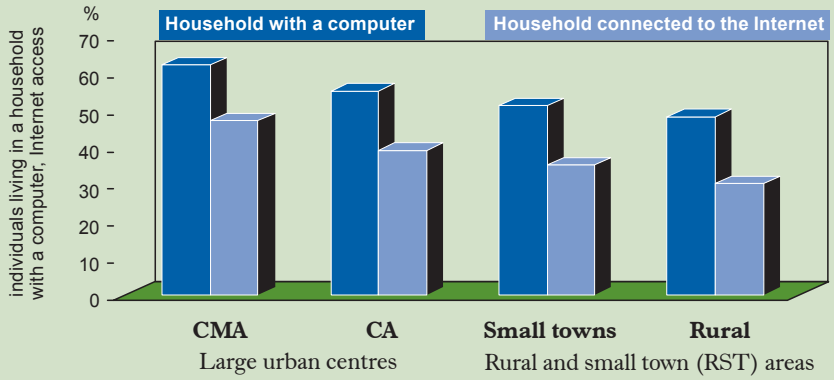
RST small towns *refer to the population living in towns of 1,000 to 9,999 and outside a CMA or CA.* ***RST rural*** *refers to the population living outside centres of 1,000 to 9,999 and outside a CMA or CA.*

Half of rural and small town residents live in households with a computer

In 2000, approximately one-half of Canadian rural and small town (RST) residents lived in households with a computer and nearly one-third of these households were connected to the Internet (Figure 5.7.1). This is in contrast to the proportion of Census Metropolitan Area (CMA) residents in households with a computer (62.0%) and connected to the Internet (45.0%) (McLaren 2002). Between 1989 and 2000, the proportion of residents living in households with a computer has approximately tripled in both rural and urban areas. Nevertheless, RST residents continue to have a lower proportion of computers in the home (Figure 5.7.2). This gap between rural and urban areas was about the same in 2000 as it was in 1994. The divide persisted even when other characteristics were taken into account, such as level of education and household income (McLaren 2002).

Data for this article come from the 2000 General Social Survey (GSS), Cycle 14 and the Household Internet Use Survey (HIUS), various years.

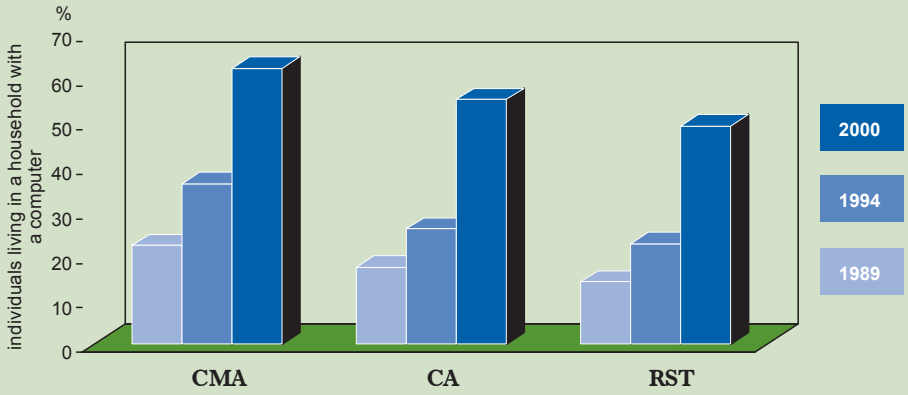
Figure 5.7.1 Rural residents less likely to live in a household with a computer or connected to the Internet, 2000



Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.

Note that the respondent was a person, 15-years of age or older, who was randomly selected from within the household.

Figure 5.7.2 The shares of individuals in a household with a computer in larger urban centres and RST areas have all tripled, 1989, 1994, 2000



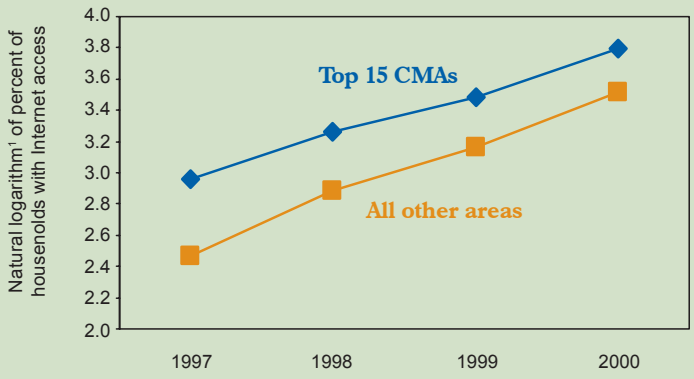
Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.

Note that the respondent was a person, 15-years of age or older, who was randomly selected from within the household.

The rate of growth of Internet access is similar among metropolitan and non-metropolitan households

The rate of growth of the proportion of households with Internet access increased similarly for both metropolitan (top 15 CMAs) and non-metropolitan (all other) households between 1997 and 2000 (McLaren 2002). Given that households in "all other areas" are adopting the Internet at the same rate as the "top 15 CMAs", the gap between metropolitan and non-metropolitan areas did not close appreciably during the reference period (Figure 5.7.3)

Figure 5.7.3 The rate of increase of Internet access is similar within and outside the major CMAs, 1997-2000



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

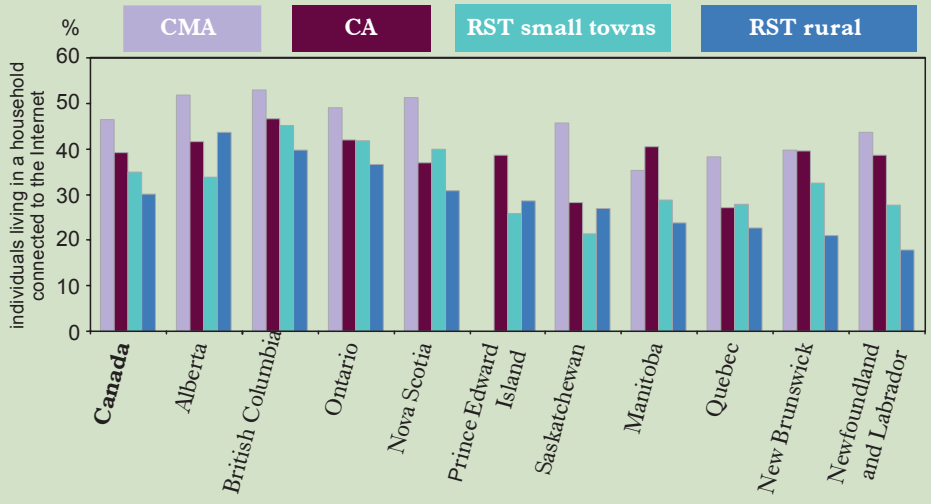
[1] The slope of a line of the logarithm of a variable plotted over time can be read directly as the rate of growth of the variable.

Note: The top 15 Census Metropolitan Areas are Halifax, Québec, Montréal, Ottawa, Toronto, Kitchener, Hamilton, St. Catherines - Niagara, London, Windsor, Winnipeg, Calgary, Edmonton, Vancouver and Victoria.

Alberta, British Columbia, Ontario and Nova Scotia have highest proportion of RST home Internet connections

In addition to having the highest overall rates of Internet connectivity, the provinces of Alberta, British Columbia, Ontario and Nova Scotia had the highest proportion of RST residents with home Internet connections. However RST residents in most provinces were still less likely to be in a household connected to the Internet than residents living in CMAs or CAs (Figure 5.7.4).

Figure 5.7.4 Rural individuals are less likely to be in a household connected to the Internet, 2000



Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada.

Note: Respondent was a person, 15-years of age or older, who was randomly selected from within the household.

Does "rurality" constrain computer and Internet use?

Research has shown that the proportion of households with computers and Internet access in Canada increases with higher levels of income and education. This trend is also apparent in rural and small town households. As well, for each education and income class, rural individuals are less likely to own a computer or to be connected to the Internet compared to individuals in urban areas. Therefore, unique issues within rural Canada may be acting as barriers to Internet adoption. Some of these issues may include cost and availability of telecommunication infrastructure for rural households (Dryburgh 2001).

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Chapter 6 NETWORKING BUSINESS

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Chapter 6
NETWORKING BUSINESS

ICTs have many applications in the private business sector, almost as wide and diverse as the industries that use them. While the nature and use of ICTs may vary considerably – for example, digital delivery of music and video in the entertainment industry, self-checkout in the grocery store, and encrypted email and secure websites in the financial sector – there are several underlying trends in ICT use that are evident in the private sector as a whole. This chapter identifies some of the most important changes in recent use of ICTs by business in general, but also explores variations in ICT use at the industry level.

One sweeping change occurring in the private sector is that businesses are becoming increasingly interlinked through ICTs. Whether by exchanging e-mail, linking partners through their websites, or streamlining transactions such as online purchasing and selling, businesses are attempting to increase the efficiency of their operations. Such practices can therefore represent an important source of growth in many industries. Of course, the introduction of new technologies and corresponding changes in business practices are not always successful, as this chapter will demonstrate. Overall, however, the findings portray a dynamic Canadian private business sector.

The Canadian workforce has felt the impacts of businesses' increased connectivity first hand, through both the variety of ICTs used, as well as the increased intensity of their use. This has important implications for employers, who need to find workers who possess or are capable of attaining skill sets that reflect their companies' ICT needs, and who must also provide the training and facilities necessary to help employees take advantage of emerging technologies.

Data come from the Survey of Electronic Commerce and Technology (SECT) which has been conducted each year since 1999. For 2002, the survey covered the entire economy, with the exception of crop and animal production and support activities, fishing, hunting and trapping, and local governments. Responses were collected from approximately 21,000 enterprises. Respondents were asked to indicate their ICT use, the value of orders received over the Internet, as well as the perceived benefits and barriers to e-commerce.

6.1 Use of ICTs

The use of ICT goods and services, including desktop PCs, e-mail, and the Internet have now become a regular part of working life for the majority of Canadians in the workforce. The proportion of employees using such ICTs is particularly high in tertiary services industries (with the exception of accommodation and food services), as compared to primary or secondary industries.

Table 6.1.1 Percentage of employees with access to personal computers, e-mail and Internet, by industry, 2000-2002

	Employee access to PC, workstation or terminal			Employee access to e-mail			Employee access to the Internet		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
					%				
Forestry, logging, & support activities*	27.8	49.1	42.5	15.2	36.8	34.0	17.1	41.8	37.0
Mining and oil and gas extraction	55.7	43.5	55.1	39.8	36.3	50.4	38.8	35.9	49.5
Utilities	75.6	83.2	76.8	56.6	76.9	72.1	53.2	76.1	71.4
Construction	..	48.1	55.1	..	34.4	36.0	..	38.5	40.3
Manufacturing	40.7	42.8	44.6	27.9	31.5	35.1	27.0	31.0	34.6
Wholesale trade	66.5	68.8	69.9	43.9	50.9	54.6	44.7	52.9	57.1
Retail trade	47.8	57.1	60.1	21.4	28.0	35.8	24.4	32.9	41.4
Transportation and warehousing	50.5	46.7	48.0	26.8	30.5	32.8	28.0	36.8	37.0
Information and cultural industries	88.7	89.6	91.9	78.9	83.3	87.7	79.5	83.5	88.3
Finance and insurance	78.7	82.0	77.6	65.2	67.1	69.1	60.9	64.2	66.7
Real estate and rental and leasing	57.5	58.7	65.5	35.7	39.7	47.2	36.3	40.1	51.7
Professional, scientific & tech. services	89.4	91.2	93.7	75.8	83.1	85.6	75.4	83.3	86.8
Mgmt. of companies and enterprises	49.0	63.8	55.3	32.0	50.1	48.9	35.0	54.4	47.9
Administration and support, waste management & remediation	60.0	62.3	63.6	43.5	51.3	50.5	46.3	52.5	52.5
Educational services (private sector)	82.5	84.7	81.1	68.6	69.3	76.0	74.8	73.8	76.4
Health care and social assistance (private sector)	71.6	75.0	75.7	35.4	38.7	46.3	36.8	46.5	50.4
Arts, entertainment and recreation	56.8	64.0	71.2	36.2	47.5	64.5	40.1	48.3	65.2
Accommodation and food services	27.1	34.0	27.4	11.7	16.6	11.9	13.2	19.8	14.3
Other services (except public admin.)	54.7	59.5	63.9	30.8	36.5	44.0	33.4	40.3	48.8
Total private sector	**58.4**	**62.9**	**65.2**	**37.8**	**44.7**	**49.4**	**39.1**	**47.5**	**52.2**

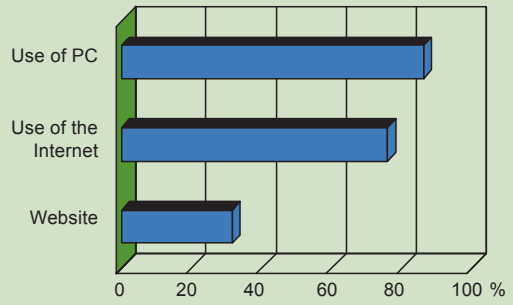
Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

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

"The turbulence of the dot-com boom-and-bust, and ensuing technology sector downturn, has masked a sea of change in the overall economy, brought about by the large scale integration of Internet-based business processes into the industrial mainstream" (Canadian e-Business Initiative 2003).

Although the introduction of personal computers (PCs) has occurred over several decades and their use has become standard practice in many types of business, PC use continues to grow. As of 2002, 85.5% of all private sector businesses used PCs. The biggest change in recent years, however, has been use of the Internet, which has risen dramatically in the last few years alone. In 1999, only about half (53.0%) of enterprises used the Internet, but by 2002 more than three-quarters of firms (75.7%) were online, indicating that the Internet has become a standard business tool. In fact, firms using the Internet accounted for 97% of economic activity in 2002. The rapid increase in Internet use was facilitated in part by the widespread presence of PCs at the time the Internet was introduced and marketed to businesses on a wide scale, beginning in the mid-1990s. The use of websites also increased substantially, from 22.0% of firms in 1999 to 31.5% by 2002. Web sites can be used by businesses for more sophisticated Internet applications, such as online purchasing and selling. While only 7.5% of businesses used the Internet to sell goods or services online in 2002, they accounted for nearly 30% of gross business income. And those operating websites, while small in number, represent a large part of the Canadian economy, accounting for 83% of gross business income. The majority of private sector businesses, however, have yet to implement such practices as we shall see later in this chapter.

Figure 6.1.1 Business penetration of ICTs, 2002



"The spread of Internet-based business networks across the economy has also been largely responsible for the highest levels of sustained economic growth and productivity improvement in North America in almost half a century… Such powerful changes, however, typically produce winners and losers - firms, sectors or countries that respond aggressively and effectively to the need to enhance their competitiveness through investment in technological innovation, and those who do not" (Canadian e-Business Initiative 2003).

The relatively high economic significance of those enterprises operating websites and using the Internet to sell, suggests that patterns of ICT use may be closely tied to firm size, with more sophisticated ICTs and applications concentrated in the hands of larger enterprises. Differences in ICT use by firm size, as well as industry type, are examined in the sections that follow.

6.1.1 Use by enterprise size

The use of several types of ICTs and ICT-based applications bears strong relationships to firm size. The Internet is used by over 90.0% of large and medium-size firms, whereas about three-quarters (73.1%) of small firms used the Internet in 2002. Patterns of website use by firm size are also clearly evident. Developing an effective web presence often requires investment and knowledge in areas of expertise such as web design, communication and Internet-based marketing. While more than three-quarters (77.1%) of large firms had a website, only 26.6% of small firms operated their own website in 2002.

Table 6.1.1.1 Use of ICTs, by enterprise size, 2002

	Large	Medium	Small
		%	
Use of Internet	99.0	91.8	73.1
Website	77.1	61.8	26.6

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Note: Size boundaries are based on number of Full Time Employees. Small Firms are represented by firms with 0-19 Full-Time Employees, Medium firms consist of 20-99 Full-Time Employees (20-499 in the Manufacturing sector) and Large firms are defined as those with 100 or more Full-Time employees (500 or more for Manufacturing).

While firm size may help explain patterns of ICT use, studying firm size in isolation would mask other factors shaping businesses' level of connectivity. Indeed, significant variability exists in the use of ICTs by industry type, and these patterns are examined in the next section.

6.1.2 Use by industry

Information and cultural industries (NAICS 51) include enterprises engaged in publishing, motion picture and sound recording, broadcasting and telecommunications, and information services and data processing. Many of these industries belong to the ICT sector.

ICTs often confer distinct advantages to different industries, something that becomes evident when the use of PCs, the Internet and websites are compared across industries. As has been the case for several years, the information and cultural industries continue to be a leader in computerization in the workplace.

However, other industries have also been rapidly gaining ground. Private sector educational services rank among the leaders in PC, Internet and website use and manufacturing industries

have also moved quickly to take advantage of ICTs, especially with respect to websites where growth has been particularly high. Utilities industries are another leading sector and professional, scientific and technical services industries also have high rates of PC and Internet use, although their use of websites still approximates the private sector average.

Table 6.1.2.1 Use of ICTs, by industry, 2000-2002

	Use of personal computers			Use of the Internet			Website		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
					%				
Forestry, logging, & support activities*	65.5	81.7	73.8	42.3	68.2	64.3	4.7	15.3	9.4
Mining and oil and gas extraction	94.0	87.8	87.9	78.0	77.6	81.8	22.6	39.2	35.5
Utilities	98.7	96.9	93.4	80.8	93.7	93.0	31.3	45.1	47.4
Construction	..	79.8	82.9	..	70.5	68.5	..	24.3	22.9
Manufacturing	89.2	92.6	95.9	77.5	82.4	88.5	38.0	45.9	54.7
Wholesale trade	89.9	91.8	93.2	75.3	81.7	86.0	34.3	37.6	40.7
Retail trade	75.5	81.5	83.0	52.7	65.2	72.1	22.9	26.7	30.7
Transportation and warehousing	75.6	72.8	76.7	57.5	57.4	63.7	12.9	11.1	15.8
Information and cultural industries	94.4	98.0	98.1	92.7	92.9	96.7	54.5	65.1	67.5
Finance and insurance	84.5	88.4	84.9	75.9	82.0	78.5	34.4	47.8	43.2
Real estate and rental and leasing	70.9	73.0	76.6	51.2	53.4	64.7	21.9	22.3	25.0
Professional, scientific & tech. services	94.8	94.7	96.3	84.0	90.7	92.4	30.0	31.9	33.4
Mgmt. of companies and enterprises	62.9	72.2	66.3	52.9	63.1	59.0	16.9	13.8	23.2
Administration and support, waste management & remediation	87.2	88.3	82.1	75.0	80.0	73.1	32.7	39.7	35.1
Educational services (private sector)	94.9	97.9	95.5	89.2	93.0	94.9	69.7	61.7	74.4
Health care and social assistance (private sector)	90.3	92.0	93.8	61.7	70.4	74.6	15.6	18.6	18.2
Arts, entertainment and recreation	87.2	92.2	89.2	69.2	81.5	86.7	36.0	45.8	51.0
Accommodation and food services	66.5	67.1	68.7	44.0	48.0	58.1	18.5	20.1	21.7
Other services (except public admin.)	76.4	77.5	81.2	51.8	58.6	67.6	22.3	24.5	30.4
Total private sector	**81.4**	**83.9**	**85.5**	**63.4**	**70.8**	**75.7**	**25.7**	**28.6**	**31.5**

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

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

While not among the overall leaders in Internet use, the accommodation and food services and real estate, rental and leasing industries experienced the strongest increase in Internet use between 2001 and 2002. Interestingly, a few industries experienced drops in Internet and website use between 2001 and 2002, albeit relatively slight. These declines may suggest that some firms invested in Internet use and websites but found them not to be productive or suited for their business. They may also suggest the entrance of new businesses that have yet to take advantage of such ICTs. Barriers and benefits to electronic commerce, as well as the nature and size of this phenomenon, are explored next.

6.2 E-commerce

Adoption of ICTs, such as the Internet and websites, opens the door to a relatively recent yet potentially powerful application, electronic commerce. By presenting the opportunity to streamline purchasing and selling activities and reduce associated transaction costs, increase interaction with other businesses and expand customer base beyond traditional markets, e-commerce can transform existing means of business.

Because electronic commerce occurs in many forms, and has evolved over a short period of time, one of the biggest challenges to understanding its significance is through measurement. Having developed frameworks and definitions through international collaboration and coordination, the role of e-commerce in the economy on a wide scale - as well as its importance to particular sectors of the economy - can be more accurately portrayed.

The Survey of Electronic Commerce and Technology defines e-commerce as ***sales over the Internet, with or without online payment****.* ***Included*** *is the value of orders received over the Internet.* ***Excluded*** *are sales using electronic data interchange over proprietary networks and transactions conducted on automatic teller machines. The value of financial instruments transacted on the Internet such as loans and stocks are not considered e-commerce sales, but the service charges received for conducting these transactions over the Internet are included.*

While only 7.5% of private sector firms used the Internet to sell in 2002, this figure varies considerably by industry. A substantially higher proportion of businesses (31.7%) used the Internet to make online purchases, and these firms accounted for 65.1% of economic activity, suggesting again that e-commerce activities tend to be concentrated among large firms.

Although not occurring among the majority of firms in any one sector, e-commerce sales represent an important activity for some. Private sector educational services lead the way, with just over one-fifth of enterprises (21.3%) selling over the Internet in 2002. The information and cultural industries were also a leader in

this area, with 18.8% of firms selling. Sales in this industry were also concentrated in large firms, as those selling accounted for nearly half (48.7%) of all economic activity in that sector. It should be noted that even though this industry is a leader in the proportion of firms involved in e-commerce sales, that pro-

Table 6.2.1. Percentage of enterprises using the Internet to purchase and sell, by industry, 2000-2002

	Use of the Internet to sell			Use of the Internet to purchase		
	2000	2001	2002	2000	2001	2002
			%			
Forestry, logging, & support activities*	1.6	4.3	5.0	4.5	11.0	20.1
Mining and oil and gas extraction	0.4	0.2	3.2	20.4	14.5	26.4
Utilities	4.6	1.4	1.6	25.5	31.5	41.6
Construction	..	0.7	4.1	..	16.7	26.8
Manufacturing	8.2	11.7	12.1	21.3	29.1	40.5
Wholesale trade	13.5	12.9	12.6	22.9	26.4	36.3
Retail trade	8.7	10.8	11.4	13.5	16.9	29.1
Transportation and warehousing	2.0	2.2	3.6	15.0	11.6	19.2
Information and cultural industries	18.9	20.1	18.8	52.7	51.8	59.9
Finance and insurance	7.3	9.6	8.0	20.2	24.9	36.6
Real estate and rental and leasing	4.8	7.3	4.1	8.8	13.4	19.8
Professional, scientific & tech. services	7.2	5.8	7.8	35.8	42.1	50.6
Mgmt. of companies and enterprises	1.4	4.8	5.9	8.5	8.4	21.1
Administration and support, waste management & remediation	6.4	10.7	11.0	22.5	30.9	28.5
Educational services (private sector)	15.6	14.0	21.3	41.0	39.3	46.1
Health care and social assistance (private sector)	1.3	0.6	1.4	14.4	20.0	29.5
Arts, entertainment and recreation	5.3	10.0	14.1	15.9	23.2	35.6
Accommodation and food services	5.1	3.7	4.4	10.1	9.4	18.2
Other services (except public administration)	3.5	3.6	4.4	10.5	14.8	23.4
Total private sector	**6.4**	**6.7**	**7.5**	**18.2**	**22.4**	**31.7**

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

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

portion is not growing. This in itself is reflective of the private sector as a whole. Growth in the proportion of firms selling has been slow, perhaps reflecting the volatility of the e-commerce market. In 2002 for instance, for every ten firms that started selling goods or services over the Internet, seven stopped. The market is characterized by increased volume, but the total number of sellers is not growing substantially.

The use of online purchasing, on the other hand, has been growing steadily in many sectors. The information and cultural industries (59.9%) and private sector educational services (46.1%) are once again leaders in this area. While the professional, scientific and technical services industry ranked near the private sector average for online sales, this industry was much more active in online purchasing, with over half of firms (50.6%) involved in this aspect of e-commerce.

6.3 The value of Internet sales

E-commerce still represents a very small share of overall economic activity. The $13.3 billion in Internet-based orders, with or without online payment, represented about 0.6% of total economic activity in 2002. This proportion has risen steadily however, and amounts to three times the proportion from 1999 when e-commerce accounted for approximately 0.2% of total economic activity.

Wholesalers reported the biggest increase and were the overall leaders in Internet sales, taking in $3.7 billion in orders in 2002. Manufacturing industries did not report a marked increase but still remained among the leaders in Internet sales, together with transport and warehousing, and retail trade. Each of these industries reported close to $2 billion in Internet sales in 2002. Combined, all four industries dominated the private sector, accounting for 70% of all Internet sales in 2002.

Internet sales represented the highest share of total sales in the transport and warehousing industry (2.4%). This industry was followed by professional, scientific and technical services (1.4%), information and cultural industries (1.2%) and wholesale trade (1.1%).

Business-to-business (B2B) sales continue to account for the vast majority (72.6%) of Internet sales, while the share of business-to-consumer (B2C) sales, albeit growing, stood at only 27.4% in 2002. B2C sales were of particular importance however to the arts, entertainment and recreation and retail trade sectors, where they accounted for 97.0% and 85.0% of Internet sales respectively.

Although access to international markets is sometimes identified as a key advantage of electronic commerce, the strongest gains in e-commerce sales occurred in the domestic market. E-commerce sales within Canada rose 35.1% from the

previous year to $10.4 billion in 2002. Over the same time, online sales for export rose only slightly to $2.9 billion, and accounted for just over one-fifth of total e-commerce sales. Export sales were most important to the retail trade sector, which held a one-third share of the total online export market. In fact, over half (56.0%) of the retail trade industry's online sales were destined for export in 2002.

Table 6.3.1. Internet sales, by selected industry, 2000-2002

	Internet sales with or without on-line payment			Internet sales as a % of total operating revenue		
	2000	2001	2002	2000	2001	2002
	millions of dollars			*%*		
Manufacturing	1,305	1,680	1,957	0.2	0.3	0.3
Retail trade	890	1,485	1,718	0.4	0.6	0.5
Information and cultural industries	274	389	829	0.5	0.6	1.2
Accommodation and food services	175	259	166	0.6	0.3	0.4
Professional, scientific and technical services	335	424	983	0.6	0.7	1.4
Finance and insurance	635	624	852	0.3	0.3	0.4
Transport and warehousing	990	937	1,924	1.5	1.4	2.4
Wholesale trade	1,041	1,915	3,693	0.3	0.6	1.1
Other industry sectors	1,601	2,676	1,217	0.3	0.5	0.2
Total private sector	**7,246**	**10,389**	**13,339**	**0.4**	**0.5**	**0.6**

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Table 6.3.2 Internet sales by type, 2000-2002

	2000	2001	2002
		%	
Enterprises selling over the Internet	6.4	6.7	7.5
		% of total Internet sales	
Business-to-business (B2B) sales	80.0	77.8	72.6
Business-to-consumer (B2C) sales	20.0	22.2	27.4
Sales to foreign businesses and consumers	16.6	25.8	21.9

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Internet sales depend, of course, on the presence and effectiveness of websites that offer goods and services. While 31.5% of private sector enterprises operated websites in 2002, these sites often vary considerably in terms of the features they use to attract or retain customers.

Table 6.3.3 Characteristics of enterprise websites, 2000-2002

	2000	2001	2002
		%	
Interactivity (2-way communication)	23.5	26.9	23.1
Secure website	17.7	19.3	22.0
Digital products or services	12.7	13.4	12.0
Privacy policy statement	11.7	13.5	11.5
Online payment capability	8.0	9.6	10.0
Access via wireless mobile device	..	3.6	4.9

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

One of the more popular features of websites is interactivity, or two-way communications capability. This feature was employed by nearly one-quarter (23.1%) of firms operating websites in 2002, often consisting of e-mail addresses or forms that potential customers use or complete to obtain service. Secure websites, which prevent information from being viewed on the Internet by third parties, were the only other feature common to more than one-fifth of websites in 2002. This feature may become more popular as businesses attempt to address customer concerns about fraud and privacy. Interestingly, only 10.0% of firms operating websites were able to accept payment directly online.

6.4 Barriers to e-commerce

While e-commerce continues to grow, the majority of businesses in the private sector do not engage in online sales or purchasing, and these activities only account for a very small fraction of total economic activity. The reason most often cited by businesses that use the Internet but do not engage in e-commerce is that they feel that their goods do not lend themselves to Internet transactions (Table 6.4.1). This perception may be gradually changing, however, as 2002 marked the first time when fewer than half (48.7%) of Internet users who do not use e-commerce reported that this was a factor in their decision not to buy or sell online. The second most popular reason why business users of the Internet did not buy or sell online was that they preferred to maintain their current business model (36.2%), often meaning that they did not wish to change customer

Standard definitions of e-commerce have been developed through the efforts of the WPIIS and in consultation with policy makers, business executives, statisticians, and data users. The nature of data collection in different surveys should be taken into consideration, however, when attempting to make international comparisons. For example, surveys may differ in coverage of sectors, firms (establishment/enterprise), and timing, as well as the size of the firms sampled (OECD 2002).

Although the OECD provides measures of business Internet penetration that are based on a slightly different sample of businesses than in Canada (the OECD publishes estimates of Internet penetration among businesses with 10 or more employees; Canadian statistics published here reflect all businesses exceeding a low-revenue threshold), available international data suggest some interesting trends:

In 2001, Internet penetration was particularly high in Denmark (93%) and other Nordic countries including Finland, Sweden and Norway. Internet penetration was also very high in Japan (91%), Australia (86%) and New Zealand (84%). In general, penetration rates exceeded 80% in many OECD countries.

The development of websites is occurring particularly rapidly in Northern Europe, followed by Australia, New Zealand and Canada, but is much less common in Italy and Spain.

On average, twice as many businesses use the Internet to purchase than to sell.

The Nordic countries are also leaders in Internet sales as a percentage of total sales. In Sweden, 13.3% of total sales were electronic transactions (conducted over any computer-mediated network) in 2000. Using a narrower definition - electronic sales conducted over the Internet only - total Internet sales generally fell in the range of 0.3% to 2.0% of total sales among OECD countries. Norway emerged as a leader in 2001 with a 2.0% share of total sales (excluding the financial sector) conducted over the Internet, followed by the United Kingdom (1.8%), Spain (1.4%) and Austria (1.0%) (figures from 2000). The Canadian share, as mentioned earlier, is small but growing (from 0.2% in 1999 to 0.6% in 2002).

The United States uses a broader definition (sales over the Internet, extranet, EDI and other on-line systems) and covers selected industries. Using this broader definition, e-commerce accounted for 1.5% of U.S. retail sales in the second quarter, 2003 (U.S. Census Bureau 2003).

or supplier relationships, typically occurring through personal interaction. Just over one-fifth (20.1%) of firms cited security concerns as a reason not to engage in e-commerce, representing an increase from years prior. Recent events that have captured attention including hacking, denial of service attacks and loss or theft of confidential information may have heightened both businesses' and consumers' awareness of security issues (Ellison and Clark 2001).

Table 6.4.1 Barriers to e-commerce, 2000-2002

Reasons why Internet users do not use e-commerce	2000	2001	2002
		%	
Goods do not lend themselves to Internet transactions	58.6	54.7	48.7
Prefer to maintain current business model	33.1	35.2	36.2
Security concerns	15.6	14.9	20.1
Cost of development and maintenance is too high	10.0	10.3	15.2
Lack of skilled employees	9.5	9.1	12.1
Customers are not ready	10.7	9.9	12.0
Uncertain about benefits	8.4	7.5	8.1
Concern about competitors analyzing company information	5.8	6.5	8.0
Suppliers not ready	6.2	5.6	6.5
Internet available to us is too slow	4.3	5.3	5.8

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Nearly half (45.3%) of households accessing the Internet in 2001 identified that they were very concerned about the security of their Internet transactions and 38.5% were very concerned about their privacy on the Internet (Household Internet Use Survey). These concerns may contribute to consumers' reluctance to shop online. Businesses, business associations and governments are working to develop and raise awareness of privacy and security policies and legislation in an effort to instill and develop consumer confidence (Ellison and Clark 2001).

Summary

This chapter demonstrates that a number of ICTs have become integral parts of Canadian business in recent years, but with respect to electronic commerce there is still plenty of room for growth. Clearly, not all businesses utilize ICTs and pursue e-commerce with the same vigor. Distinct differences may be identified by both firm size and industry type.

Although use of the Internet is standard among large- and medium-size firms in the private sector, small firms are significantly less likely to go online. Ownership of websites also tends to be much more prevalent among large enterprises. These trends may change as smaller firms recognize the potential of such ICTs (and their associated applications) as important business tools and if, and when, they become more affordable.

However, the findings of this chapter also stress that not all ICTs are suited to all business environments. A large number of businesses, for instance, use the Internet but do not engage in e-commerce. Nearly half of the enterprises within this group indicated that they feel their goods and services do not lend themselves to Internet transactions. If this perception continues to hold, there will be little impetus to change existing practices. To what extent these perceptions are real, in the sense that businesses have been able to measure and determine that e-commerce is not appropriate for their business, and to what extent these barriers are cultural, perhaps resulting from lack of information or reluctance to change, is a question that warrants further evaluation (Charles, Ivis and Leduc 2002).

Variation in the use of ICTs across industries also points to the need to examine the potential of ICTs at a level of detail sufficient to understand reasons why some technologies may be advantageous to particular types of businesses, but may not be appropriate in other environments. Evidence from this chapter suggests already that differences between industry groups can be quite significant, and leading sectors in ICT adoption have been identified.

At the macroeconomic scale, the impacts of adoption of various ICTs in terms of changes in business organization and efficiency are areas that also warrant further study. Spurred by competition and the quick pace of change on the technological front, the nature, role and utility of ICTs in the business world are evolving very rapidly.

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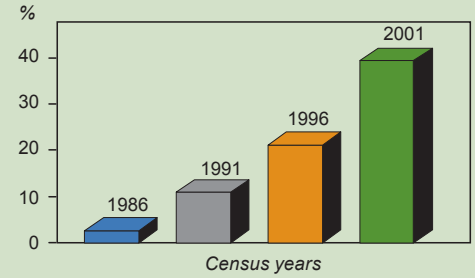
6.5 Computer adoption by Canadian farmers

Verna Mitura is an analyst in the Agriculture Division, Statistics Canada. Using data from the Census of Agriculture, she presents an analysis of ICT use in the farming business.

Farmers in Canada have been adopting computer technology for farm management applications at a rapid rate. In 1986, when computers were generally being introduced to Canadian business, 2.7 % of Canadian census-farms were using computers for farm management. By 1991, 11.0 % of census-farms had embraced computer technology and the adoption of computers for farm management has doubled every five years since, reaching 39.4 % by 2001 (Figure 6.5.1). This may seem relatively low given that nearly 60.0% of Canadian households had a computer in 2001, however until recently, it was simply not as practical for some rural areas to use computers, as was in the urban cities.

In 2001, more than two-thirds of census-farms with receipts of at least $250,000 used a computer to manage the farm business (Statistics Canada 2001). A recent study of computer technology in Canadian farm businesses found that the probability of computer adoption for farm management increased with farm size (in terms of gross receipts), but decreased with the age of the operator. The adoption of computer technology for farm management was also seen to increase for female operators who work part-time off the farm or run another business (Sabuhoro and Wunsch 2003).

Figure 6.5.1 Computer use by census-farms, Canada, 1986, 1991, 1996, 2001



Since 1986, the Census of Agriculture has collected data on the use of personal computers in the business management of agricultural operations. For the first time in 2001, the census collected information on the types of computer applications used in agricultural operation. Farm operators refer to those persons responsible for the day-to-day management decisions made in the operation of the census farm or agricultural operation. Up to three farm operators could be reported per farm.

Quebec census-farms have the highest computer adoption rate

In 2001, Quebec had the highest proportion of census-farm computer use at 47.7 %. This is an improvement for the province given that in 1991, Quebec was ranked eighth of the ten Canadian provinces in computer adoption and third by 1996 (Figure 6.5.2 and Table 6.5.1). It would be instructive to examine why computer adoption rates are so high on Quebec census farms, since Quebec tends to have relatively low household Internet penetration rates. Since 1991, Alberta has consistently ranked second in computer use by census-farms. The Atlantic provinces and the Prairie provinces of Saskatchewan and Manitoba fall below the national average.

Figure 6.5.2 Computer use by census-farms, by province, 2001

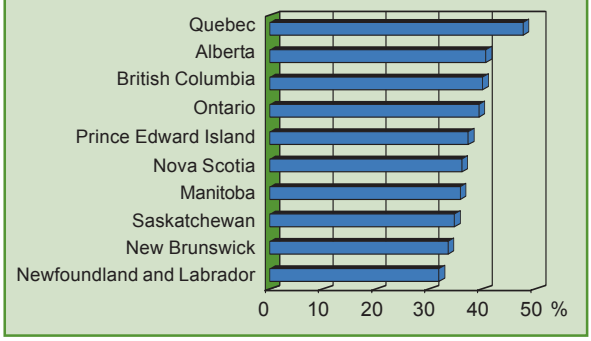


Table 6.5.1 Computer use on census-farms, by province, 1991, 1996, 2001

	1991		1996		2001	
	%	*Rank*	%	*Rank*	%	*Rank*
British Columbia	14.3	1	23.6	1	40.1	3
Alberta	12.2	2	22.9	2	40.7	2
Saskatchewan	11.1	4	19.9	6	34.8	8
Manitoba	8.6	9	18.9	8	35.9	7
Ontario	11.3	3	20.9	4	39.4	4
Quebec	9.1	8	22.1	3	47.7	1
New Brunswick	9.5	7	17.6	9	33.6	9
Nova Scotia	10.3	5	19.9	7	36.2	6
Prince Edward Island	8.1	10	20.3	5	37.4	5
Newfoundland and Labrador	9.8	6	15.1	10	31.9	10
Canada	**11.0**	**...**	**21.2**	**...**	**39.4**	**...**

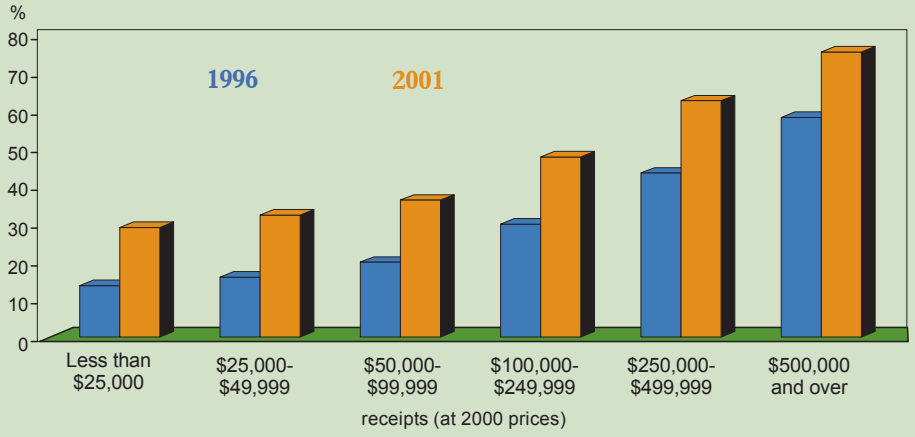
Source: Census of Agriculture, Agriculture Division, Statistics Canada.

Gross farm receipts are reported in 2000 constant dollars. The level of education is based on the highest level of schooling obtained by the farm operator, i.e. the highest grade or year of elementary or secondary school attended, or the highest year of university or other post-secondary institutions (non-university) completed. University education is considered to be a higher level of schooling than other post-secondary (non-university). The attainment of a degree, certificate or diploma is considered to be at a higher level than years completed or attended without an educational qualification. For the purposes of this analysis, less than high school includes those operators for whom the highest level of schooling is less than Grade 9; high school includes those for whom the highest level of schooling is between grades 9 and 13.

Computer use by census-farms rises with farm receipts and level of education

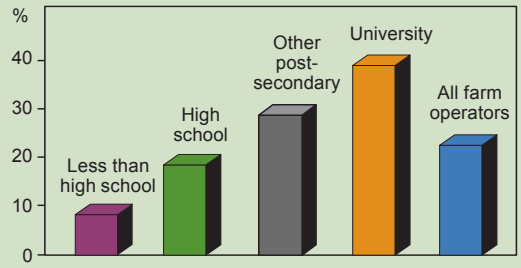
The proportion of operators using computers in the management of their farming business increases with the value of farm receipts and their level of education. In 2001, approximately 30.0% of operators with receipts of less than $50,000 were using computers. There is a significant upward trend in computer use as the farm receipts class rises from $50,000 to over $500,000. In 2001, 36.0% of operators with farm receipts ranging from $50,000 to $99,999 used computers while 76.0% of farmers with sales of $500,000 and over used computers in the management of their farming operations (Figure 6.5.3) (Statistics Canada 2001).

Figure 6.5.3 Computer use by census-farms, by receipts class, 1996, 2001



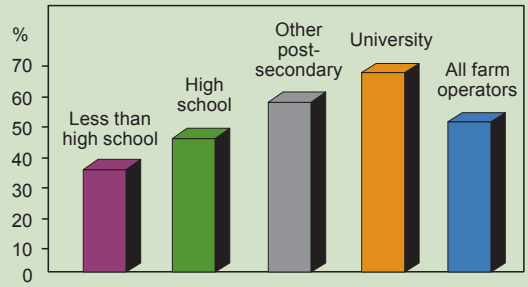
In 1996, 40.2% of the farmers in Canada with a university education used a computer for farm business management, while only 19.2% of farmers with high school education did so (Figure 6.5.4) (Statistics Canada 1996). This trend is also apparent for larger-scale farms – those with gross farm receipts exceeding $250,000 – albeit, these farms are already more likely to adopt computers. There are approximately 44 thousand larger-scale farms in Canada (11.3 % of all census-farms). Sixty-five percent of larger-scale farmers with a university education were using computers for their farm business, compared to 44.0 % of those with high school education (Figure 6.5.5).

Figure 6.5.4 Computer use by census-farm operators, by level of education, 1996



Source: Census of Agriculture, Agriculture Division, Census of Population, Statistics Canada.

Figure 6.5.5 Computer use by larger-scale farm operators, by level of education, 1996



Source: Census of Agriculture, Agriculture Division, Census of Population, Statistics Canada.

The future of farming: "virtual agriculture"

The main computer applications for Canadian farm business management today include financial accounting or bookkeeping (77.6%), browsing the Internet (70.4%), word processing (64.6%), e-mail (63.2%), and crop and livestock record-keeping (40.9%). Operators who used the computer to connect to the Internet represented 28.0% of all operators of census-farms in Canada. This is generally comparable to the adoption of the Internet in the United States, where 29.0% of US census-farms had Internet access in 1999 (USDA 2001).

The Internet provides Canadian farmers with a powerful information tool for gaining market knowledge in such areas as "real-time" market pricing, weather reports, and market sales. It is also a significant resource for researching production and other related information, as well as direct communication with customers and suppliers of farm products.

The role of the computer on the farm is advancing to an entirely new level of application which some academics have termed "virtual agriculture" (Holt and Sonka 1994). The power of the memory and functionality of computers is enabling virtual teams of agricultural specialists (researchers, universities, farmers, marketers, processors, retailers and consumers) to integrate an entire agricultural value chain from production to consumption. This means integration into the value chain of many areas of agriculture including food products, agri-industrial goods (i.e. ethanol, car parts, environmental packaging, and beauty products to name a few) and agri-tourism. Farmers will become a crucial link in this value chain which may improve upon their financial security and lower production and marketing risk. Computers will be the driving force behind this complex communication and coordination system and may be as important to agricultural change in the 21st century as mechanization was to the 20th century. Farmers who choose not to be part of these developments may be excluded from significant opportunities.

On-going computer education and training will be important for farm families. Given the distance of some farm families from major centres, on-line computer training combined with local support services will be important. One barrier keeping some farmers from adopting the Internet in Canada is the lack of access to telecommunications infrastructure in rural areas. For example, high-speed Internet is not yet a possibility for many farmers. As technology advances, it is expected that these barriers would be overcome.

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6.6 Building a digital workforce – technology, training, and productivity

Tony Fang is an analyst in the Business and Labour Market Analysis Division, Statistics Canada. He profiles technology and training in the workplace, from the perspective of both employers and employees.

As we become immersed in information and technology, Canada's economic prosperity, development, and social and cultural cohesion depend as never before on the knowledge, training, skills and ideas of its citizens. These skills are required to move forward in what we now know as the Information Society. This study examines data from the Workplace and Employee Survey (WES) to determine how technology and training are linked in the workplace. The use of ICTs by employers and employees, as well as the potential impact of technology on both firm performance (innovation, productivity and competitiveness) and employee outcomes (wages, job and monetary satisfaction) will be discussed, together with some recommendations for the use of technology and training in the workplace.

The Workplace and Employee Survey (WES) is a linked file consisting of both employer and employee components. Employers are sampled by physical location and employees are then sampled within each location from employer-provided lists. The survey excluded business locations in the Yukon, Nunavut and the Northwest Territories, along with agriculture, fishing, road, bridge and highway maintenance, government services and religious organizations. The initial wave of WES was first conducted during the summer and fall of 1999. Responses were received from 6,322 business locations and 23,540 employees. Since the WES is a longitudinal survey, it will be repeated for six years in the same business locations with two-year rotating panels of their employees.

The survey covers a broad range of topics such as technology adoption, innovation, human resources practices, labour turnover, and business strategies among others. Socio-demographic characteristics such as employee age, occupation, and education are also captured.

Computer use in the workplace varied by industry

Just over 60% of employees used a computer at work in 1999 (Table 6.6.1). This proportion varied by industry and firm size. Industries in finance and insurance, information and cultural and business services were leaders in employee computer use, while industries in construction, labour intensive tertiary manufacturing, retail trade and commercial services were clearly lagging behind.

Not surprisingly, the proportion of employees using computers increases by firm size. The larger the workplace – based on the number of employees – the higher the proportion of employees using computers (Table 6.6.2).

Table 6.6.1 Percentage of computer users in the workplace, by industry, 1999

Industry	%
Forestry / Mining	54.9
Labour intensive tertiary manufacturing	39.9
Primary product manufacturing	49.6
Secondary product manufacturing	56.4
Capital Intensive tertiary manufacturing	67.6
Construction	37.6
Transportation/ wholesale/ storage	65.5
Communications / utilities	66.8
Retail trade & commercial services	47.2
Finance and insurance	93.9
Real estate/ rental/ leasing	65.9
Business services	79.6
Education & health care	63.5
Information, cultural	86.1
Total	**60.8**

Source: Workplace and Employee Survey, Business and Labour Market Analysis Division, Statistics Canada.

There are differences between WES and the Survey of Electronic Commerce and Technology (SECT) estimates due to differences in survey methodology, reference periods, questionnaires, and sampling and non-sampling errors.

Table 6.6.2 Percentage of computer users in the workplace, by size, 1999

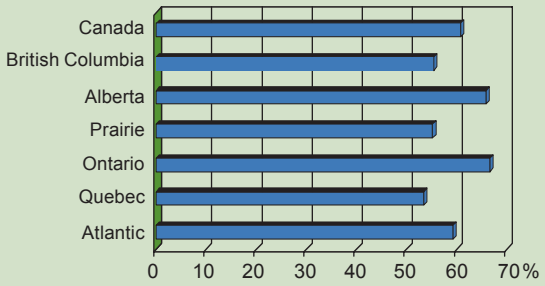
Size of business location	%
Fewer than 20 employees	55.8
Between 20 and 49 employees	56.6
Between 50 and 499 employees	59.9
500 or more employees	73.3
Total	**60.8**

Source: Workplace and Employee Survey, Business and Labour Market Analysis Division, Statistics Canada.

Proportion of computer users in the workplace highest in Ontario

Ontario had the highest proportion of computer users in the workplace (66.6%), followed by Alberta (65.8%) and the Atlantic region (59.2%). Quebec had the lowest proportion of employees using computers (53.4%), while about 55.0% of employees used computers at work in the Prairie region and British Columbia (Figure 6.6.1). Non-unionized workplaces have the same proportion of computer users (61.0%) as their unionized counterparts.

Figure 6.6.1 Percentage of employees using computers in the workplace, by region, 1999



Computer-related training in the workplace

A number of Canadian studies have established the possible link between technology and training. For example, Baldwin, Gray and Johnson (1996) reported that establishments in the manufacturing sector that introduced advanced technologies experienced an increase in their skill requirements as a result. This echoes the findings of Wannell and Ali (2002), namely that employees working in firms that have implemented new technology or software are more likely to receive either classroom or on-the-job computer-related training.

Two types of computer-related training supported by the employer will be examined here – classroom training and on-the-job training. Classroom training (sometimes called formal training) is defined as having a predetermined format, predefined objectives, specific content and progress that can be monitored or evaluated. On-the-job training is given during work hours and at the workplace (in a location that is not necessarily separate from the "production facilities").

Technology and training in the workplace are interrelated

Not surprisingly, the workplaces with a higher proportion of employees using computers were more likely to support computer-related training (Table 6.6.3). The finance and insurance (41.4%), information and cultural (25.7%), and communications and utilities (24.0%) industries were the most supportive of computer-related classroom training, while workplaces in construction (7.8%), real estate (8.6%), and labour intensive tertiary manufacturing (17.8%) industries were less likely to support this type of training. A similar pattern is observed for on-the-job training. However a slightly higher proportion of workplaces support on-the-job computer-related training than classroom training.

Table 6.6.3 Percentage of workplaces supporting computer-related training, 1999

Industry	Classroom	On-the-job
	%	
Forestry / Mining	16.5	18.3
Labour intensive tertiary manufacturing	17.8	15.6
Primary product manufacturing	23.3	26.6
Secondary product manufacturing	21.0	21.7
Capital intensive tertiary manufacturing	21.5	22.6
Construction	7.8	9.8
Transportation/ Wholesale/ Storage	17.2	25.1
Communications / Utilities	24.0	24.9
Retail trade & commercial services	9.3	16.9
Finance and insurance	41.4	47.1
Real estate/ Rental/ Leasing	8.6	12.8
Business services	17.7	23.9
Education & health care	16.0	20.0
Information, cultural	25.7	28.2
Total	**15.2**	**20.5**

Source: Workplace and Employee Survey, Business and Labour Market Analysis Division, Statistics Canada.

A clear link also emerges between the proportion of workplaces supporting computer-related training and firm size. Larger firms (500 or more employees) tend to train more, ranging from 84.1% for classroom training and 73.7% for on-the-job training, to only 11.0% for classroom training and 16.6% for on-the-job training in the smallest workplaces (fewer than 20 employees) (Table 6.6.4). As found by Turcotte et al. (2002), although small firms are far less likely to offer to train employees, those who do so train a slightly higher proportion of employees than large locations. This seems to indicate that the fixed costs (rental of facilities, hiring of instructors, etc.) associated with training may be a greater barrier for small locations.

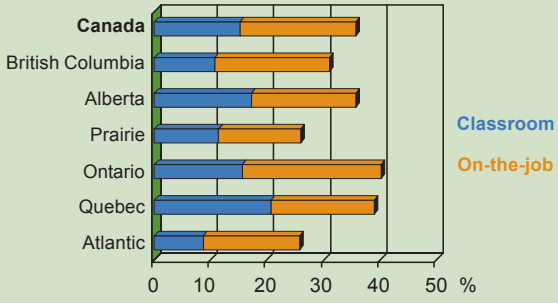
For classroom computer-related training, workplaces in Quebec are the most supportive (20.6%), followed by Alberta (17.2%) (Figure 6.6.2). The Atlantic (8.7%) and Prairie (11.4%) provinces are below the national average of 15.2%, while support for classroom training in Ontario stands at 15.5%. On the other hand, Ontario ranks highest for on-the-job training (24.7%). Only Quebec was more likely to support classroom training (20.6%) than on-the-job training (18.3%).

Table 6.6.4 Percentage of workplaces supporting computer-related training, by size, 1999

Size of business location	Classroom	On-the-job
	%	
Fewer than 20 employees	11.0	16.6
Between 20 and 49 employees	35.6	42.0
Between 50 and 499 employees	57.6	56.9
500 or more employees	84.1	73.7
Total	**15.2**	**20.5**

Source: Workplace and Employee Survey, Business and Labour Market Analysis Division, Statistics Canada.

Figure 6.6.2 Percentage of workplaces supporting computer-related training, by region, 1999



Older and younger workers less likely to receive training

Workers aged 16-24 years and those aged 55 and older are less likely to receive computer-related training (Table 6.6.5). Dryburgh (2001) cited various explanations for training differences by age. Although older workers tend to have lower educational attainment and are less likely to use computers at work, they are more highly represented in management and professional occupations which tend to have higher training rates. However, older workers are more likely to turn down training opportunities. Younger workers are likely experiencing the school-to-work transition and may take more part-time, temporary, or contract work which usually allows for fewer training opportunities.

Highly educated workers are more likely to receive training

Employees with university degrees are more likely to receive training than those with high school or even some post-secondary education. There are two plausible explanations for this result. The first is associated with trainability. High educational attain-ment may reflect a high ability to learn, so training opportunities are geared towards employees with higher education. The second explanation may be related to a human resource strategy which invests more (i.e. training) in core employees who are usually more highly educated. Full-time employees are also more likely to receive training. This is particularly the case for classroom training, where the proportion of full-time employees is double that of part-time employees (Table 6.6.5).

Employees in clerical/administrative and professional occupations are most likely to receive computer-related classroom training, compared with managerial, technical, marketing/sales and unskilled occupations. Overall, a higher proportion of employees receive on-the-job training than classroom training in all occupations except professional (Table 6.6.5). This suggests that a certain level of skill or formal training is required for professional occupations.

Female employees are slightly more likely to receive training than male employees for both classroom and on-the-job computer-related training. There are no discernible differences between immigrants and Canadian born workers with regards to receiving computer-related training.

The impact of computer use on employee satisfaction

The use of computers at work may have a profound impact on employees, both financially and psychologically, through higher compensation associated with higher productivity, organization of work, and innovative human resource management.

Hourly wage

Overall, workers who use computers are paid 41.2% more than those who do not (Table 6.6.6). The pay gap exists even after various personal characteristics (gender, marital status, immigrant status), job characteristics (occupation, years of work experience, job tenure, part-time status, and union/collective agreement status) and firm characteristics (firm size, industry group) are controlled for. The adjusted gap is 14.0%. This may indicate that computers do increase employee productivity, all else equal. However, some research suggests that unmeasured employee attributes associated with computer use accounts for the wage premium (Morissette and Drolet 1998; Autor, Levy and Murnane 2001).

Table 6.6.5 Percentage of employees taking computer-related training, as reported by employees, 1999

	Classroom	On-the-job
	%	
Employment status		
Full-time	9.4	9.2
Part-time	4.7	7.3
Occupation		
Manager	8.9	10.4
Professional	15.5	11.8
Technical / trades	5.6	6.1
Marketing / sales	2.2	5.7
Clerical / Administrative	15.8	17.3
Unskilled production worker	0.3	14.0
Educational attainment		
Less than high school	1.5	3.2
High school graduation	5.7	7.8
Some post-secondary education	8.8	9.0
Trade	5.9	8.4
College	11.7	10.8
Undergraduate degree	12.6	12.0
Professional degree	7.1	4.6
Graduate degree	15.2	10.1
Other educational attainment	7.0	6.9
Gender		
Male	6.9	6.9
Female	9.8	10.6
Immigrant status		
Yes	7.9	9.7
No	8.6	8.6
Age		
16-24 years	4.0	5.9
25-39 years	8.7	9.6
40-54 years	9.6	9.8
55 years and +	7.2	5.3
Size of business location		
Fewer than 20 employees	4.7	7.5
Between 20 and 49 employees	6.1	8.0
Between 50 and 499 employees	10.0	9.3
500 or more employees	13.8	10.8
Region		
Atlantic	7.9	8.3
Quebec	7.5	4.6
Ontario	9.5	10.4
Prairies	6.0	10.0
Alberta	11.1	11.1
British Columbia	6.4	9.6
Total	**8.4**	**8.8**

Source: Workplace and Employee Survey, Business and Labour Market Analysis Division, Statistics Canada.

Table 6.6.6 Employee satisfaction variables, by computer use and socio-demographic characteristics, as reported by employees, 1999

	Hourly wage ($)		Job satisfaction		Money satisfaction	
	PC	No PC	PC	No PC	PC	No PC
Employment status						
Full-time	21.4	15.4	3.3	3.2	2.9	2.9
Part-time	18.5	13.4	3.2	3.2	2.9	2.9
Occupation						
Manager	27.1	15.9	3.4	3.4	3.0	3.1
Professional	26.0	22.1	3.3	3.1	2.9	2.7
Technical / trades	18.6	15.8	3.2	3.2	2.9	2.8
Marketing / sales	12.5	9.5	3.2	3.1	2.9	2.8
Clerical / Administrative	14.8	12.2	3.3	3.1	2.9	2.9
Unskilled production worker	17.9	13.2	3.2	3.1	3.1	2.9
Educational attainment						
Less than high school	15.3	13.1	3.3	3.2	3.0	2.9
High school graduation	17.8	13.6	3.3	3.2	2.9	2.9
Some post-secondary education	17.9	13.8	3.2	3.1	2.9	2.9
Trade	19.3	16.7	3.3	3.2	3.0	2.9
College	19.4	15.7	3.2	3.1	2.9	2.8
Undergraduate degree	26.1	18.5	3.3	3.0	3.0	2.7
Professional degree	30.8	26.1	3.1	3.3	2.7	2.7
Graduate degree	31.4	20.5	3.4	3.2	3.0	2.8
Other educational attainment	20.8	15.0	3.4	3.1	3.0	2.7
Gender						
Male	23.9	16.4	3.3	3.2	3.0	2.9
Female	18.4	13.2	3.3	3.2	2.9	2.8
Immigrants						
Yes	20.7	14.9	3.3	3.2	2.9	2.9
No	22.1	14.4	3.2	3.1	2.9	2.9
Age						
16-24 years	11.8	10.3	3.1	3.0	2.8	2.7
25-39 years	19.2	15.1	3.2	3.1	2.9	2.8
40-54 years	23.7	16.0	3.3	3.2	3.0	2.9
55 years and +	24.0	16.1	3.4	3.3	3.0	3.0
Size of business location						
Fewer than 20 employees	17.3	13.4	3.3	3.3	2.9	2.9
Between 20 and 49 employees	18.3	13.2	3.2	3.1	2.8	2.8
Between 50 and 499 employees	21.3	15.4	3.3	3.1	2.9	2.8
500 or more employees	26.3	19.6	3.3	3.2	3.0	2.9
Region						
Atlantic	18.1	12.5	3.3	3.3	2.9	2.9
Quebec	19.9	15.1	3.3	3.2	3.0	2.9
Ontario	22.2	15.0	3.3	3.2	3.0	2.9
Prairies	18.4	13.3	3.3	3.1	2.8	2.8
Alberta	20.4	13.9	3.3	3.2	2.9	2.8
British Columbia	21.2	16.4	3.2	3.2	2.9	2.9
Total	**20.9**	**14.8**	**3.3**	**3.2**	**2.9**	**2.8**

Source: Workplace and Employee Survey, Business and Labour Market Analysis Division, Statistics Canada.

PC: with computer use; No PC: without computer use

Job satisfaction
Job satisfaction is a well-established predictor of effective commitment and higher productivity. Both job and monetary satisfactions are measured by a four-point scale (with 4 being very satisfied and 1 being very dissatisfied). Workers using computers generally view their work settings as more attractive than those who do not. This remains the case even after other personal, job and firm characteristics as described above are accounted for.

Monetary satisfaction
Workers using computers are also more satisfied with their compensation than those not using computers, even after adjusting for various personal, job and firm characteristics as before.

The impact of computer use on the workplace

Several studies on the workplace impacts of computer use have been undertaken using WES data. Turcotte, Léonard and Montmarquette (2002) found that training and innovation or the implementation of new technologies, are positively correlated. This positive correlation between technology and training on the employer side is also reflected on the employee side by the fact that those who use a computer at work are more likely to be trained.

In a similar spirit, Turcotte and Whewell (2002) examined the association between productivity gains and ICT use in Canadian workplaces. Taking advantage of the linked nature of the survey, their work departs from the existing literature in an important way: they investigate the extent to which investments in ICTs combined with investments in human capital affect the productivity of firms and the wages of workers. The analysis concludes that workplace productivity is strongly associated with computer-related investments and that these gains are significantly improved when the workforce is more educated and trained. Their results confirm that the type of training matters more than the quantity of training. Sizeable productivity gains can be made by combining investments in technology with investments in human capital, in particular providing computer training to less educated workers.

Summary

About 61% of employees used a computer at work in 1999. Industries in finance and insurance, information and cultural and business services were leaders in employee computer use. The proportion of employees using computers at work increased with firm size and in terms of regional differences, Ontario and Alberta led the way.

There is considerable evidence that technology and training in the workplace are interrelated. Most of the industries and regions with high computer use were

also likely to support computer-related training. Not surprisingly, small firms were less likely to offer training. When they did, however, they trained a slightly higher proportion of employees than larger locations. This suggests that the fixed costs of training may be a major barrier for smaller workplaces. Significant policy implications can be drawn given that small firms are among the fast growing in the Canadian economy, as well as the major source of employment growth.

The distribution of computer training also differed by employee characteristics. Older and younger workers, as well as less-educated workers, were also less likely to receive training.

Computer use has been found to have a positive impact on both workplace performance (such as innovation and productivity) and employee outcomes (such as hourly wage, job and monetary satisfaction). Interestingly, research based on the WES has shown that sizeable productivity gains can be achieved by combining technology investment with human capital investments, particularly by providing computer training to less-educated workers.

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Chapter 7 GOVERNMENTS ON THE NET

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Chapter 7
GOVERNMENTS ON THE NET

Governments have long been aware of the significant role information and communications technologies (ICTs), and the Internet in particular, can play in delivering efficient public services. The pervasive nature of ICTs has fundamentally changed the means of interaction both between and within government departments and agencies, as well as with the public they serve. By now, many Canadians have already experienced their government online, whether searching the Internet for government information, corresponding by e-mail with government departments, or filing electronic income tax returns. Through these early applications, Canadians have come to expect more flexibility and accessibility in the delivery of government services.

Connectedness *is the availability and use of information and communications technologies and associated services to facilitate communication, interactions and transactions, whenever and wherever (The Conference Board of Canada 2002).*

With the sheer volume of information and countless 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 time and distance. The effective management of this information through the Government Online initiatives (GOL) represents a potential source of cost savings for both the government and individual users.

However these new opportunities do not come without 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. 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 shape and facilitate a fair and competitive environment for all businesses and industries involved.

To respond to the changes in expectations and the complexity of the needs of the public, government must adopt a more horizontal approach to service delivery, that is, one that crosses programs, departments and jurisdictions (GOL Advisory Panel 2002).

The Government of Canada is also investing in putting major benefits programs online, such as the Canadian Pension Plan, Old Age Security and Employment Insurance. Initial investments have been made in rethinking these services and in piloting new ways of service delivery (Government of Canada 2002).

In Canada, GOL is one of the six pillars of the 'Connectedness' agenda. Canadians are taking advantage of government services online, whether searching for government information or carrying out activities like drivers' license renewals and filing taxes (i.e. NetFile). In 2002, for example, approximately 38% of the tax filing population – or 8.9 million people – filed electronically (GOL Advisory Panel 2002). There are other GOL services available, including a secure online service providing personalized tax information about tax refunds, the Canada Child Tax Benefit or Registered Retirement Savings Plan (RRSP) deduction limits. Businesses can conveniently register for Canada Customs and Revenue Agency accounts with Business Registration Online, while Patent, Trademark, Copyright and Industrial Design applications can be filed online with the Canadian Intellectual Property Organization (The Ottawa Citizen 2002).

The Government of Canada's Connectedness Agenda includes six pillars: Government Online, 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. GOL will contribute to improving the efficiency of the Government of Canada and, by demonstrating innovative Internet applications, will help establish Canada as a leader in the knowledge-based economy and society.

The Government of Canada has set a target of putting the most frequently used services online by 2005 (Government of Canada 2002). What is Government Online (GOL) expected to bring to Canadians?

- **More accessible government**

  Information on government services and the most commonly used forms will be online and organized in a way that makes sense to Canadians.

- **Better, more responsive service**

  Information and transactional services of most importance to individual Canadians and businesses will be online, providing fast and convenient service in response to citizen needs.

- **Building trust and confidence in online delivery**
  Personal information, individual privacy and transactions with government will be protected and secure.
- **Service for all Canadians**
  Canadians will continue to have a choice of delivery channels (mail, fax, telephone, in-person, and online), in both official languages and accessible to persons with disabilities.

Canadians want online delivery:

- *77% of Canadians think that the Internet will improve how they receive services from the Government*
- *73% believe that putting services and information online is a good use of tax dollars*
- *78% believe that GOL makes the government more innovative*
- *77% believe that GOL will improve how Canadians interact with Government*
- *56% of Canadian Internet users have visited a Government of Canada Website*

Source: Communication Canada 2001.

Statistics Canada, as one of the key players and content providers to the Government of Canada's newly redesigned Canada site (http://www.canada.gc.ca), is also an important part of the GOL initiative. Since Statistics Canada is an information producer and an early adopter of the Internet, much of our data holdings are spread throughout the Canada site, which has been organized into subject areas or e-clusters. The Agency participates in many GOL-related activities and is a lead department for the Business Information and Analysis e-cluster, as well as the Economy e-cluster. Statistics Canada's own website (http://www.statcan.ca) is already well-developed and moving towards the e-cluster or portal approach to delivering information to specific users. The next phase for the Agency will be an online data reporting option for survey respondents. Statistics Canada has long recognized the opportunity and strategic value of the online channel; questionnaires for some surveys have been available in electronic format since the early 1990s. Gradually over the next few years, over 50 business and agriculture surveys, as well as some household surveys, will provide respondents the option of reporting electronically. The approach will be such as to ensure that confidentiality, privacy and data quality are not compromised.

7.1 Measuring GOL

Because of the comprehensive nature of the Connectedness agenda, both in terms of the resources required to deploy ICTs and applications, and their potential for benefiting Canadians, measurements general to government connectivity and specific to GOL are indispensable in order to quantify and monitor progress. Now that the agenda is well underway, suitable indicators identify underlying trends in both the use of ICTs by the federal and provincial governments in Canada, as well as their uptake by individuals.

Nearly all federal and provincial government institutions were using personal computers and the Internet in 2002. The overwhelming majority also had a Web presence. However, just 68.9% of federal and provincial government institutions purchased goods or services over the Internet and only 21.6% used the Internet to sell goods or services. These institutions accounted for 76.0% and 33.0% of the public sector's total economic activity, respectively[15] (Statistics Canada 2003).

Table 7.1.1 Government connectedness, 2000-2002

	2000	2001	2002
		%	
Federal and provincial government institutions that			
used personal computers	100.0	100.0	99.4
used e-mail	100.0	100.0	99.4
used the Internet	100.0	100.0	99.4
had a website	96.2	96.9	94.8
used the Internet to purchase goods or services	59.0	46.1	68.9
used the Internet to sell goods or services	21.6	16.0	21.6

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Table 7.1.2 Characteristics of government websites, 2000-2002

	2000	2001	2002
		%	
Federal and provincial government institutions that			
had a website	96.2	96.9	94.8
Characteristics of website			
online payment	10.3	15.1	20.2
interactivity	58.6	33.1	59.8
digital products or services	31.2	18.5	18.5
information about employment opportunities	62.7	..	..
secure	51.9	45.0	47.5
privacy policy statement	48.9	42.8	48.7
access via wireless mobile device	..	10.6	14.1

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

15 *Weighted by the number of employees.*

Additional useful indicators were also obtained regarding employee access to ICTs, which has remained at high levels for some time.

Table 7.1.3 Government employee connectedness, 2000-2002

	2000	2001	2002
		%	
Federal and provincial government employees with			
access to a personal computer, workstation or terminal	91.9	92.7	89.7
access to e-mail	91.0	92.1	88.3
access to the Internet	85.5	87.3	85.0

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Public institutions have shown a high propensity to use networks to share information both internally and externally. This might include information about products and services, training, job opportunities, and information for customers or clients. A recent study on information sharing reveals that the public sector demonstrates a market orientation towards using electronic networks to facilitate job mobility and training that was not echoed by the networked private sector (Earl 2003). Indeed, making job opportunities highly accessible and visible is an important component of human resources management in large, public sector organizations. The influence of GOL initiatives is evident in these results, as public sector institutions lead the way in the adoption of these e-business solutions.

Is the public sector technology -ready for GOL?

Percentage of public institutions using electronic networks to:

- *facilitate job mobility from within their organization (55%)*
- *facilitate job mobility from outside their organization (50%)*
- *share product/service information within their organization (35%)*
- *share product/service information outside their organization (40%)*
- *share customer information within their organization (35%)*
- *share customer information outside their organization (20%)*

Source: Earl 2003.

GOL is changing the way in which government interacts with its people. 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 (29.2%) of all households, their proportion among regular home Internet users has become sizeable (56.7%). Moreover, that proportion increased substantially between 1998 and 2002, as did the home penetration rate.

Table 7.1.4 Households searching for government information online, 1998-2002

	1998	1999	2000	2001	2002
All households	8.2	12.7	18.9	25.6	29.2
Regular home-use households	36.4	44.1	47.1	52.5	56.7

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

Cycle 14 of the General Social Survey (GSS), conducted in June 2000, asked individuals whether or not they had ever used the Internet for various types of activities. Three-quarters of Internet users reported that they used the Internet to search for information on goods and services. This was followed by online news sites (54.7%), health and medical information (45.9%) and information on government programs or services (41.0%). Of those searching for health and medical information, a significant proportion visited Health Canada's site (36.0%), while 16.0% reportedly accessed other government sites for such information.

Of those searching for information on goods or services, 10.0% reported searching for government labour market programs, such as Employment Insurance or youth programs in the previous month[16]. Seven percent of Canadian Internet users reported that they had expressed their personal views or concerns directly to the government via the Internet.

Canadian expectations of GOL are generally positive, according to a survey conducted on behalf of Communication Canada in the winter of 2001. More than three-quarters (78%) of Canadians believe that putting programs, services and information online will make the government more innovative. Canadians also believe that the GOL initiative will improve the overall relationship between the government and citizens. Those with Internet access ranked the filing of income taxes as the highest priority for GOL services (61%), followed by opportunities

16 *This question asked about what type of information respondents used the Internet to search for in the past month, whereas the question about whether they had used the Internet to access information on government programs or services referred to 'ever used'. Men were more likely than women to have ever accessed government programs on the Internet, as were Internet users between the ages of 25 and 29 (50.0%) (Dryburgh 2001).*

to provide feedback to the government, such as responding to surveys and voting. Passport applications (46%) and checking Canada Pension Plan status (44%) were also popular. Canadians with Internet access were most interested in seeing information about government programs and services online (60%). Other types of information included job opportunities (54%), education (52%) and health information (49%) (Communication Canada 2001).

Canadians have positive expectations of GOL. They place a high priority on reliable service and accurate information through the Internet, but most of all they expect the government to provide a high level of security and privacy. Consequently, most Canadians are still reluctant to divulge confidential personal data in electronic transactions with the government (Communication Canada 2001).

New indicators of government connectedness continue to be compiled, along with statistics on government e-commerce (Table 7.1.5). Although the proportion of public administration institutions selling online has been variable, the value of these online sales has been steadily increasing. Most of these sales were to residential consumers in Canada. Reasons why government may not be involved in e-commerce have also been studied (Table 7.1.6). The most common barrier to selling online for government was security concerns (39.9%), followed closely by the perception that their goods or services do not lend themselves to Internet transactions (39.2%). Interestingly, a growing proportion of public sector institutions is becoming concerned with security while a declining proportion is citing that goods or services do not lend themselves to Internet transactions. With the federal government's commitment to be fully online by 2005, these trends are not surprising.

Table 7.1.5 Governments selling over the Internet, 2000-2002

	2000	2001	2002
		%	
Federal and provincial government institutions			
% using the Internet to sell goods or services	21.6	16.0	21.6
value of sales over the Internet *(millions of dollars)*	28.5	40.2	77.0

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Table 7.1.6 Barriers to governments selling over the Internet, 2000-2002

	2000	2001	2002
		%	
Why public administration Internet users do not sell online			
Security concerns	24.3	23.2	39.9
Goods do not lend themselves to Internet transactions	42.8	48.7	39.2
High cost of development and maintenance	11.4	11.2	19.7
Prefer to maintain current business model	11.4	11.9	18.8
Lack of skilled employees	10.1	9.6	16.3
Customers are not ready	7.9	16.3	16.3
Uncertain about benefits	4.6	3.6	2.3

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada

Canada is a leader in government online. International comparisons help to identify areas where Canada is leading or lagging other countries, however few countries are currently able to provide official data on ICTs in government. These measurements of government connectedness are essential in order to monitor progress in an information society.

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7.2 ICTs in education

In conjunction with its GOL initiatives the Canadian government has been striving to provide access to the Internet for all Canadians. In 1999, Canada was the first country to connect its public schools and libraries to the Internet through well-known programs, such as Community Access Program (CAP), SchoolNet and Computers for Schools. Canada also leads the way in student access to computers (The Conference Board of Canada 2002). 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 enormous task of monitoring and assessing the use, effectiveness and impacts of these technological applications on student learning and performance.

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.

7.2.1 Information and communications technologies in the education sector

Johanne Plante is an analyst with the Centre for Education Statistics. In this article, she examines ICT access and use in education, as well as some findings on the relationship between ICT use and academic performance in reading.

The revolution in the field of information and communications technologies (ICTs) combined with the advent of the knowledge economy, have led to profound economic, social and cultural change around the world. As is the case in many countries, Canada is in the midst of this phenomenon. The labour market as it previously existed is no longer. As Lavoie and Roy (1998) point out, the rate of growth of knowledge-intensive occupations has been twice that of other occupations for the past two decades. The new economy now requires workers who are increasingly educated and highly skilled, and who are able to use increasingly sophisticated applications in the field of ICT.

To respond, among other things, to the need for a highly skilled labour force in all sectors of the economy and in all regions of the country, elementary and secondary schools have a leading role to play in the development of the knowledge and skills of students, especially with respect to the use of ICTs for future employment.

Integration of ICTs in Canadian schools

Policymakers in Canada are looking to the introduction of ICTs in the education sector to improve school performance, increase equity among students and enhance the ability of students to use technologies and software in their future jobs. To meet this challenge, a series of well-coordinated federal policies and programs were developed to provide every school in communities across the country with access to ICTs.

One of the many programs introduced by the federal government was the *SchoolNet* program, which was initially mandated to work in partnership with provincial and territorial governments, the teaching community and the private sector to connect Canadian schools and libraries to the Internet. In the second phase of its mandate, *SchoolNet* was to extend the school Internet connection to classrooms. Thus, by May 2000, more than half a million computers had been connected to the Internet in Canadian schools (Canada's *SchoolNet* 2003). In the 2001 Speech from the Throne, the federal government committed to continue supporting *SchoolNet* to provide Canadian schools and public libraries with better access to high speed Internet and to increase and enhance online educational content (Canada's *SchoolNet* 2003).

Other programs were also launched to improve access to ICTs in schools, in particular, the *Computers for Schools* (CFS) program. The goal of this program was to distribute recycled computers, donated by governments and the private sector, to schools located in disadvantaged regions (*Computers for Schools* 2003). The *Community Access Program* (CAP) was another initiative aimed at providing Canadians with public access to the Internet in the evenings and on weekends (*Community Access Program* 2003).

Role of the education sector in accessing and using ICTs

A 2001 report prepared jointly by Statistics Canada, Human Resources Development Canada and the Council of Ministers of Education, Canada, mentioned that in order to meet the challenges emerging as we enter the 21st century, elementary and secondary schools have a central role to play in laying a solid base upon which subsequent knowledge and skills can be developed.

According to the same report, students leaving secondary school without a strong foundation may experience difficulty accessing the labour market. Thus, by promoting equitable access to ICTs for all students, educational institutions can help reduce the risks of creating a "digital divide" based on gender, geographical location and different socioeconomic groups of students, thereby simultaneously increasing the chances of success in the labour market.

Through the Council of Ministers of Education, Canada, the provinces and territories are working together to present a common vision of how ICTs should be applied at the elementary and secondary level to enhance learning and support students and teachers. Most jurisdictions agree on the following points: provide students with the knowledge and skills that they require to meet the challenges of the 21st century, provide teachers with continuous training and the support required for them to integrate technologies in their classroom teaching methods, and lastly, improve student and teacher access to multimedia equipment and to information services (Council of Ministers of Education, Canada 1997).

Using data collected from a number of surveys, this study describes the current situation with respect to student access and use of ICTs in Canadian schools and homes. In this process, we seek to explain some of the discrepancies around access to and use of these technologies based on various factors such as sex, socioeconomic status of the student, language spoken most often at home, geographic location, and the type and size of the school. Comparisons of the proportion of Canadian students with access to computers and the Internet at home and in school will also be made with the corresponding percentages in other countries and by each Canadian province. We will then examine whether there is a link between school performance and use of ICTs by students and conclude with a list of possible barriers to the integration of ICTs in the classroom.

Portrait of the present situation: Access and use of ICTs

In Canada, the education system strives to set high levels of scholastic success that incorporates a principle of equity of results between genders and socioeconomic groups. Data from the Program for International Student Assessment (PISA) show that Canadian students are among the top-ranked in the world with respect to access to computers at school and in the home.

At school

The number of students per computer is often used as a reference point for measuring student accessibility to technology. According to PISA, the median value for 15-year-olds in the Organization for Economic Cooperation and Development (OECD) member countries was 13 students per computer in 2000, but the ratios varied considerably from one country to another.

As shown in Table 7.2.1.1, with a ratio of six students per computer, Canada ranked second among OECD member countries in terms of access to computers in school. Australia and the United States were first with a ratio of five students per computer, while Mexico and Spain both had ratios of over 20 students per computer.

Table 7.2.1.1 Number of students per computer, international comparisons, 2000

	25th percentile	50th percentile (median va1ue)	75th percentile
Australia	4	5	7
Finland	6	8	12
France	6	11	15
United Kingdom	6	8	9
United States	4	5	7
Mexico	12	23	59
Japan	7	12	18
Spain	14	21	29
Canada	**4**	**6**	**8**
Country average	8	13	24

Source: Program for International Student Assessment (PISA) 2000.

Note : Ratio between the enrolment in the institutions attended by students 15 years of age and the total number of computers in these institutions by type of institution, weighted by enrolment.

Among Canadian provinces, Manitoba was the province with the best access to technology with a ratio of four students per computer. Nova Scotia, Ontario and Alberta were close behind with a ratio of 5:1, while Quebec had the highest ratio with nine students per computer (Table 7.2.1.2).

High access rates were also found for Canadian elementary schools. According to the data obtained from school principals as part of the National Longitudinal Survey of Children and Youth (NLSCY), almost three of four youth aged 6 to 12 years (74%) attended a school where at least half of the classrooms had a computer.

However, the fact that the computer equipment is available does not mean that the students and teachers make effective use of it, that it is easily accessible or even that it is of good quality (for example, compatibility, memory, speed, age of the computer, peripherals and software).

Table 7.2.1.2 Number of students per computer, Canada and provinces, 2000

	25th percentile	50th percentile (median va1ue)	75th percentile
Newfoundland and Labrador	5	6	8
Prince Edward Island	6	7	9
Nova Scotia	4	5	7
New Brunswick	4	6	8
Quebec	7	9	11
Ontario	4	5	7
Manitoba	3	4	5
Saskatchewan	5	6	7
Alberta	4	5	6
British Columbia	4	6	7
Canada	**4**	**6**	**8**

Source: : Program for International Student Assessment (PISA) 2000.

Note : Ratio between the enrolment in the institutions attended by students 15-years of age and the total number of computers in these institutions by type of institution, weighted by enrolment.

This article uses reference data for the year 2000 of the Program for International Student Assessment (PISA), a collaborative project of the member countries of the Organization for Economic Cooperation and Development (OECD). In Canada, PISA is administered by a partnership consisting of the Council of Ministers of Education, Human Resources Development Canada and Statistics Canada.

The purpose of the project is to periodically evaluate the achievements of 15-year-old boys and girls in reading, mathematics and science using an international standard test. Canada and 31 other countries participated in PISA 2000 where the focus was mainly on reading. In Canada, approximately 30,000 15-year-old students from over 1,000 schools took part in the survey in the spring of 2000.

The PISA 2000 Survey consisted of a direct evaluation of the skills of students using tests of reading, mathematics and science and questionnaires to collect basic information from the students and principals of the schools.

The main questionnaire for students who participated in PISA 2000 contained two questions on domestic belongings, in which a computer and a connection to the Internet were listed. Students were also asked about their specific use of the computer and the Internet at school and at home. The questionnaire for school principals included questions on the number of computers available at the school, Internet connections and resource constraints.

Fifteen-year-old Canadian students reported high rates of access to the computers in their schools. However, while slightly more than three-quarters (76%) of 15-year-old Canadian students indicated high rates of access to their school computers, only 39% of them reported actually using them almost every day or several times per week. These results compare favourably with those of other countries in terms of the frequency of access to and use of a computer. Indeed, among OECD countries, 56% of 15-year-old students had access to a computer at school almost every day or several times per week, while only 38% of them reported actually using them that frequently (Table 7.2.1.3).

This article uses reference data for the years 1998 and 1999 from the National Longitudinal Survey of Children and Youth (NLSCY). This survey is a long-term study of Canadian children that follows their growth and well-being from birth to early adulthood. Initiated in 1994, the NLSCY is a joint project of Statistics Canada and Human Resources Development Canada.

The study was designed to gather information on the factors that influence the social and emotional development and behaviour of children and youth. It provides a means of monitoring the impact of these factors on their development over time.

The survey covers a wide range of subjects including health, physical development, learning and behaviour of children, along with data on their social environment (family, friends, school and community). The findings of the NLSCY are used by a variety of individuals from all levels of government, universities and organizations responsible for policy development.

According to PISA data, student access to computers at school varies very little based on whether the school is private or public, but does vary considerably based on whether the school is in a rural or urban area, or depending on its size. As shown in Figure 7.2.1.1, 80% of students in schools located in rural areas reported having access to a computer almost every day or several times per week, while this rate was 75% for students in schools in urban areas. Similar results were obtained by Looker and Thiessen (2003) in their research paper entitled, "The digital divide in Canadian schools: factors affecting student access to and use of information technology". According to these authors, schools appear to play a key role in overcoming the "digital divide" between students in rural and urban secondary schools in terms of access to the computer and its frequency of use.

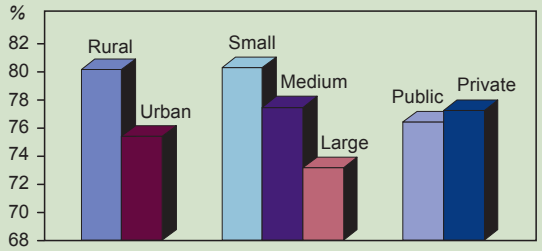
Along the same lines, while almost 80% of students attending small and medium-size schools reported frequent access to computers, only 73% of students attending large schools reported the same access. In terms of the access rate of students by type of school, 77% of students from private schools stated that they had access to a computer almost every day or several times per week, while this was the case for 76% of students attending a public school (Figure 7.2.1.1).

Table 7.2.1.3 Access to and use of computers by 15-year-old students, Canada and OECD member countries, 2000

	Canada		OECD countries	
	Access	Use	Access	Use
At home				
Almost every day	81	51	64	39
Several times per week	4	21	6	21
Between weekly and monthly	2	10	3	5
Less than monthly	1	4	3	5
None	12	13	24	24
At school				
Almost every day	52	18	27	10
Several times per week	24	21	29	28
Between weekly and monthly	12	23	20	26
Less than monthly	7	22	10	16
None	5	16	14	19

Source: Program for International Student Assessment (PISA) 2000.

Figure 7.2.1.1 Frequent access to computers at school among 15-year-olds, by type of school, 2000



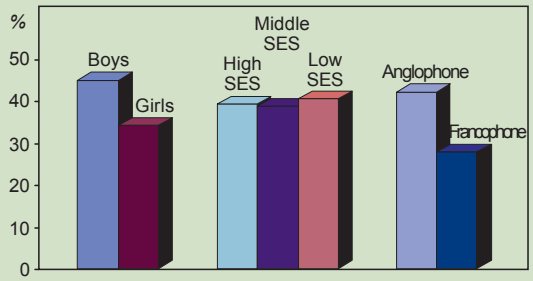
Fifteen-year-old boys reported using computers at the school frequently in a larger proportion than girls in the same age group. According to PISA 2000 data, 45% of 15-year-old boys stated that they used computers almost every day or several times per week, while this rate fell sharply for girls (34%) (Figure 7.2.1.2). Differences in attitudes between boys and girls toward computer use explain in part the gender-related differences;

For the purposes of this analysis, a school in a rural area is a school located outside a census metropolitan area (CMA) and a census agglomeration (CA), while a school located within these large urban centres is considered to be a school in an urban area.

The size of a school was established based on the distribution of the number of students in all schools. Schools in which the number of students was in the lowest quartile (less than or equal to 25th percentile) in terms of the distribution of the number of students were defined as being small schools (600 or fewer students). Medium-size schools were defined as schools in which the number of students fell between the 25th and 75th percentile, or between 600 and 1,300 students. Large schools were defined as schools in which the number of students was at the top of the distribution (greater than or equal to 75th percentile) and had 1,300 or more students.

70% of boys believe that it is important to be able to work with the help of a computer, while this percentage falls to only 58% for girls. In addition, 85% of girls feel comfortable when using a computer, compared with 92% of boys. In response to the question, "*Do you feel comfortable taking a test using the computer?*", 67% of girls aged 15 years said yes, while the rate increased to 77% for boys. The proportion of girls who reported feeling comfortable producing work on the computer was virtually the same as that of their male counterparts (89% and 88% respectively).

7.2.1.2 Frequent use of computers at school among 15-year-olds, by student characteristic, 2000



According to Figure 7.2.1.2, parental factors do not appear to seriously impact computer use at school. In fact, 39% of students of low or middle socioeconomic status (SES) reported high rates of computer use, compared with 40% of students of high socioeconomic status.

Although parental factors do not appear to impact the frequency of use of a computer at school, the language spoken most often at home does appear to have a significant impact. While close to 42% of Anglophone students frequently use a computer at school, this rate falls to 28% among Francophone students (Figure 7.2.1.2). According to PISA data, one-quarter of Francophone students reported never using a computer at school, compared with only 13% of Anglophone students.

One of the factors that might explain this difference in the frequency of use of computers by Anglophones and Francophones is the fact that most of the learning materials on the Internet are presently posted in English. This is also the case with much of the software available on the market. While French is the second most common language on the Internet, French-language content constitutes only 3% of the available Internet content, compared with 91% for English-language content (Council of Ministers of Education, Canada 1997). However, it should be noted that computers are used for purposes other than navigating the Internet and therefore the lack of French-language content on that network does not entirely explain why Francophone students use computers less often than Anglophone students.

At home

In Canada, computer access is even higher at home. As shown in Table 7.2.1.3, 85% of students aged 15 years reported having access to a computer at home almost every day or several times per week. Higher accessibility rates to computers at home than at school were reported in all OECD countries where an average of 70% of students aged 15 years have frequent access to a computer at home.

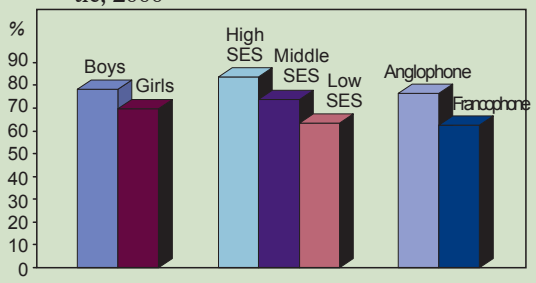
As for the Canadian provinces, the majority of them reported averages above 80% for students having access to a computer at home almost every day or several times per week. Only Newfoundland and Labrador, Prince Edward Island, New Brunswick and Quebec had averages below 80%.

Simply because there is access to a computer does not mean that it is used frequently, especially in school. In fact, as shown by Table 7.2.1.3, 15-year-old Canadians more often tend to report frequent computer use at home than at school. Over 70% of Canadian students in this age group use a computer at home almost every day or several times per week, while only 39% of them use a computer as often at school.

More frequent use of a computer at home than at school was observed in most OECD countries. On average, 60% of 15-year-old students in OECD countries reported using the computer frequently at home, compared with 38% at school (Table 7.2.1.3).

As was the case at the school, the proportion of Canadian females aged 15-years using a computer frequently at home was lower than that of boys in the same age group. According to PISA data, 77% of boys in this age group reported having used computers almost every day or several times per week in 2000, while this proportion was only 69% among their female counterparts (Figure 7.2.1.3).

Figure 7.2.1.3 Frequent use of computers at home among 15-year-olds, by student characteristic, 2000



The difference between 15-year-old boys and girls in terms of access to information technology in the home was constant in all OECD countries. In all of these countries, boys tended to use computers at home more often than girls, almost every day, several times per week or between once per week and once per month (Statistics Canada 2002).

*The **socioeconomic status** (SES) of the student was derived from student responses on parental occupation. The index captures the attributes of occupations that convert parents' education into income, and is based on either the father's or mother's occupations, whichever is the higher.*

For the purpose of this analysis, the socioeconomic status of the student was established on the basis of the distribution of this variable for all students. A low socioeconomic status was assigned to students whose socioeconomic status was in the first quartile. A student whose socioeconomic status fell in the second or third quartile was considered to have a middle socioeconomic status and a student whose socioeconomic status fell in the upper proportion of the distribution was assigned a high socioeconomic status.

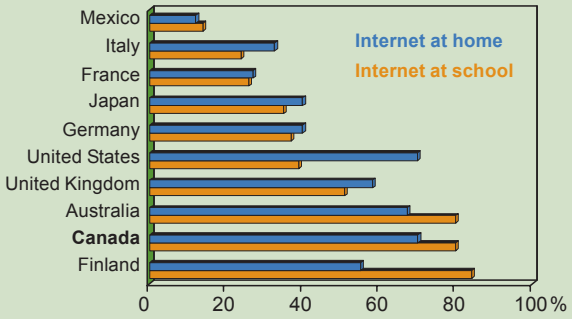
Contrary to the findings at school, the student's socioeconomic status appears to play a significant role in terms of access to and frequency of use of a computer at home. In Canada, 15-year-old students whose parents have a high level of education tended to have access to a computer and connection to the Internet at home more often. In fact, 93% of students with a high SES reported having access to a computer at home almost every day or several times per week, compared with 86% of students of middle SES and 75% of students of low SES. In terms of the frequency of use of a computer at home, 82% of students of high SES reported high rates of computer use, while this rate fell to 73% for students of middle SES and to 63% for students of low SES (Figure 7.2.1.3).

As was the case in schools, the language spoken most often in the home appears to also have a significant impact on the frequency of computer use in the home. While over three-quarters of Anglophone students use a computer frequently at home, this rate falls to 62% among Francophone students (Figure 7.2.1.3). According to PISA results, slightly less than one quarter (23%) of Francophone students reported never using a computer at home, compared with 11% of Anglophone students.

Connection to the Internet

Not only are computers widely accessible in Canada, but they are also suitably connected. However, computers in schools are more often connected to the Internet than home computers. According to PISA, 80% of computers in Canadian educational institutions were connected to the Internet network, while this proportion fell to 70% for connections in the home. About half of school computers were connected to this network among all OECD member countries. With a proportion of 70%, access to the Internet in Canadian homes significantly exceeded the average of 47% recorded for OECD member countries as a whole (Figure 7.2.1.4).

Figure 7.2.1.4 Percentage of computers connected to the Internet, 2000



In Australia, Finland, Iceland and Luxembourg, there was a high degree of connectivity with 80% or more of the computers connected to the network in schools. However, only 39% of computers in American schools are connected to the Internet, even though the United States is among the leading countries in terms of the ratio of students per computer. Home Internet access rates comparable to those in Canada were reported in Australia (67%) and the United States (70%). Australian access to the Internet was also higher at school than in the home, but the reverse was noted in the United States.

High Internet connection rates were recorded in schools in all Canadian provinces, but especially in the case of the Maritime provinces, Quebec and Alberta, where the rates were over 80%. Contrary to the Internet connection rates in schools, which were relatively similar across provinces, there were huge variations reported in home connection rates. More than half of home computers were connected to the Internet in all Canadian provinces, but only in Ontario, British Columbia and Alberta were the rates higher than 70%.

Despite the high Internet connection rates in Canadian schools, only 44% of students reported frequent use of the Internet, that is, several times per week or several times per month. Canadian provinces also did well in terms of the number of students using the Internet frequently, ranging from 33% in New Brunswick to 55% in Alberta and Newfoundland respectively. Among OECD member countries, Denmark was the country with the largest proportion of students using the Internet frequently (75%), followed by Finland (61%) and Sweden (59%). The lowest proportions of students who reported using the Internet frequently were found in Mexico with 8% and Japan with 9%.

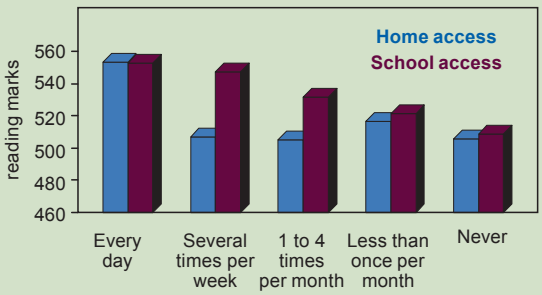
As with access to computers at school, high levels of connection to the Internet were noted in Canadian elementary schools. Indeed, according to data collected from school principals under the National Longitudinal Survey of Children and Youth (NLSCY), over half (53%) of youth in this age group attended a school in which at least half of the classrooms were connected to the Internet.

ICTs and school performance

The findings on the impact of ICT on school performance vary considerably from one study to another. While some studies show that computers can help school performance, others state the opposite and even go so far as to question their effectiveness in this field.

We will therefore try to examine the relationship between ICT access and use at school and in the home and the marks obtained by students aged 15-years from the PISA 2000 survey.

Figure 7.2.1.5 Relation between reading marks and frequency of access to a computer, 2000



Based on these data, there appears to be a positive relationship between the reading marks obtained by 15-year-old students and the frequency of access to computers at school. However, while the reading marks of students with access to a computer at home were higher than those of students with no access to a computer, the frequency of this access does not appear to have as significant an impact as access at school (Figure 7.2.1.5).

Indeed, the positive relationship that appears to exist between access to a computer at home and school performance could likely be attributed more to family characteristics and the student's home environment than to access to the computer itself. According to the data gathered from PISA, the higher the SES of the student, the higher the marks obtained in reading. Of the 88% of students who

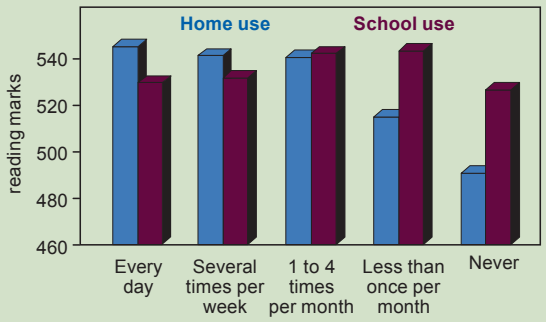
Reading literacy *is defined in PISA as the ability to understand, use and reflect on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate effectively in society. This definition goes beyond the notion that reading literacy means decoding written material and literal comprehension. Reading incorporates understanding and reflecting on texts. Literacy involves the ability of individuals to use written information to fulfill their goals and the consequent ability of complex modern societies to use written information to function effectively.*

The concept of ***reading achievement*** *in PISA was divided into five levels. Essentially, these levels represent the most difficult test items that a student could answer. Therefore, a student at one level could be assumed to be able to answer questions at all lower levels. To help in interpretation, these levels were linked to specific score ranges on the original scale.*

had access to a computer in the home in 2000, 69% came from a family of middle to high SES. Several studies, including the one by Human Resources Canada, the Council of Ministers of Education, Canada and Statistics Canada in 2001, have already shown the existence of a relationship between school performance and the family characteristics and home environment of a student. According to that study, while the SES of the family is a key factor in a student's success, the results indicate that this factor is not the only one to have a positive impact on student perfor-mance. Indeed, it appears that parents who take an interest in the education of their children, who are involved and who provide a home environment which stimulates learning can also have a positive impact on their children's outcomes.

As Figure 7.2.1.6 shows, while the frequency of computer use at home appears to have a positive impact on the marks obtained in reading by 15-year-old students, the frequency of computer use at school seems to indicate an inverse relationship. According to the PISA study, students who used a computer at school at least once per week did not outperform students who used them less frequently. Johnson (2000) found similar results using data from the American survey, *National Assessment of Educational Progress* (NAEP 1998). According to that study, students who used computers in class at least once per week did not obtain better results in reading than students who used them less than once per week.

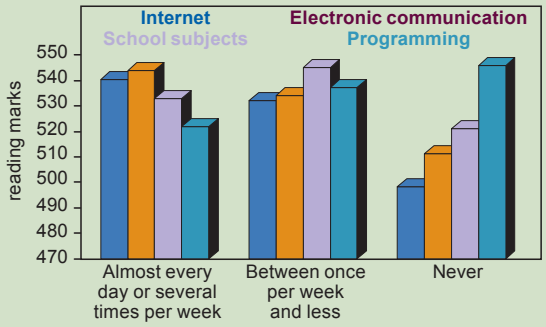
Figure 7.2.1.6 Relation between reading marks and frequency of computer use, 2000



Although the relationship between marks in reading and frequency of use of a computer appear to vary depending on whether the computer is used at school or at home, what is the relationship when the computer is used for very specific reasons? As shown in Figure 7.2.1.7, there appears to be a positive relationship between marks obtained in reading and the frequency of computer use for electronic communications (e.g. email, chat session) or for use of the Internet. In the case of students who reported using a computer almost every day or several times per week to help in learning school subjects, these students seem to have performed better than those who never used the com-puter for this reason, but worse than those who said they used it less frequently. An inverse relationship

between reading marks and frequency of computer use was found for students who stated that they used the computer for programming reasons.

Figure 7.2.1.7 Relation between reading marks and frequency of computer use, by type of use, 2000



Barriers to integrating ICTs in classrooms

Thanks to ICTs, learning is no longer restricted by time or by place. Students can now access teachers and information outside the reality of a classroom and can do so at any time. However, as the Council of Ministers of Education, Canada (1997) pointed out, although we understand the importance of ICTs as teaching and learning tools, most educational institutions in Canada are only beginning to use ICTs to teach curriculum subjects.

According to data from the National Longitudinal Survey of Children and Youth (NLSCY), slightly more than one-quarter of youth took part in a class where the teacher reported having used a computer as a teaching tool for students or to access the Internet. According to the same survey, about one in three youth had a teacher who reported having used a computer as a teaching tool for students outside the classroom, as a learning tool for their own needs, so that students could use basic software (e.g. word processing, spreadsheets or graphics) or simply to allow students to access self-learning software. About one in ten youth was in a class where the teacher reported having used a computer to make presentations or demonstrations in class, to provide students with telecommunication software (e.g. to send and receive messages, discussion groups or chat sessions) or for specialized software for learning specific subject matter (e.g. music, art, graphics and robotics).

Some authors have identified problems or barriers that delay the integration of ICTs in classrooms or as teaching and learning tools. Some of these barriers include the lack of funds for acquisition or maintenance of computers, a lack of computers and their fast obsolescence, inadequate quantities of quality software to meet the needs of teachers, and lastly, the lack of training and support provided to teachers to facilitate integration of ICTs in the class (Council of Ministers of Education, Canada 1997).

Thus, before the benefits associated with the use of technology in Canadian schools can really be felt, schools will have to provide adequate access to ICTs, teachers will have to learn to use these technologies as teaching and learning tools, and students will have to acquire greater autonomy in terms of their learning.

Summary

Greater competition between nations and advancements in constantly changing technologies will require a skilled workforce capable of adapting to rapid and constant change occurring in the work environment. To be able to function effectively in this constantly changing world, the adults of tomorrow will need, more than ever before, greater knowledge and skills to enable them to meet the new demands of the market.

If Canada is to retain its leadership role and remain competitive internationally, it must train a highly skilled workforce that will be able to respond to the demands of the new economy and take on new challenges that emerge as we enter the 21st century.

In order to meet the need, among others, for a highly skilled workforce in all sectors of the economy and in all parts of the country, elementary and secondary schools have a central role to play to develop the knowledge and skills of students with respect to the use of ICTs for future jobs. By providing students with equitable access to ICTs, educational institutions can help reduce the risks of creating a "digital divide" based on gender, geographic location and different socioeconomic groups of students, thereby increasing their chances of success in the labour market. With a ratio of six students per computer, Canada is among the world leaders when it comes to access to computers in schools. High computer access rates have also been found in Canadian elementary schools, where almost three in four children aged 6 to 12 years attend a school in which at least half of the classrooms have a computer.

Thanks to ICTs, learning is no longer restricted by time or by place. Students can now access teachers and information outside the reality of the classroom, and can do so at any time. Canada has high rates of student connection to the Internet both at school and in the home. Regardless of the discipline of studies that students may choose, they will have to be able to use ICTs if they want to occupy a strong place in the new knowledge economy.

As the Council of Ministers of Education, Canada (1997) pointed out, although we understand the importance of ICT as a learning tool, most educational institutions in Canada have only begun to test its full potential in the instruction of curriculum subjects. A number of barriers are slowing the integration of these

technologies and before the benefits associated with the use of technologies in Canadian schools can really be reaped, schools will have to provide adequate access to ICTs, teachers will have to learn to use this technology as teaching and learning tools, and students will have to acquire greater autonomy in their learning.

In order to be able to effect an exhaustive analysis of access to ICTs and their use and infrastructure in all Canadian elementary and secondary schools, a new survey, entitled *Information and Communications Technologies in Schools Survey* (ICTSS), was launched in the fall 2003. This survey, sponsored by Industry Canada's *SchoolNet* program, will provide essential benchmark data on the status of ICT integration in the education field across Canada.

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7.2.2 Online learning

Canadians are also making use of ICTs for education and learning outside of traditional school programs. In 2002, nearly half (47.3%) of households regularly using the Internet did so for the purposes of formal education and training (Statistics Canada 2003a). The use of ICTs for postsecondary education programs, distance learning and continuing education are further examples of Canada's commitment to investing in skills and learning. Online education, or e-learning, provides an alternative approach to skill development, as well as a more flexible and convenient method of learning for Canadians who are struggling to balance home and work life (The Conference Board of Canada 2002).

Not only can students attending postsecondary institutions learn online, but some can now use campus computer labs to check assignment grades posted by professors, print off lecture notes, and even watch video versions of missed classes. Meanwhile, many postsecondary institutions are using wireless technology to connect their students, whether in residences, libraries, lounges or classrooms (The Ottawa Citizen 2002).

> *Postsecondary students can spend as much time online as in lecture halls. And that's revolutionizing the way profs are teaching (The Ottawa Citizen 2002).*

Distance education has also expanded with the advent of Internet technology. People living in rural and remote communities can now participate in an interactive learning environment despite the challenges of geography (The Conference Board of Canada 2002).

Having access to ICTs to enable education and learning is only one piece of the picture. Making effective use of these technologies is the other and, perhaps, more crucial piece. Investment in education, ICT literacy and technology skills is essential if Canada is to succeed in an information society.

In 2002, all public educational services had access to personal computers and the Internet, as did the large majority of their employees (92.7% had direct access to computers, 91.8% had direct access to the Internet). Nearly all public educational services had a website, while more than 73.0% used the Internet to purchase goods or services (Statistics Canada 2003b).

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7.3 ICTs in health

Health care is viewed as one of the most important social issues by Canadians. Quality, cost-effective health care is a growing concern for an ageing population, as is timely access and efficient service delivery. Modern medicine increasingly depends on ICTs to achieve these goals. From laser-guided heart surgery to electronic health records, ICTs can connect health professionals, administrators, policy makers and patients with the knowledge and expertise necessary to make faster and better decisions.

In 2002, all public sector health care and social assistance services had access to personal computers and nearly all had access to the Internet (99.3%). Nearly two-thirds of employees in these institutions had access to computers, and only half had access to the Internet. About three-quarters of these services had a website (Statistics Canada 2003).

The adoption of ICTs by the health care system has often been advocated by all levels of government in order to integrate and coordinate services between provincial and territorial governments and community-based services. For example, a wireless system in a Toronto-area hospital that features online medication orders, electronic charting, and automatic cross-checking of prescribed drugs with a drug interaction database allows the hospital's physicians, nurses and pharmacy simultaneous access to patient records. Satellite link-ups that allow patients living in rural or remote locations to be diagnosed and treated by specialists a few hundred kilometres away improve the quality and accessibility of care, not to mention the cost-savings for travel and accommodations (The Conference Board of Canada 2002).

Delivery of health information and services to Canadians involves a number of public and private sector stakeholders. As part of the GOL initiative, Health Canada promises to be front and centre in the advancement of timely electronic health information and service delivery. The department's website (http://www.hc-sc.gc.ca) contains a massive amount of information and receives thousands of visits. It provides downloadable forms and allows client feedback. Health Canada also publishes a monthly electronic magazine (REAL Health), as well as a monthly online e-mail News Digest. The Office of Health and the Information Highway (OHIH) was created in 1997 as the Health Canada focal point for all matters concerning the use of ICTs in the health sector. OHIH coordinates, facilitates and manages health infostructure-related activities, while also promoting the development of policy in the areas of electronic health records (EHR), protection of personal health information, and telehealth. Health Canada is also the founding partner of the Canadian Health Network (CHN), a national, bilingual Internet-based health information source for Canadians. CHN improves access to timely, reliable and relevant information relating to health and well-being through networks of national health information providers (Health Canada 2001).

An "infostructure" is a combination of the words "information" and infrastructure". An infrastructure is a foundation on which to build. The main concern is information and its development, analysis, adaptation and communication. The notion of a "health information highway" or "health infoway" addresses the importance of effective communications as well as information to improve the health of Canadians. Essentially, the Canada Health Infoway is the key information and communications foundation for the health care system and for improvements to the health of Canadians (Health Canada 1999).

Another major departmental effort is that of the Canada Health **Info***way*, founded as a strategic response by federal, provincial and territorial governments to the development of diverse health information and technology initiatives across Canada. Many of these centred on the development and adoption of electronic health systems and, more specifically, electronic health record solutions. **Info***way* is dedicated to advancing the development of Canada's health infostructure by empowering individuals and communities to make informed choices about their own health, the health of others and Canada's health system (Health Canada 1999).

The Internet is becoming a useful tool for the health care consumer. Whether searching for information about a specific condition, alternative treatments, or the right diet regime, health and medical information is readily available at the click of a mouse. In 2000, six million Canadians, or 46% of Internet users aged 15 and over, used the Internet to search for health or medical information. They were most likely women (52% compared with 41% of men), over the age of 24, living in households with children[17]. More than half (52%) of those looking online for health information searched for new research, diagnosis and treatment options for specific illnesses, while 28% wanted information on lifestyle issues, such as nutrition and exercise (Table 7.3.1) (Stevenson 2002).

The Federal Budget of 2003 provided an additional $600 million to Canada Health Infoway to accelerate the development of electronic health records (EHRs), common information technology standards across the country, and the further development of telehealth applications, which are critical to care in rural and remote areas. EHRs are an essential building block for a modernized, more integrated health care system. They give health providers rapid access to the medical records of their patients including physician visits, hospital stays, prescription drugs and laboratory tests while safeguarding patient privacy (Department of Finance Canada 2003).

17 *Among those households searching online for health-related topics, 18% had a child or children under age 5, 26% had children between 6- and 12-years and 22% had teenagers.*

Table 7.3.1 Percentage of Canadians who have ever used the Internet to search for health information, by type, 2000

Type of health information	%
Diseases	52
Lifestyle	28
Analysis of symptoms	23
Drugs	20
Alternative medicine	12
Surgeries	7
Health care system	7

Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics Division, Statistics Canada

Canadians using the Internet to search for health information were also asked to indicate the websites they visited. Health Canada sites were most popular (24%), followed closely by commercial sites (21%), professional health associations (17%) and non-profit organizations (17%), universities (16%) and other government sites (11%) (Stevenson 2002).

Steady growth in the percentage of Canadian households using the Internet for health-related information is also evident from Table 7.3.2.

Table 7.3.2 Households searching for medical or health information online, 1998-2002

	1998	1999	2000	2001	2002
All households	9.6	15.6	22.9	30.1	32.8
Regular home-use households	42.5	54.2	57.1	61.8	63.9

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

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7.4 ICTs and the law

Technology is revolutionizing law and order in Canadian society. It is being used both to practice and enforce the law more efficiently and effectively. At the same time however, technological innovation has the potential to create new crimes, as well as new ways to commit old crimes. To address the intersection of technology and crime, the Federal Prosecution Service of the Department of Justice formed the ***e*Prosecutions Secretariat** in 2001. This small group monitors the impact of technology on the work of prosecutors and participates in a variety of projects within and outside of the Department of Justice that relate to technology and the practice of criminal law. The Secretariat also participates in a provincial and territorial working group on cyber-crime and guides police and prosecutors through the electronic age of microchips and cyberspace (Department of Justice 2003).

From crimes of fraud and money laundering to child pornography and drug trafficking, the computer and the Internet can potentially be dangerous tools. Electronic crime fighting raises many new questions about how to gather, disclose and present digital evidence of these crimes. The ***e*Prosecutions Secretariat** offers cyber-crime training and assistance to prosecutors and police, while also ensuring that the government is aware of the policy issues and challenges surrounding technology in the criminal justice system. The effective management of information through computerized systems and data networks is also an important objective of electronic crime fighting. The Integrated Justice Information (IJI) initiative was launched in 1999 in order to simplify the exchange of information and knowledge among criminal justice agencies and improve the management of case information. Headed by the Department of the Solicitor General of Canada, its partners include the Department of Justice, Canada Customs and Revenue Agency, Citizenship and Immigration Canada and the Royal Canadian Mounted Police (RCMP). One of the key outcomes of this collaboration is the Canadian Public Safety Information Network (CPSIN), which is intended to bring all the players together in a modern national network (Department of Justice 2003).

*Cyber-crime is generally defined as a criminal offence involving a computer as the object of the crime, or the tool used to commit a material component of the offence. Crimes in which the computer is used as the **tool** consist of crimes that law enforcement has been fighting in the physical world but are now increasing in frequency on the Internet – these include child pornography, criminal harassment, fraud, intellectual property violations and the sale of illegal substances and goods. Crimes in which the computer is used as the **object** are new and specifically related to computers and networks – these include hacking or unauthorized use of computer systems, defacing websites, and creation and malicious dissemination of computer viruses (Statistics Canada 2002).*

To date, Canada does not systematically collect national statistics on cyber-crime. Canada was, however, one of the first countries to enact criminal laws in the area of computer crime. A study by an UN-sponsored network of Internet policy officials reported that Canada is ahead of nearly two-thirds of the 52 countries surveyed in enacting laws to fight cyber-crime. In 1985, amendments to the Criminal Code introduced a comprehensive set of laws directed at computer crime. These included unauthorized use of computer, mischief in relation to data, possession of device to obtain telecommunication facility or service, and theft of telecommunication service. The Criminal Law Improvement Act made various amendments to the Criminal Code in 1997, including possession of device to obtain computer service (Statistics Canada 2002).

In some cases, traditional crimes have simply adapted to new technology and, in turn, the criminal justice system has had to adapt accordingly. Other computer-related crimes have required new laws, such as computer fraud and computer forgery. In the case of child pornography, for example, revisions to the legislation were made to ensure that the offence was defined in a way that captured the new technological aspect of the crime – it was already illegal in Canada to possess child pornography, but changes were made to make it illegal to download and view this type of material online (Statistics Canada 2002).

One of the biggest challenges of cyber-crime is the seamless nature of the Internet – crimes may be committed from any country, against any person, and often without a trace. It is not surprising, then, that initiatives for combating cyber-crime largely rely on international cooperation. The first international effort to deal with computer crime was initiated by the OECD in the 1970s. Efforts were made in the definitions and guidelines to promote harmonization of international computer crime laws. More recently, Canada – along with 29 other countries – signed the Council of Europe Convention on Cyber-Crime in 2001. This multilateral agreement will require parties to establish laws against cyber-crime, to ensure that law enforcement has the necessary authority to investigate and prosecute cyber-crime offences, and to provide international cooperation to other parties in computer-related crime. However, many countries, including Canada, have not yet ratified this first international treaty on crimes committed via the Internet and other computer networks. A number of other efforts among G8 nations are also underway, as are national, provincial and territorial measures (Statistics Canada 2002).

The 2000 General Social Survey collected general information on individual use of technology, and specific information on offensive content and security issues relating to the Internet. Overall, the majority (53%) of Canadians 15 years of age and over had used the Internet at home, work or somewhere else in the last 12 months. Of these, six percent of parents reported that their child came across offensive content on the Internet. Nearly half (49%) had come across websites

containing pornography, while 13% of users had come across content that promoted hate or violence to a particular group. Eight percent of Internet users had also received threatening or harassing e-mail, while five percent experienced problems associated with security (Table 7.4.1).

Table 7.4.1 Problems associated with security on the Internet, 2000

	Percentage of Canadian Internet users citing security problems
Threatening email	9
Personal information made public	11
Hacking	32
Viruses	45

Source: General Social Survey, Cycle 14, Housing, Family and Social Statistics, Statistics Canada.

The Adult Criminal Court Survey further collects data on federal statute charges in seven provinces and one territory, representing 80% of the national adult court caseload. Table 7.4.2 presents the number of charges for technology-specific offences, with the most common being theft of telecommunications services.

Table 7.4.2 Number of charges, technology-specific offences, 2000-01

Criminal code offence	
Mischief in relation to data	16
Theft of telecommunication service	270
Possession of device to obtain telecommunication facility or service	133
Unauthorized use of computer	58

Source: Adult Criminal Court Survey, Canadian Centre for Justice Statistics, Statistics Canada.

The Computer Crime Program at the RCMP has also made progress in the area of cyber-crime. Their new Technological Crime Branch is responsible for research and development, policy and standards, and investigational support in technological crime. Specialized duties of the Branch include investigating crimes where computer systems and/or their contents are the objects of crime, and providing computer investigative support in the search, seizure and analysis of electronic evidence. According to the RCMP's operational statistics reporting system, the number of cyber-crimes has increased from 54 incidents in 1997 to a whopping 768 incidents in 2001 (Statistics Canada 2002).

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Part 3
CURRENT ISSUES OF THE INFORMATION SOCIETY

Chapter 8 THEMATIC ANALYSES

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Highlights

- Following exceptional growth in the last half of the 1990s, employment in the computer and telecommunications industries declined nearly 10% between 2001 and 2002, but has since stabilized.

- Although the digital divide in Canada is generally closing, differences in ICT penetration between the lowest income deciles and very high income groups persist.

- Mobile services were the most competitive of the telecommunications services markets in Canada in 1999, while the local wireline market was the most concentrated.

- Nearly one-half (49%) of regular Internet-use households and a majority of regular business users (58%) connected to the Internet with broadband technologies.

- Through the 1980s and 1990s, productivity growth in ICT manufacturing was greater than that of core ICT services (i.e., computer services and telecommunications), but ICT services led in terms of GDP and employment growth.

- Many cultural industries are still in the process of developing new ICT delivery channels, such as websites and online sales.

Chapter 8
THEMATIC ANALYSES

ICTs touch all sectors, all facets of life and all corners of the world in which we live, learn and work. This chapter presents a selection of analytical articles that delve more deeply into important developments at the crossroads of the information society. What does it all mean? How do ICTs affect the everyday life of Canadians?

8.1 The high-tech labour market

Geoff Bowlby is an analyst in the Labour Statistics Division. He writes here about the state of employment in the computer and telecommunications industries following the boom years.

In 2001, with a collapse in demand for high-tech products and services, there were a number of high-profile layoffs in the sector. At its peak in the first quarter of 2001, the computer and telecommunications (CT) industries[18] employed 650 thousand people. A year later, there were 585 thousand in this sector, a drop of 9.9%. Meanwhile, the unemployment rate in these industries rose from only 3.9% to 6.6%.

CT employment - two years after the boom

The decline in CT employment has been documented before (Bowlby and Langlois 2002; Vaillancourt 2003) but as the layoffs began to subside, the woes of the high-tech sector took a back seat. But what has happened since March 2002? How has the high-tech workforce changed in the last year?

In short, CT employment in Canada has stabilized. But beneath the relative calm lies a story of continued struggle and restructuring. Some workers in CT, most notably the lowest skilled, continue to face layoffs in the sector, while others have enjoyed somewhat of a recovery.

This article looks at employment trends in occupations in the high-tech industries, with a focus on what has happened to skilled and lesser skilled workers. The analysis will also show how average wages and wage distributions have changed in CT industries over the last couple of years.

18 *The computer and telecommunications (CT) industries are a subset of the information and communications technologies (ICT) sector. Essentially, they are the industries of the ICT sector that can be identified at a 4-digit North American Industrial Classification Systems (NAICS) level. See text box. For more detail on what is included among the CT industries, consult Bowlby and Langlois (2002).*

The following computer and telecommunications (CT) industries form the industrial aggregate on which the analysis in this article has been based. These industries are part of the widely used ICT sector definition – developed by the OECD in 1998 – but represent only those industries that can be defined at the four-digit NAICS level:

Manufacturing
Commercial and service industry machinery (3333)
Computer and peripheral equipment (3341)
Communications equipment(3342)
Audio and video equipment (3343)
Semiconductor and other electronic components (3344)
Navigational, measuring, medical and control instruments (3345)

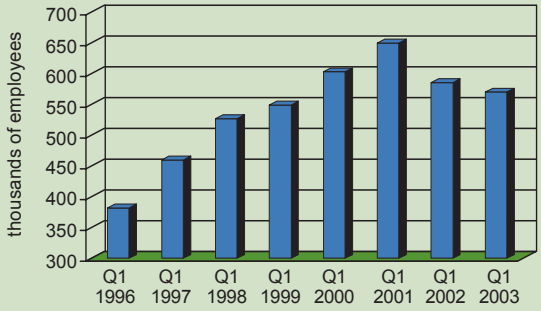
Services
Computer and communications equipment, wholesaler-distributors (4173)
Software publishers (5112)
Telecommunications services (5133)
Data processing services (5142)
Computer systems design and related services (5415)
Electronic and precision equipment repair and maintenance (8112)

Overview

Following exceptional growth in the last half of the 1990s, employment in CT industries declined. After the sharp decline of nearly 10.0% between 2001 and 2002, it appears to have stabilized. In the first quarter of 2003, CT employment stood at 570 thousand (Figure 8.1.1).

The data used in this study come from the Labour Force Survey (LFS). The LFS is a monthly survey, providing information on major labour market trends such as employment, unemployment and participation rates. The survey sample consists of about 53,000 households or more than 100,000 individuals. Respondents stay in the sample for six months, and are residents of Canadian provinces, aged 15 years and over. Persons living on Indian reserves, inmates of institutions, territorial residents and full-time members of the Armed Forces are excluded from the sample, representing about 2% of the Canadian population.

Figure 8.1.1. Employment in CT industries



In all four of Canada's high-technology hubs, Toronto, Montreal, Ottawa-Gatineau and Vancouver, CT employment remains below the peak of two years earlier. In all except Vancouver, high-tech employment has stabilized (Table 8.1.1). Of these four cities, Vancouver had the highest concentration of workers in telecommunications in 2002, currently the fastest-declining component of the CT industries.

Table 8.1.1 Employment in CT industries, by city, age group, sex and class of worker, first quarter averages, 2001-2003

	First quarter			% Change	
	2001	2002	2003	2001-2002	2002-2003
	thousands				
Total	**649.8**	**585.7**	**570.0**	**-9.9**	**-2.7**
Location					
Toronto	197.8	152.8	159.0	-22.8	4.1
Montreal	104.7	99.4	102.7	-5.1	3.3
Ottawa	68.5	57.7	56.7	-15.8	-1.7
Vancouver	59.1	55.8	43.3	-5.6	-22.4
Rest of country	219.7	220.0	208.3	0.1	-5.3
Age group					
15 to 24	66.1	52.8	49.9	-20.2	-5.6
25 to 54	556.5	500.6	487.6	-10.1	-2.6
55+	27.1	32.2	32.5	18.9	0.9
Sex					
Men	492.8	386.0	381.3	-10.2	-1.2
Women	220.0	199.6	188.7	-9.3	-5.5
Class of worker					
Employees	569.6	505.0	487.2	-11.3	-3.5
Self -employed	80.2	80.6	82.8	0.6	2.7

Source: Labour Force Survey, Labour Statistics Division, Statistics Canada.
Note: Not seasonally adjusted.

The high-tech layoffs of 2001 hit core-age (25- to 54-year-olds) workers and youths the most. While there were slight declines in these two groups between the first quarters of 2002 and 2003, they were nowhere like the drops of the previous year. The drop in high-tech employment also eased for both men and women.

Manufacturing stable, telecommunications down

After shedding one in four workers between the first quarters of 2001 and 2002, the manufacturing part of the computer and telecommunications industry remained essentially unchanged. In the services component of the CT industries, a large drop in telecommunications services employment was moderated by a rebound in computer systems design and related services (Table 8.1.2).

Table 8.1.2 Employment in CT industries, by detailed industry, first quarter averages, 2001-2003

	First quarter			% Change	
	2001	2002	2003	2001-2002	2002-2003
	thousands				
Total computer and telecommunications	**649.8**	**585.7**	**570.0**	**-9.9**	**-2.7**
Manufacturing	165.6	124.9	127.5	-24.6	2.1
Services	484.2	460.8	442.5	-4.8	-4.0
Telecommunications	157.2	154.4	124.6	-1.8	-19.3
Computer systems design	256.8	237.6	254.4	-7.5	7.1

Source: Labour Force Survey, Labour Statistics Division, Statistics Canada.
Note: Not seasonally adjusted.

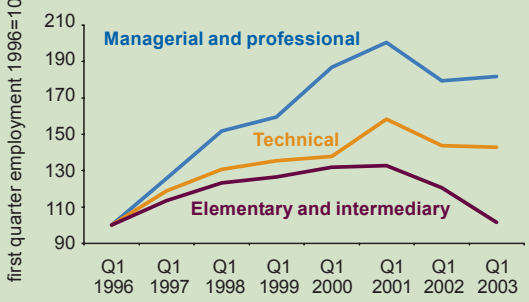
Low-skill jobs in high-tech continue to take a hit

Overall job growth in the CT industries came mostly from managerial and professional jobs. Over the 1996-2003 period, the proportion of these jobs more than doubled vis-à-vis lower skilled jobs. While overall employment stabilized after the bust, employment levels continue to fall sharply to less than pre-boom levels for the lowest skilled[19] workers in the industry.

The employment bust began with job losses among the lowest skilled workers (those who worked in occupations that normally do not require college or university education) in the first quarter of 2001. The cuts then hit the workers in occupations that demand an intermediary or technical skill set in the second quarter, and higher skill managers and professionals only after the third (Figure 8.1.2).

19 *Human Resources Development Canada developed the skill levels used in this report. Embedded within each occupation code in the National Occupational Classification (NOC) is the skill level normally held by workers in the occupation. This skill level is based on what formal education is normally required for the job, although the system also incorporates whether or not the job requires supervisory responsibility, or significant health and safety responsibilities. For more information, please see www.hrdc-drhc.gc.ca and search "National Occupational Classification".*

Figure 8.1.2. Low-skill high-tech employment decline persists



While the cuts started sooner for the least educated, they have continued longer and as a result, have been the most severe. Following a decline of 12 thousand or 9.1% between the first quarters of 2001 and 2002, there was a further reduction of 19 thousand (-15.8%) people employed in low skill occupations in the CT industries in the next four quarters. By the first quarter of 2003, there were 101,000 people employed in CT industries who worked in jobs that did not require post-secondary education, only three-quarters the level of two years earlier (Table 8.1.3).

At first, the sharp and prolonged drop in employment for workers in the low skill group was driven by a reduction in assemblers of high-tech manufactured goods. Between the first quarters of 2001 and 2002, their numbers plummeted 27.2%, but they have declined at a much slower pace in the last year (-6.3%). More recently, the downturn among the lowest skilled is related to declining clerical staff, which fell 19.2% between the first quarters of 2002 and 2003.

The next wave of layoffs was among those in jobs that normally require college education. This began in the second quarter of 2001. By the first quarter of 2002, there had been a reduction of 17,000 or 9.2%, a decline driven by a sharp reduction in people employed in two occupations: a) telecommunication line workers and installers and b) administrative officers.

Table 8.1.3 Employment in CT industries, by occupation and skill level, first quarter averages, 2001-2003

	First quarter			% Change	
	2001	2002	2003	2001-2002	2002-2003
	thousands				
All occupations in computer and telecommunications industries	**649.8**	**585.7**	**570.0**	**-9.9**	**-2.7**
Total managerial and professional	**338.1**	**302.5**	**306.8**	**-10.5**	**1.4**
Managers	76.7	68.8	59.7	-10.2	-13.3
Engineers	45.5	31.3	34.8	-31.3	11.5
Computer programmers and systems analysis	193.9	179.6	191.1	-7.4	6.4
Other managerial and professional	22.0	22.9	21.1	3.9	-7.7
Total technical	**180.4**	**163.8**	**162.7**	**-9.2**	**-0.7**
Line workers	29.2	25.3	22.1	-13.3	-12.9
Technical sales specialists	42.4	39.9	34.5	-6.0	-13.6
Technical occupations in engineering	62.1	63.8	70.5	2.7	10.5
Other technical occupations	46.7	34.8	35.6	-25.5	2.5
Total intermediary and elementary	**131.3**	**119.4**	**100.6**	**-9.1**	**-15.8**
Assemblers in manufacturing	41.7	30.3	28.4	-27.2	-6.3
Clerical occupations	76.5	73.4	59.3	-4.0	-19.2
Other intermediary and elementary	13.2	15.6	12.8	18.3	-18.0

Source: Labour Force Survey, Labour Statistics Division, Statistics Canada using skill definitions developed by Human Resources Development Canada.
Note: Not seasonally adjusted.

Unlike the lower skilled occupations, the number of people working in jobs that normally require college education has stabilized between the first quarters of 2002 and 2003. During this time, employment has slipped by one thousand, a much smaller decline from the previous year. As telecommunications line workers and technical sales specialists have continued to become more scarce, there were some gains among engineering technicians. On average for the first quarter of 2003, 163 thousand CT workers were employed at jobs that require college education, 9.8% below the level two years earlier.

The second quarter of 2001 was when employment for the highest skilled – managers and professionals – was at its highest. The decline in employment in these occupations in the CT industries lasted a year, bottoming out in the second quarter of 2002, thus, many such jobs have been gained over the last few years.

In total, employment in the high-skilled occupations dropped 11% between the first quarters of 2001 and 2002. During the last year, however, there has been some recovery in managerial and professional employment. Compared to the first quarter of 2002, employment was up four thousand (1.4%), to 307,000. While managerial jobs continue to decline at a fast clip, there has been some added employment among engineers as well as computer programmers and systems analysts, the largest occupational group in these industries.

Because of the persistent decline in employment in lower-skill occupations over the past couple of years, the composition of the CT workforce has shifted in favour of those occupations that normally require post-secondary education. While low-skilled occupations made up 20.2% of all employment in the CT industries in the first quarter of 2001, two years later that share had dropped to 17.6%. Meanwhile, occupations that normally require a college education increased from 27.8% to 28.5% of all jobs in computer and telecommunications. High-skill management and professional employment also saw relative gains, increasing their share from 52.0% to 53.8%. These findings are much more pronounced if the 1996-2003 period is examined.

Stagnant demand for workers in CT industries, but wages still inch up

While demand for workers in the CT industries has decreased in recent years, as reflected in falling employment and rising unemployment rates among workers, median wage rates for employees[20] in CT have not fallen, at least in part because of the continued layoff of lower-skilled, lower paid workers.

In the first quarter of 2003, the median hourly wage in CT was $21.63, 2.3% higher than a year earlier. Even during the worst of the job cuts, wages rose – although not at a rate that would beat increases in the cost of living. Between the first quarters of 2001 and 2002, median wages rose 0.8%.

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20 *The Labour Force Survey does not collect wage information on the self-employed.*

Table 8.1.4 Median hourly wage rates, CT industries, by occupation, first quarter averages 1999, 2001 and 2003

	First quarter			Change in 2 years before employment peak (Q1 1999 to Q1 2001)	Change in most recent 2 years (Q1 2001 to Q1 2003)
	1999	2001	2003		
	$			%	
Total, all occupations	**19.06**	**20.98**	**21.63**	**10.0**	**3.1**
Management occupations	26.17	30.45	33.40	16.3	9.7
Business, finance and administrative occupations	16.68	16.83	17.36	0.9	3.2
Natural and applied sciences and related occupations	21.27	24.45	24.04	15.0	-1.7
Computer programmers and systems analysts	22.21	25.21	25.43	13.5	0.8
Engineers	24.12	31.73	32.69	31.6	3.0
Other occupations in natural and applied sciences	16.47	17.67	18.58	7.3	5.2
Sales and service occupations	15.63	18.11	19.82	15.9	9.4
Technical sales specialist	14.23	17.69	21.21	24.3	19.9
Other sales and service occupations	16.96	20.13	13.14	18.7	-34.7
Trades, transport and equipment operators and related occupations	20.93	21.67	22.89	3.5	5.7
Telecommunications line workers and repairers	22.83	23.10	24.14	1.2	4.5
Other occupations in trades, transport etc.	17.15	18.57	15.38	8.3	-17.2
Occupations unique to processing, manufacturing and utilities	11.94	12.28	12.86	2.9	4.7
Assemblers in manufacturing	11.58	11.75	12.49	1.4	6.3
Other occupations in processing, manufacturing and utilities	15.20	20.17	15.50	32.7	-23.2
All other occupations	19.22	19.72	18.98	2.6	-3.8

Source: Labour Force Survey, Labour Statistics Division, Statistics Canada.

Note: Not seasonally adjusted.

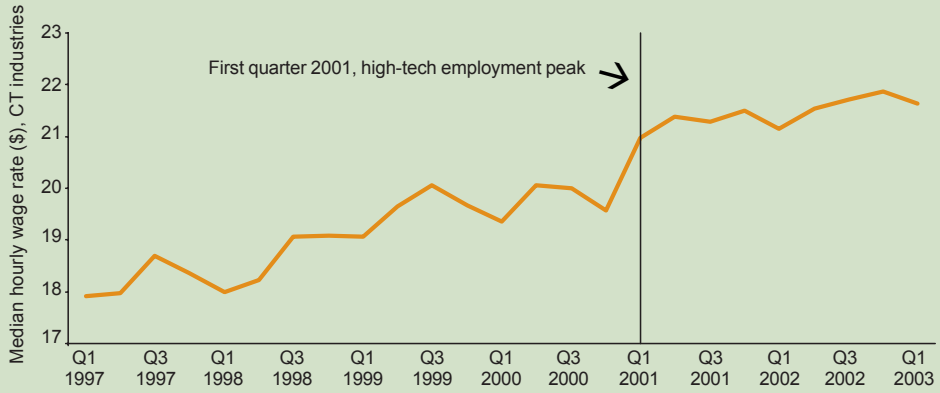
CT workers are, on average, paid much better than people in the rest of the economy as a whole. The median hourly wage for all employees in the first quarter of 2003 was $16.00, 26% less than employees in the CT industries. While over one in ten CT workers is paid $40 or more per hour, only one in 36 employees is paid this much in the rest of the economy.

These recent wage gains in the CT industries pale in comparison to its hey-days, when reports of occupational shortages were more widespread. In the two years preceding the first quarter of 2001, when employment in computer and telecommunications peaked, median wages jumped 10.0%. In comparison, in the most recent two years, median wages have increased only 3.1% (Figure 8.1.3).

Since the end of the employment boom, wage gains have slowed down for almost all occupations in the computer and telecommunications industries. The most dramatic example occurred among engineers. Between 1999 and 2001, median wages shot to $31.73 per hour, an increase of almost 32%. In the last two years, the wages for engineers have inched up only 3%.

The largest occupation group, computer programmers and systems analysts, have also seen a dramatically reduced rate of growth in wages. In the last two years of the boom, wages for these workers increased 13.5%, but have changed little since the first quarter of 2001. At $25.43 per hour in the first quarter of 2003, the median wage for computer programmers and analysts was a mere 0.8% higher than two years earlier.

Figure 8.1.3 Wages still rising, but at slower pace



Summary

Employment in CT industries increased significantly in the last half of the 1990s and into 2001. It then took a hit but since layoffs have subsided, it has stabilized. However, firms in these industries continue to reduce employment in occupations that require the least skill, and have recently returned to hiring added managerial and professional staff.

This has meant a compositional shift in employment, to a workforce with more formal education. As a result, average wages have continued to increase, despite the drop in demand for workers in the sector. Even though wages continue to rise, they are not doing so at a rate anywhere close to that during the boom years.

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8.2 Information technology occupations

Much has been written about the state of employment in high-technology over the last few years, but how much is known about the people who work in this sector? The rapid growth of information and communications technologies (ICTs) in the 1990s created a massive explosion in the demand for ICT-skilled workers. Information technology (IT) occupations were deemed an attractive profession for young graduates and people looking to change their careers. From socio-demographic characteristics and industry concentration to hours and earnings, the first section presents highlights from a recently released profile of IT workers using the first estimates available from the 2001 Census. The profile, authored by Roman Habtu, can be found in Statistics Canada's *Perspectives on labour and income*. The second section offers early findings from pilot surveys devoted to IT occupations. Written by Lucie Cloutier, an analyst in the Small Business and Special Surveys Division, it describes the development and progress of work related to IT occupations.

8.2.1 A profile of selected IT occupations

Over 387 thousand people were employed in the selected occupations related to IT in 2001, representing 3% of all employed Canadians. The majority of these workers (75%) were employed in four IT occupations: information systems analysts and consultants, computer programmers, user support technicians, and computer and network operators and web technicians. Of the remaining workers, half were computer and software engineers. IT occupations were largely made up of relatively young and highly educated workers. The average age of IT workers was 36, compared with 39 for all occupations, while 44% of IT workers had at least a bachelor's degree, more than double the proportion in all occupations (20%) (Habtu 2003).

The data for this article come from the 2001 Census. Occupations were classified for the first time according to the National Occupational Classification for Statistics (NOC-S). Nine occupations related to information technology (IT) are included as follows:

Computer engineers (except software engineers)
Information systems analysts and consultants
Database analysts and data administrators
Software engineers
Computer programmers and interactive media developers
Web designers and developers
Computer and network operators and web technicians
User support technicians
Systems testing technicians

The employed population refers to those who worked in the reference week (the week prior to census enumeration day) or were absent from work for various reasons.

The analysis contained here differs from the previous section (section 8.1) in that it looks at selected IT occupations across the economy, as opposed to employment in selected ICT industries regardless of occupation.

The set of occupations selected focuses explicitly on IT rather than ICT occupations. It therefore does not include certain specialist occupations in telecommunications, cable or other industries of the ICT sector.

Part-time employment was less prevalent among IT workers at only 6%, compared with 18% for employed workers in all occupations. Self-employment also represented a relatively small proportion of employed IT workers (11%). Median earnings for IT workers were generally higher than the rest of the labour force, indicating high returns to this highly educated group. Moreover, 29% of IT workers earned $60,000 or more in 2001, compared with only 14% of all employed workers. Only one in seven worked 50 hours or more – a proportion lower than the one in five for all occupations.

Although IT occupations were male-dominated (73%), women are making progress – more than one-quarter of IT workers were women in 2001. Women were especially well represented as database analysts and administrators (42%), systems testing technicians (41%), and web designers and developers (33%).

IT workers were largely concentrated in four industries – more than 40% worked in the professional, scientific and technical services industry, followed by information and cultural (12%), manufacturing (10%), and public administration (9%). In 2001, exactly half of these IT workers were employed in Ontario, compared with 39% of all workers. Quebec had the second highest proportion of IT workers (22% of all IT workers), followed by British Columbia (11%) and Alberta (9%). IT occupations were largely found in urban areas, where 93% of IT workers were employed, compared with 81% of all workers. The highest concentration of IT workers was in Ottawa-Gatineau (8% of employees worked in IT occupations), while Toronto, Montreal, Vancouver and Calgary also employed high proportions of IT workers.

8.2.2 A survey of information technology occupations

Statistics Canada's National Survey of Information Technology (IT) Occupations is part of an ongoing research project that was developed in response to conflicting views about a labour shortage of IT workers in the late 1990s. An analysis of Labour Force Survey (LFS) data found no evidence of tight labour market conditions for these occupations, however the notion of an IT labour shortage persisted among employers. In 1999, Human Resources Development Canada (HRDC) proposed a research project in co-operation with the Software Human Resource Council (SHRC). This project was designed to collect information

about the state of the IT labour market, including industry needs, skills gaps and, in particular, whether there was a shortage in the IT labour market and if so, how severe?

Prior to the commencement of the project, HRDC developed 21 new occupations under the National Occupational Classification for Statistics (NOC-S) to recognize the diversity of emerging IT job functions. This was a substantial improvement over the previous classifications which denoted only three occupations – computer programmers, systems analysts, and computer engineers. The new classifications are based on the job titles in the Occupational Skills Profile Model (OSPM) created by SHRC.

The surveys

In 2000, Statistics Canada conducted a pair of pilot surveys on the subject of IT occupations. Conducted by the Small Business and Special Surveys Division, on behalf of HRDC, these surveys had two main objectives: to test the 21 newly developed occupational classifications and to determine the feasibility of collecting detailed IT labour market information on a national scale, across many different industries.

The pilot surveys consisted of two separate but related surveys – the *employer* survey was conducted in the spring of 2000, while the *employee* survey took place in the fall of the same year. The surveys were conducted among firms in the insurance carriers industry in Ontario, the architectural, engineering and related services industry in Quebec and the computer systems design and related services industry across Canada.

The sample for the employer survey was selected from Statistics Canada's Business Register. The locations selected had at least 6 employees, at least one of whom was an IT employee. Approximately 1,200 employers responded to the survey, providing information with regard to their experiences in hiring and recruitment, training, vacancies and retention, as well as counts of employees and contract workers in 21 occupations.

The sample for the employee survey was taken from the employer survey. At the end of the employer survey, employers were asked to allow employees to participate in the second phase of the survey. Employers either provided a list of employees in two selected occupations, or randomly distributed the survey to employees in the selected occupations. Approximately 1,450 employees responded to questions on their occupational histories, educational background, and skills and training. Demographic information was also collected.

Early results

Results from the pilot surveys showed that a large number of employers faced considerable difficulty in finding and retaining appropriately qualified individuals. The turnover and vacancy rate for IT employees in the surveyed industries was high. Employers in the *computer systems design and related services* industry indicated that 34% of their IT employees had been hired in the past 12 months. They further indicated that 12% of their IT positions were vacant at the time of the survey and that 35% of those vacancies had gone unfilled for 4 months or more. Nearly half or more of all employers in the industries surveyed indicated some or a lot of difficulty in hiring appropriate employees. They attributed these difficulties to a number of factors, such as more attractive compensation, location, work challenges or career growth opportunities offered by competing companies. However, the largest factors by far were felt to be a lack of potential employees with the relevant experience or required skills, cited by at least 60% of all firms in the industries surveyed.

While the employee survey results indicated that many employees were well educated, with college diplomas and/or university degrees, more than half the employers reported the need to provide training to new employees. Employers reported providing a wide variety of training, although the focus seemed to be on training related to systems and applications software, the former provided by over 60% of firms in the selected industries and the latter by 45% or more of all firms. Employees and employers seemed to agree that better compensation and opportunities for better career growth were major factors causing employees to change jobs.

A national survey

The lessons learned from the employer and employee pilot surveys have proven useful in developing a national survey that would provide governments and businesses with up-to-date labour-market information for IT occupations within various industries and regions. The National Occupational Classification was updated to include 23 new classifications for IT occupations in 2001.

For private sector industries, the sample for the national employer survey was again drawn from the Business Register. About 31,000 locations were selected from the relevant industries. These locations must have more than six employees and at least one IT employee.

For the public sector, about 2,000 divisions/directorates were randomly selected from the Government directory. In collaboration with Treasury Board, 15 departments and agencies were selected to be part of the survey because of their high concentration of IT employees, representing about 90% of all IT employment in the federal administration. Within these selected organizations, divisions/directorates with a high concentration of IT employees were selected to represent the federal public administration. The same process was used to select the provincial public administration sample.

The national employee survey was administered in the same way as the pilot survey. About 35,000 employees could potentially respond to the questionnaire.

Dissemination of results

Collection of all units was completed in September 2003 and data processing is underway. Data from the National Survey of Information Technology Occupations will be released to the public through *The Daily* (http://www.statcan.ca) in the spring of 2004. Information about the survey is available from the Small Business and Special Surveys Division of Statistics Canada, while survey reports and analyses can be found on the SHRC website at http://www.shrc.ca.

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8.3 The digital divide in Canada

George Sciadas is Chief of Information Society Research and Analysis in the Science, Innovation and Electronic Information Division. This article presents some of the highlights from his analytical work on the digital divide. The entire study, "Unveiling the Digital Divide" can be found in Statistics Canada's Connectedness Series.

The commercial arrival of the Internet, in conjunction with the convergence of information and communications technologies (ICTs), has generated the need for a new understanding of old issues, as well as the understanding of new. Prominent among these is the digital divide, commonly understood as the gap between ICT "haves" and "have-nots". Governments, business, international and non-governmental organizations are in the midst of numerous initiatives to address ICT-related inequities, with the hope to reap 'digital dividends'.

The data used in this study come from several sources at Statistics Canada. A major database contains information on households, compiled over many years and through different survey instruments going as far back as 1953. Until recently, the information was collected by the Household Facilities and Equipment Survey. As of 1997, its content has been embodied in the Survey of Household Spending. Other data for household Internet use, including all data that refer to use from any location, come from the Household Internet Use Survey. Data regarding the use of the Internet by individuals come from the 2000 General Social Survey, which was dedicated to the use and impacts of technologies.

Defining the digital divide and the impact of timing

The concept "digital divide" serves as an umbrella term for many issues, including infrastructure and access to ICTs, use and impediments to use, and the crucial role of ICT literacy and skills to function in an information society. In reality, many divides exist. They can be identified for any permutation of i) individual ICTs and the timing of their introduction, and; ii) variable of interest. Data show that household penetration of several ICTs increases with income (Figure 8.3.1) and that the effect of income is more pronounced on new technologies rather than older and established ones. However, the income divide is also present in the case of vehicles (an example of a non-ICT commodity) showing that the effect of income on penetration is not simply an ICT phenomenon.

The timing of the introduction of individual ICTs is important in placing digital divides in perspective. For example, a "telephone divide" today must be seen under the light that the technology, in its basic form, has been around for over a century. This differs from the divide

associated with the Internet, which has been around for less than a decade in its commercial incarnation. Historically, the introduction of new commodities has been gradual. Figure 8.3.2 presents a collection of recorded penetration histories over an almost 50 year period. Despite perceptions about the meteoric rise of the Internet, fast as though it may have been, the penetration of television in people's lives was faster. The penetration of the VCR was also very fast, particularly during its first decade. While the speed of adoption among commodities differs, their penetration is generally characterized by accelerating growth in the initial periods, which eventually gives way to decelerating growth.

Figure 8.3.1 Household penetration, by income, 2000

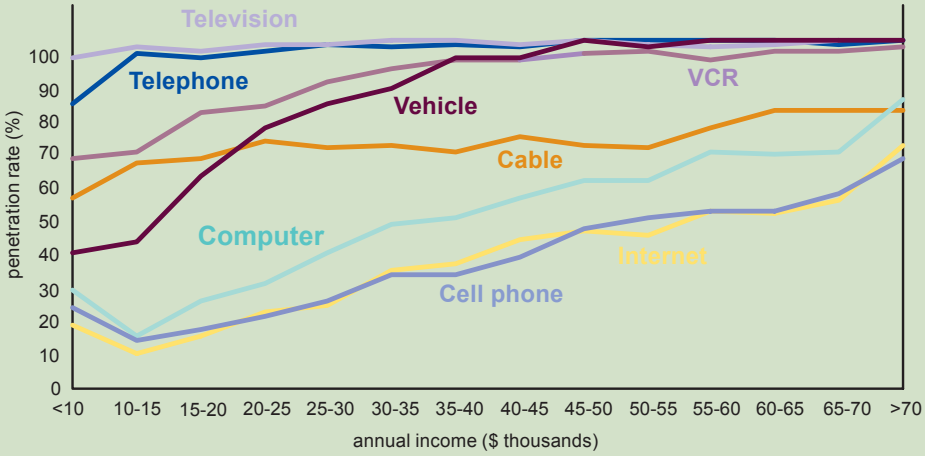
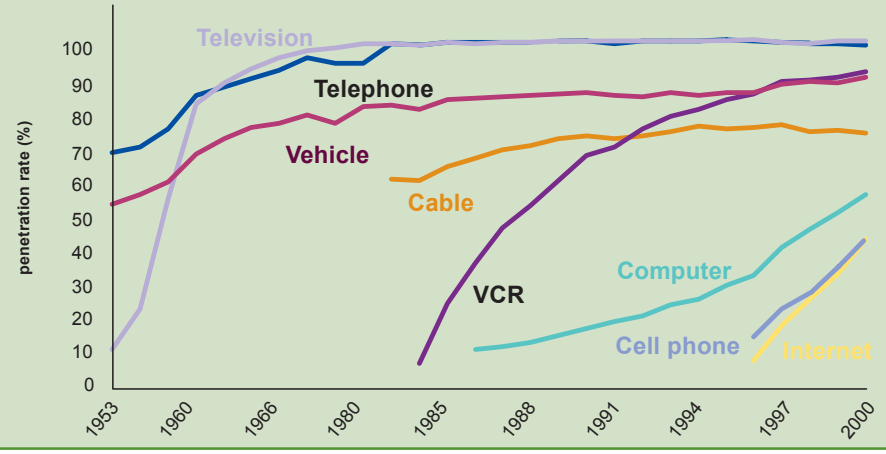


Figure 8.3.2 Penetration over time



The digital divide is defined as a relative concept whose measurement involves comparisons between 'have-more' and 'have-less' groups. Its size can be approximated with the difference in the penetration rates between high and low income groups. Such differences, computed for households in the top and bottom income deciles for selected years, are contained in Table 8.3.1. The findings indicate that the divide in newer technologies (Internet, computers, cell phones) is sizeable and drops for older and saturated technologies (television, telephone). The fact that the telephone divide widened sharply in the last year of data serves as an example that closing divides should not be taken for granted, but they can regress.

Table 8.3.1 Differences in penetration rates, top vs. bottom income deciles

	1982	1986	1990	1996	2000
			percentage points		
Telephone	7.4	7.5	4.6	5.2	11.9
Television	3.9	2.9	2.2	1.5	3.8
Cable	-	-	-	24.6	23.2
VCR	-	47.1	54.3	36.4	33.4
Computer	-	18.8	31.8	48.2	65.2
Internet	-	-	-	18.2	62.5
Cell phone	-	-	-	24.8	55.9
Vehicle	56.5	56.4	51.3	47.1	58.8

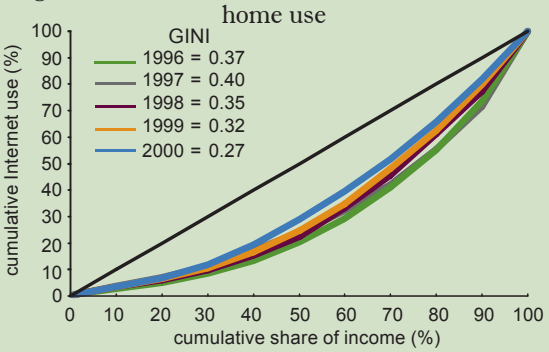
A shrinking or growing phenomena?

Notwithstanding the size of the digital divide, a more pertinent question is whether it is growing or closing. While inequalities of this type are difficult to prove conclusively with any single measure, in an overall sense the digital divide is slowly closing. As seen in Figure 8.3.3, with the exception of 1996, the estimated Lorenz curves[21] for each successive year are cleanly enveloped by those of the previous year, and the Gini coefficients[22] are declining. However, this analysis camouflages important movements at more detailed levels. Thus, further analysis was performed.

21 *The Lorenz Curve is a method commonly used to study the inequality of the distribution of income. Making appropriate modifications to the standard application, this analytical tool is adapted to fit the context of the digital divide. Rather than plotting penetration against each income percentile, the cumulative distribution of penetration is plotted against the cumulative income percentiles, from lowest to highest.*

22 *Gini coefficients are calculated to provide an overall measure. Gini coefficients can assume values from 0 (perfect equality) to 1 (extreme inequality). The larger the area between the 45°line and the Lorenz curve, the further away from perfect equality, and the higher the value of the Gini coefficient.*

Figure 8.3.3 Evolution of relative Internet divide, home use



Computing the distribution of Internet users by income decile for the 1996-2000 period reveals that there has been a sizeable decline in the relative share of the highest income decile (from 28.4% of all users down to 18.2%) and a much smaller decline of the importance of the 9th decile. While the relative loss of the importance of the two highest income deciles was matched by gains in the middle incomes, it did not translate to relative gains for the lowest two deciles. In addition, a detailed examination of the income deciles from which new Internet users came confirms that while the relative contribution of the higher-income groups declined and that of the others increased, the gains were once again more pronounced among the middle incomes rather than the lowest deciles.

A more explicit look at the divide involves the computation of the differences in Internet penetration among many pairs of income deciles for every year of available data. Then, as a measure of the evolution of the divide, the changes in these differences were computed, annually and for longer periods (and an adjustment was made for the growing income gap between high and low incomes). In this specification, a positive number indicates a growing divide (the bigger the number, the bigger the growth) and a negative number indicates a closing divide. The results are provided in Table 8.3.2. Generally, the divide is smaller, the smaller the income difference between the groups examined (this is evident in the first five lines and more visibly, in the 2000-1996 column). As well, the pattern of its evolution is mixed. The key finding is that although a closing divide appears between certain income groups, this is so because upper middle incomes catch up to the very top (2000-1997 column, top-9th, top-8th and 9th-8th deciles). There is still a persistent divide between pairs of very high and very low incomes (e.g. top vs. bottom, 9th vs. 2nd and 8th vs. 3rd deciles), indicative of growing disparities. To demonstrate the degree to which such comparisons depend on

the exact cut-off selected, the exercise was repeated with only two broad income groupings - the top half and the bottom half. In this case, considering the situation of the bottom three deciles, the digital divide is clearly growing.

Collectively the findings conclude the digital divide is sizeable. It is however, generally closing, the result of the progress made by middle-income groups (particularly upper-middle) when compared to the highest income group. The lowest income groups (the three bottom deciles) continue to lose ground vis-à-vis the very high-income groups. Clearly, despite changes, there is a long way to go before the divide between these groups is eliminated.

Table 8.3.2 Evolution of differences in Internet penetration rates (income adjusted percentage points)

Deciles	1997-1996	1998-1997	1999-1998	2000-1999	2000-1996	2000-1997
top - bottom	21.0	4.3	6.9	1.1	32.5	12.3
9th - 2nd	17.1	5.0	11.9	3.7	36.1	20.7
8th - 3rd	11.1	9.6	3.8	3.4	26.9	16.9
7th - 4th	8.9	3.6	7.0	-4.7	14.6	6.0
6th - 5th	1.1	6.6	-3.4	1.8	6.0	5.1
top - 9th	4.4	1.1	-6.2	-1.6	-1.5	-6.7
top - 8th	9.4	-5.2	1.9	-5.0	1.7	-8.3
9th - 8th	4.9	-6.3	7.8	-3.1	3.4	-1.5
8th - 7th	0.8	4.6	-4.7	4.9	5.0	4.7
6th - 4th	4.4	6.1	-0.2	-0.1	9.9	5.7
5th - 4th	3.4	-0.4	3.1	-2.1	3.9	0.6
4th - 3rd	1.5	1.3	1.8	3.1	7.2	6.2
top 5- bottom 5	**12.8**	**6.8**	**6.0**	**2.8**	**28.5**	**15.6**

References

Sciadas, George (2002) "Unveiling the Digital Divide", *Connectedness Series*, Statistics Canada, Catalogue No. 56F0004MIE, no. 7, September.

8.4 The state of telecommunications services in Canada

Heidi Ertl is an analyst in the Science, Innovation and Electronic Information Division. This article presents some of the highlights from analytical work on market concentration in the telecommunications services industry. The entire study, co-authored with Haig McCarrell (Industrial Organisation and Finance Division), can be found in Statistics Canada's Connectedness Series.

Canada has developed a telephone system recognized to be among the best in the world. Data from Statistics Canada's *Annual and Quarterly Surveys of Telecommunications* are used to determine how the telecommunications services industry is performing in the context of a changing regulatory environment. Findings are presented based on indicators of concentration, which have been developed and analyzed for selected years and market segments.

Canada's telecommunications service providers and their network infrastructure have kept Canadians connected for over a century. From plain old telephone services to the latest mobile devices, Canada has been among the pioneers of products and sophisticated networks that make them operable. With technological advances and market liberalization, the Canadian telecommunications services industry has undergone remarkable growth and transformation, particularly in the adoption and use of telecommunications services by consumers and businesses. Service providers are continuously adjusting to these fast-changing market conditions and opportunities, a process that has included an unprecedented wave of mergers and acquisitions. The structural changes stemming from the increasingly competitive environment make the tasks of measuring and assessing telecommunications services even more critical.

The telecommunications services industry comprises network operators and resellers of telecommunications services, traditionally classified to one of the five telecommunications industries under the North American Industry Classification System (NAICS 5133) – wireline (51331), wireless (51332), resellers (51333), satellite (51334), and other (51339) (Statistics Canada 1998).

Canada has taken an incremental approach to introducing competition, gradually opening up monopoly-based telecommunications markets over the last twenty years. This began with private lines in 1979, followed by the liberalization of the terminal equipment market (1980-82), the resale of long distance services (1987), privatization (international long distance carrier Teleglobe, 1987; satellite telecommunications provider, Telesat, 1992), facilities-based long distance (1992) and, more recently, local telephony (1997), payphones and overseas telephony (1998), and fixed satellite services (2000).

Telecommunications products

While telecommunications service providers offer a wide range of products to Canadian businesses, households and government, this discussion is limited to the telecommunications industry's most important products: local telephony, long distance telephony, and data and private line (or dedicated) services. These products are delivered over both fixed and wireless networks. Given that there are strong substitution effects between wireline and wireless services, the products would define a single market, as is the case for data and private line services. However, in this case, it is likely that customers are less concerned with the technology employed than with the cost of the service. There are, however, several historical, technological and regulatory reasons why market segmentation between fixed and mobile telephone services is appropriate. Thus, the provision of local or long distance services by wireline and wireless technologies will be considered here as different products, leading to the existence of different markets. Local mobile services are considered as a proxy for mobile telephony in general, since long distance mobile services are not yet provided as stand alone services.

Hirfindahl-Hirschman index analysis

Considering the diversity of products and markets, assessing the status of competition is a complex task. Indicators in the form of the Hirfindahl-Hirschman Index (HHI) were analyzed for each product, by province, in order to get a sense of market power[23]. A relative assessment among the various telecommunications services can be made by ordinal ranking of the HHIs for each province, and then summing and averaging the cardinal values[24]. The lower the average ordinal value, the less market power is deemed to be present (the less concentrated the market). The results of this methodology are presented in Table 8.4.1.

Table 8.4.1 Index of market power, telecommunications services in Canada, 1999

Rank	Telecommunications service	Provincial ordinal average	
1	Local Mobile	1.5	Less concentrated
2	LD Wireline	2.4	
3	Private Line	2.7	
4	Data	2.9	
5	Local Wireline	4.3	More concentrated

23 *The HHI is the sum of the squares of the market shares for a given product in a given province or territory. It runs between 1 (monopoly), declining with each added company and approaching 0 (where there is perfect competition). HHIs have been calculated for provincial markets for the product groups described above.*

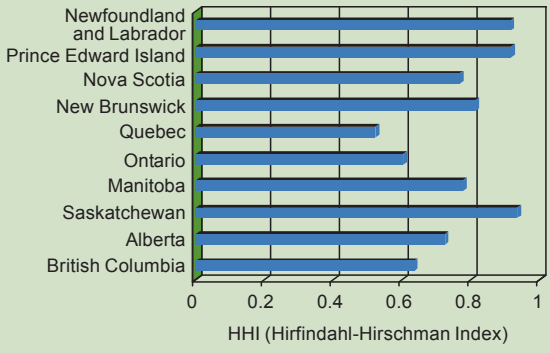
24 *For example, if local mobile services had the lowest HHI in every province, its ordinal ranking would be 1 for each province and the average of these would also be 1 (The territories have been omitted, since they have HHIs of 1 (monopoly) for all products).*

Markets were found to be less concentrated in mobile services, followed by long distance wireline, private line and data services, and lastly, local wireline services. This is what might be expected given the deregulation time frames for the various products, as well as their specific characteristics. Mobile services, for example, lend themselves best to a geographic overlap of networks, therefore setting the stage for genuine competition. In addition, a competitive market structure was adopted when mobile services were first introduced – with the initial creation of regional duopolies (two service providers in one market area).

The relatively similar ordinal ranking of the non-local wireline services (voice, data and private) is interesting. Given that data and dedicated services have been unregulated for a considerably longer period than long distance voice services, one might expect a more developed competitive market structure for the former. Voice services, on the other hand, have been provided to a large extent by non facilities-based resellers, an area characterized by ease of market entry. Do these characteristics imply coincidental HHI results? The data suggest that the number of resellers were in rapid decline over the period – there were 54% fewer in 1999 than in 1997, whereas the number of facilities-based carriers of long distance services declined only 7%. With the decline in resellers, the competitive profile of the markets for these services seems to be converging – the same companies are increasingly responsible for providing a growing share of all three of these services. The local wireline market is ranked the least competitive.

A generalized market structure index by province for 1999 is achieved by taking the average of the HHIs for each of the services by province (Figure 8.4.1). Overall, Quebec comes out on top, followed closely by Ontario and British Columbia.

Figure 8.4.1 Average HHI for telecommunications services, by province, 1999

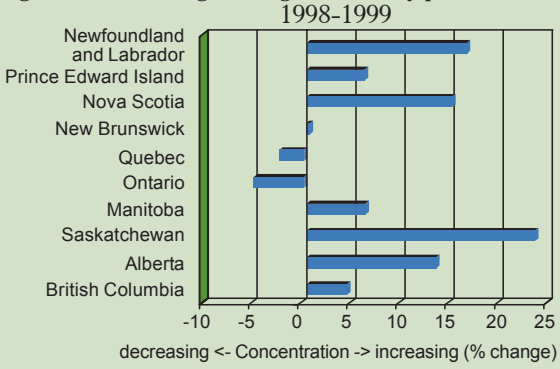


These are also Canada's three largest telecommunications markets, and their sheer size is undoubtedly a key factor explaining the extent of competition found in those markets. Smaller markets may simply not be able to generate the level of activity that would justify market entry given the significant capital investments required.

Not only did Quebec and Ontario report the lowest HHIs in the country, but the average HHI for the telecommunications services listed in Table 8.4.1 declined over the 1998-1999 period for these provinces – indicative of falling market concentrations and increased competitiveness. HHIs for four of the five telecommunications services declined in Quebec and in Ontario, yielding an average drop of 5.1% in Quebec, and an average drop of 2.5% in Ontario (Figure 8.4.2). Despite British Columbia's lower concentration compared with most other provinces, only two of the five services there showed lower HHIs – overall, they increased by an average of 4.1% from 1998 to 1999.

In the middle range, with HHIs between 0.7 and just over 0.8, are Alberta, Nova Scotia, Manitoba and New Brunswick, Canada's fourth, seventh, fifth and eighth largest telecommunications markets respectively. New Brunswick recorded the lowest average increase in HHI for the telecommunications services reported for that province, at only 0.4%. Between 1998 and 1999, two of its three telecommunications services showed a lower HHI, whereas two of five services in Nova Scotia and Manitoba, and one of four services in Alberta showed lower HHIs. Manitoba had the next smallest increase in average HHI of the middle group (6.0%), followed by Alberta (13.2%) and Nova Scotia (14.8%).

Figure 8.4.2 Average change in HHI by province, 1998-1999



The provinces displaying the highest HHIs are Newfoundland and Labrador, P.E.I, and Saskatchewan. In Newfoundland and Labrador, each of the three products for which HHIs were calculated showed markets with increased concentration, as did four of the five in Saskatchewan. P.E.I.'s average HHI only increased by 5.9%, however, meaning that it fared better than five other provinces. Newfoundland and Labrador, and Saskatchewan posted the greatest increases in concentration between 1998 and 1999, with their average HHIs rising by 16.3% and 23.2%, respectively. P.E.I. and Newfoundland and Labrador are the two smallest markets in Canada, and this has probably contributed to their higher levels of concentration. As for Saskatchewan, despite constituting the sixth largest market (considerably larger than P.E.I. or Newfoundland and Labrador), its competitive profile has lagged behind all other jurisdictions. This may be attributed to the delayed introduction of competition in that province compared to other jurisdictions. Saskatchewan was granted a five-year exemption from CRTC regulation at the time the new pro-competitive Telecommunications Act was enacted in 1993. Facilities-based long distance competition introduced in other provinces in 1992 did not come into force in Saskatchewan until November 1996. Likewise, local and pay phone competition was delayed until the year after regulatory approval for deregulating these services in other parts of the country.

Need for increased measurement of regulatory impact

Clearly, more analytical work needs to be done in this area, in an effort to measure the impacts and outcomes of the regulatory decisions that have helped shape the state of telecommunications services in Canada. Competition in the industry depends on many complex and interrelated factors, including the regulatory framework, the viability of alternatives, innovative technology, consolidation of the sector, and convergence. However, we must not forget the consumer, without whom there would be no reason to compete at all.

The telephone has come a long way since Alexander Graham Bell made the first long distance call from Brantford to Paris, Ontario in 1876. In the past 125 years, Canada has developed a telephone system recognized to be among the best in the world. The decisions and choices made now will shape the kind and quality of services we can expect in the future.

References

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8.5 High-speed on the information highway

Ben Veenhof is an analyst in the Science, Innovation and Electronic Information Division. He presents a quantification of the demand for and supply of broadband technologies in Canada using various data sources. The entire study, co-authored with Bryan van Tol (Science, Innovation and Electronic Information Division) and Prabir Neogi (Electronic Commerce Branch, Industry Canada), can be found in Statistics Canada's Connectedness Series.

Just as the introduction of personal computers and the Internet have had a profound impact on the use of ICTs, broadband has the potential to revolutionize the ways in which we use these technologies. Broadband expands the realm of *how much* information can be sent over a computer network and *how readily* that information is available. In so doing, broadband enables applications that are simply not possible with traditional "dial-up" methods of Internet access (using a telephone line and standard modem). As the technology continues to evolve, so do the technology users. Many Canadian households and small businesses are now beginning to embrace broadband technologies, previously reserved for large institutions in the public and private sectors.

However, many parts of the country, particularly rural and remote areas, currently do not have access to the types of broadband technologies found in urban centres. The geographical distribution of the Canadian population presents a major challenge to the provision of these services, largely due to the high cost of upgrading and extending infrastructure to customers dispersed over very long distances. Paradoxically, the need for access to broadband communications is often greater in remote areas than in urban centres, since the real potential of broadband lies in its ability to further reduce time and distance as cost factors (NBTF 2001).

The data used in this article are drawn from the following Statistics Canada sources: Household Internet Use Survey, Survey of Electronic Commerce and Technology, and Annual Return of Broadcasting Distribution Licensees. Figures related to the proportion of the population and number of communities served by broadband were taken from Industry Canada's Broadband for Rural and Northern Development Pilot Program.

The Government of Canada has proposed the goal of making high-speed, broadband Internet access widely available to all communities in Canada by 2005, and has launched the Broadband for Rural and Northern Development Pilot Program as a step toward achieving this goal (Industry Canada 2003). A number of provincial/territorial and municipal programs with similar goals have also been established.

Key characteristics of broadband technologies

Broadband technologies possess several key functional characteristics that distinguish them from the traditional method of "dial-up" Internet access – for example, faster transfer of information and 'always-on' connections. The most common broadband technologies used in Canada are cable modems, where Internet access is made possible using upgraded fiber-optic coaxial cable, and digital subscriber lines (DSL), which, with the necessary equipment, can provide broadband Internet access over regular telephone lines. In the business environment, DSL is also popular but high performance technologies, such as T1 lines, are also used.

This article compares the use and availability of "dial-up" connections with "*all other Internet access technologies*", grouped together as "broadband" for the purposes of statistical analysis. This definition is used with the recognition that international initiatives have found a wide-ranging use of the term "broadband" (NBTF 2001).

Canada ranks among the world leaders in broadband use by households

Broadband use is emerging as a common feature in many Canadian households, and the rate at which its use is growing has been rapid in those areas where services are available. In 2001, close to one-quarter (23.7%) of all Canadian households had a high-speed Internet connection, representing nearly half of all regular home Internet users (Table 8.5.1)

Table 8.5.1 Home Internet use by speed of access, 2001

	High-speed	Low-speed	Regular home Internet use[1]	High-speed as a % of regular home Internet use
		% of all households		
Atlantic	15.4	23.6	39.9	38.6
Quebec	17.9	24.1	42.7	42.0
Ontario	25.1	27.3	53.4	47.1
Manitoba/Saskatchewan	22.5	18.7	41.6	54.1
Alberta	28.7	22.3	51.8	55.4
British Columbia	32.6	19.7	53.7	60.8
Total	**23.7**	**24.1**	**48.7**	**48.7**

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

[1] Regular home Internet use households are households where the respondent indicated that at least one household member uses the Internet at home in a typical month.

Note: High- and low-speeds do not necessarily add to regular home Internet use due to non-response for type , speed or cost of connection.

The numbers reveal two important findings. The first is that nearly one-quarter of Canadian households used a high speed Internet connection in 2001. Unlike many other countries, where traditional dial-up access methods remain the main and, in some cases, the only source of Internet access commercially available to household consumers, Canadians are establishing themselves as among the most connected in the world in terms of broadband technologies. The high-speed numbers reported here support the observation that Canada is second only to Korea in broadband penetration rates among OECD countries (OECD 2002a).

A second observation is that the proportion of high-speed Internet subscribers in Canada tends to increase as one moves from east to west. British Columbia has emerged as a leading province in broadband use, with close to one-third of all households possessing high-speed Internet connections and 60.8% of regular home Internet users connected to broadband. In fact, in each of the Western regions (Manitoba/Saskatchewan, Alberta, and British Columbia), the number of high-speed subscribers outnumbered households using traditional dial-up methods of Internet access.

For more information on high-speed Internet services offered by the Canadian cable industry, please refer to "The cable and satellite industry in the information age", Chapter 3, section 3.3 of this publication.

Broadband by cable was a popular choice among Canadian households. Nearly 65% of households with broadband used Internet by cable in 2001. Since 1999, when the number of cable Internet subscribers was first measured, subscribership has grown from approximately 364 thousand, to over 1.75 million by the end of 2001.

The other common type of broadband connection used by Canadian households is the family of digital subscriber line (DSL) technologies. DSL has emerged as a competitive alternative for consumers in many communities, and in some areas is the primary source of broadband. While cable companies gained early entry in to the broadband market, DSL has recently been gaining ground and competition exists between cable Internet and DSL providers in Canada.

Canadian businesses move toward broadband Internet access

Broadband technologies are also being used in growing numbers by Canadian businesses, the majority of which access the Internet, as they shift away from dial-up Internet access methods. While 36.6% of firms using the Internet continue to use dial-up as their only method of access, this figure is down considerably from 2000 when the majority (59.6%) of firms using the Internet in the private sector relied on dial-up (Table 8.5.2).

Table 8.5.2 Types of Internet connections used by private sector enterprises, 2000-2002

	2000	2001	2002
	% of Internet-use enterprises		
Regular dial-up line using a standard modem	59.6	46.8	36.6
High-speed (Cable, DSL/ISDN lines, T1 line or greater)	34.7	48.4	58.4

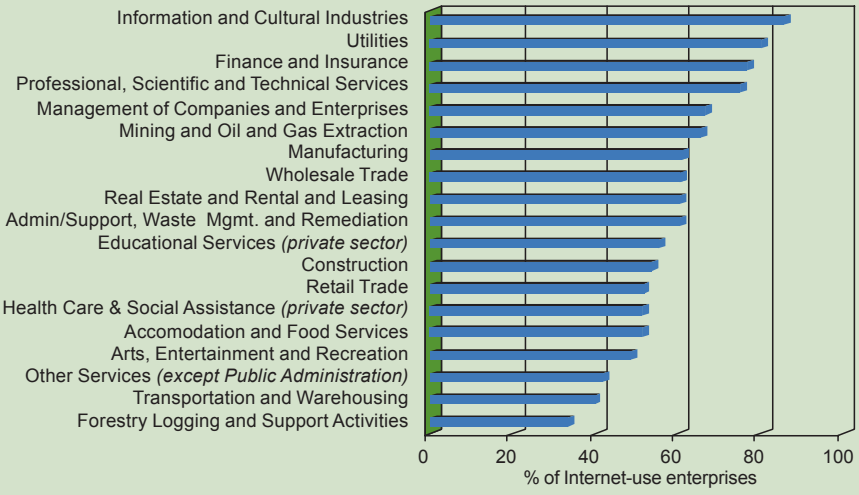
Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Note: High-speed includes the more expensive T1 lines. While not widely used by businesses in total (4.6% in 2002), T1 lines serve as an important access method, particularly among large firms with the need for a high capacity Internet service. Although penetration is low, the higher capacity of these lines means that they can be expected to carry a large share of total Internet business traffic.

Broadband use divided across industries

Overall, most private sector enterprises using the Internet do so through broadband (58.4%). In fact, in 14 of 19 industries studied in 2002, the majority of firms used broadband technology (Figure 8.5.1). This represents a considerable increase from only one year earlier when less than half of private sector firms used broadband (48.4%).

Figure 8.5.1 Percentage of private sector enterprises accessing the Internet through broadband, by industry, 2002



The information and cultural industries continue to be a leader in broadband penetration (85.7%). This is consistent with the observation that these industries have emerged as leaders of other types of ICTs in Canada, including PCs, websites, and Internet use in general (Statistics Canada 2001). These industries are also leaders in the use of high-capacity broadband services (20.2% use a T1 connection) and more sophisticated applications such as online purchasing (59.9%) and selling (18.8%).

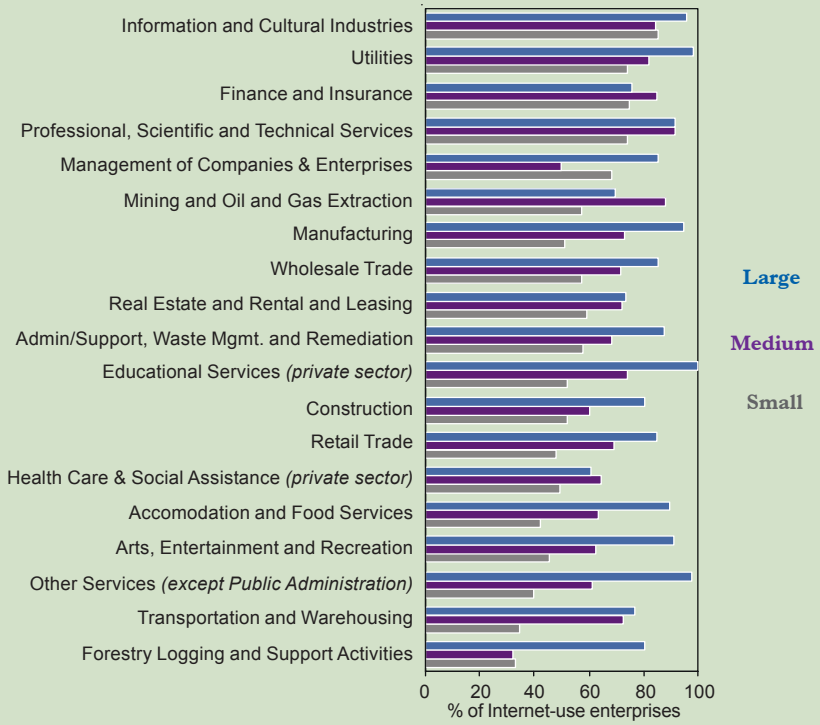
Other broadband leaders include utilities, finance and insurance, and professional, scientific and technical services. Strong penetration in finance and insurance industries was an expected finding, since they tend to be one of the more Internet-intensive industries internationally (OECD 2002b). Industries falling clearly behind in broadband penetration include forestry logging and support activities and transportation and warehousing. For these industries, broadband use occurs in fewer than 40.0% of enterprises using the Internet.

Broadband use highest among large firms

Additional analysis by enterprise size reveals a number of distinct patterns (Figure 8.5.2). Among the leading industries in broadband penetration, firm size does not seem to matter as much as in other industries. SMEs in these leading industries display penetration rates not much lower than those of large firms. This, however, cannot be interpreted as a general finding that industry matters more than firm size. Looking across all industries, it is evident that broadband penetration among large firms is rather comparable, but sizeable gaps between SMEs exist across industries.

From an international perspective, access to the Internet, regardless of mode of connection, is also highest for larger enterprises (OECD 2002b). These findings underscore the fact that, in terms of basic broadband connectivity, it is within SMEs that Canadian business has the most room to grow.

Figure 8.5.2 Broadband penetration is high for large firms but uneven among SMEs, 2002



Broadband availability

Although Canadians have emerged as world leaders in broadband use and the majority of the population (86%) resides in communities with access to broadband by cable or DSL, significant challenges remain with respect to deployment.

Broadband availability is heavily concentrated in urban parts of Canada. As noted, these areas are home to most Canadians, yet 72% of Canadian communities, located mostly in rural and remote areas, do not yet have access to broadband services (Industry Canada 2003). The cost of providing broadband services in these areas is typically higher than in urban areas. Given a smaller customer base and the fact that customers are dispersed over greater distances, building the infrastructure needed often does not make economic sense for broadband providers.

For cable Internet providers for instance, it is necessary to replace existing cable, designed for one-way delivery of television programming with an upgraded hybrid fiber-coaxial cable (HFC) network. Cable companies have completed the upgrades necessary to offer Internet by cable in almost all (96.1%) large communities (CMAs) but only 27.0% of small communities (defined as census divisions located outside CMAs or census agglomerations) (Statistics Canada 2002).

DSL services are an option in some rural areas but their deployment also faces an important technical limitation. While utilizing existing telephone wire, the additional equipment that is installed to carry DSL signals only allows the signal to travel distances of up to about 5.5 km from the telephone company's central office (TSACC 2001).

For these reasons, wireless broadband delivered by satellite or terrestrial systems may present an attractive option in rural and remote areas. Despite very high initial deployment costs, satellite is not constrained by "dollars-per-mile" costs of installation (CSTB 2002). However, market penetration is not yet material, in large part because satellite providers are recent market entrants, and prices are relatively high for many consumers. Further, many offerings currently provide only 1-way access, meaning that a dial-up connection is necessary for return signals (CRTC 2002).

Canada's National Broadband Task Force was commissioned to identify the types and needs of communities which, without government intervention, would not likely be served by broadband Internet access (NBTF 2001). The Task Force identified a variety of models to accelerate broadband deployment, making use of varying arrangements of public and private funding. Two broad strategies underlying these models include "infrastructure support", where incentives are offered to broadband providers to expand service, and "community aggregation", where demand is pooled among various groups that could potentially benefit from broadband Internet services. Examples of the former are the numerous provincial, territorial and municipal programs that have been launched. Examples of the latter include the use of inexpensive networking equipment to "piggyback" on to existing fibre builds, or the use of short-range wireless networking ("Wi-Fi") in unregulated spectrum to form private networks (CRTC 2002).

The range of initiatives already in place suggests that choices about broadband technologies and the means of funding their deployment are not likely to be uniform in nature, but will instead reflect many economic and geographic factors in rural areas. The variety of locations, distances, population densities, existing infrastructure, availability of public support and specific community needs are all factors to be considered when deciding upon broadband deployment in unserved areas.

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8.6 The Canadian economy in transition

Research on the fast transformation of today's economy has flourished in recent years. Statistics Canada's Micro-economic Analysis Division has been active with a number of studies addressing themes such as growth, productivity, the dynamics of industrial change, and the geographical dimension of economic activity. A short description of selected research projects is presented here as a guide to ongoing work in this area. These studies are disseminated by various means, including a new analytical series entitled *The Canadian Economy in Transition*.

8.6.1 Performance trends in Canadian industries

A report entitled *The Growth and Development of New Economy Industries* (Beckstead and Gellatly 2003) examines long-run production and performance trends in a large set of Canadian industries, including ICT sector industries and science-based industries that make large investments in R&D and skilled workers. It investigates whether the productivity and performance characteristics of these industries differ from that of other industries over the 1980s and 1990s. A range of characteristics and measures are analyzed, including profitability, output, capital investment, trade, R&D, employment and labour quality.

The findings support that the ICT sector is a dynamic performer, excelling in areas such as GDP growth, employment growth, productivity growth, investments in technology and R&D expenditures. In many respects, science-based industries that are not part of the ICT sector are comparably dynamic. Long-run job gains and output growth in science-based service industries have been substantial, and science-based goods industries experienced large long-run productivity gains. Neither industry group, ICT nor science, should be regarded as homogeneous. Productivity growth is far more apparent in ICT manufacturing than in core ICT services (i.e., computer services and telecommunications), whereas core ICT services led in terms of GDP and employment growth. The report also highlights examples of industries outside these technology and science environments that are outperforming the ICT sector average on many fronts.

8.6.2 A geographic analysis of employment growth in the new economy

A Decade of Growth: The Emerging Geography of New Economy Industries in the 1990s (Beckstead et al. 2003) investigates how employment growth in ICT and science-based industries is distributed across Canada's provinces, urban/rural regions and major cities over the 1990-2000 period. The absolute size of ICT and science-based workforces in different locations are compared, along with the proportional representation of ICT and science workers within local and regional economies. This report also evaluates possible explanations for why certain cities develop more intensive ICT-based economies than others.

The 1990s were characterized by strong employment growth in ICT sector industries, largely confined to major urban centres. Toronto and Montreal were leaders in ICT job creation but, by 2000, the Ottawa-Hull region had pushed ahead of all other urban areas in terms of the percentage of the local workforce employed in ICT industries. For most cities, employment growth in non-ICT science industries was much more modest. The analysis further suggests that cities with large employment bases and diversified industrial structures exhibit greater local ICT representation. However, it was also found that over the course of the decade, community size was more important than industrial diversification in determining ICT growth in Canadian cities.

8.6.3 Towards a knowledge-intensive labour market

The study *Dimensions of Occupational Changes in Canada's Knowledge Economy, 1971-1996* (Beckstead and Vinodrai 2003) explores the long-run growth of high-knowledge occupations in Canadian industry. Knowledge-based occupational groups are identified and classified into three main categories of workers – professional, technical and management. The analysis concludes that the share of employment accounted for by knowledge workers increased steadily over the reference period. Specifically, high-knowledge workers in professional and management occupations have expanded their ranks more rapidly than those in technical occupations. Although males make up a larger percentage of knowledge workers, growth in the proportion of workers who are knowledge-based is more apparent in the female employed labour force.

High-knowledge workers are more likely to be located in urban areas. Because of differences in industrial and urban structures, the growth of the high-knowledge workforce is more apparent in Ontario and Quebec. However, after controlling for these differences, most provinces have similar concentrations of knowledge workers.

The studies described here deal extensively with conceptual and measurement issues that help set the context and shape our understanding of the transitions taking place within the economy. New research is currently underway that builds on these themes and provides analytical insights into the more recent developments in Canada's technology sector. Topics include the recent restructuring in technology markets, commodity flows and industrial change, and issues of training in conjunction with high-tech workplaces.

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8.7 Connecting culture

Marla Waltman Daschko is Chief of Analysis and Integration in the Culture and Tourism Statistics Programs. In this article, she describes how ICTs are being used in sound recording, book publishing, and periodical publishing, as well as by heritage institutions.

Industries such as recording production, film and publishing, as well as performing arts and heritage institutions, have generally been slow to take advantage of the opportunities provided by new ICTs. While most of the organizations in the culture sector do benefit from the use of computers, e-mail and the Internet for operational purposes, the commercial possibilities offered by websites and online sales tools are only beginning to be explored.

The cultural industries tend to consist of a few large, vertically integrated, and often foreign-owned, enterprises, as well as many smaller, usually Canadian-owned, enterprises. Previous analysis has shown that large enterprises generally have higher rates of computer and Internet use, and a greater likelihood of having a web presence than smaller enterprises (Charles, Ivis and Leduc 2002). As the majority of Canadian enterprises in the cultural industries tend to be small, their rate of computer, Internet and website adoption is consequently lower.

Computerization tends to be very high in the information and cultural industries as a whole. In 2002, 96.7% of these enterprises used the Internet and 67.5% had websites (Table 8.7.1). However, an examination of several individual industries indicates that use of the Internet or website presence is not as pervasive.

Table 8.7.1 Use of ICTs by information and cultural industries, 2000-2002

	Use of personal computer			Use of the Internet			Website		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
	%								
Information and cultural industries	94.4	98.0	98.1	92.7	92.9	96.7	54.5	65.1	67.5
Total private sector	81.4	83.9	85.5	63.4	70.8	75.7	25.7	28.6	31.5

Source: Survey of Electronic Commerce and Technology, Science, Innovation and Electronic Information Division, Statistics Canada.

Data for this article come from the following sources: Survey of Heritage Institutions, 1995, 1997, 1999; Survey of Book Publishers and Exclusive Agents, 1998-99 and 2000-01; Survey of Periodical Publishers, 1998-99; Sound Recording Survey, 1998 and 2000. Estimates from the Survey of Electronic Commerce and Technology, 2000-2002 are also included.

Sound recording

In 2000, more than one-third of Canadian labels and record production firms had active websites while another 17% indicated that they had sites under development (Table 8.7.2). This was a slight increase from what was reported in 1998. Although these proportions are growing, it is evident that sound recording companies have not yet fully embraced the possibilities that websites can offer for the conduct of their business.

Those companies with a website used it primarily to facilitate mail-order sales or distribution of their recorded products. In 2000, 23% of record companies offered e-commerce for this purpose, while an additional 13% of record companies were in the process of developing e-commerce capabilities[25]. Some record companies preferred not to manage e-commerce from their own websites but relied on other online vendors to sell or distribute their products. In 2000, 16% of companies used online vendors and nearly 10% were developing such services for future use.

Table 8.7.2 Use of ICTs by the sound recording industry

	1998	2000
	%	
Sound recording companies with:		
active website	34.7	35.4
website under development	14.1	17.1
Mail-order sales or distribution capabilities through:		
own website	23.5	22.8
online vendor	11.2	15.5

Source: Sound Recording Survey, Culture and Tourism Statistics Program, Statistics Canada.

25 *The capacity to offer mail-order distribution should not be equated with sales from such activities, nor should these activities be confused with music downloads.*

E-commerce is now being considered as one of the essential components of the sound recording industry's new business environment. In particular, the surging popularity of illegal music downloading and the sharing of MP3 files over the Internet have contributed to an erosion of company profits and control over copyrighted products. Record companies and vendors have had to recognize the need to improve electronic access to music by consumers. The industry is working toward the creation of pay-per-use or subscription online sites, which will facilitate the legal downloading of music over the Internet. This capability is expected to support sales of recordings while improving household access to music products.

Book publishing

Book publishing companies have also been exploring the use of ICTs to improve access to products and to support sales. The industry has traditionally focused on print books and, to a lesser extent, the sale of audio-recorded books. The market is rapidly changing to include CD-ROMs and online or electronic books (e-books).

In 2000-01, the net sales[26] value of CD-ROMs was $58.1 million, a substantial increase from the net sales of $18.9 million reported in 1998-99 (Table 8.7.3). Other book formats, including videos, generated $63.0 million in revenues, while net sales of audio-recorded books were valued at $10.2 million. Online or e-books – once touted as the way of the future – have still not made much of a mark on book sales. These products generated $5.8 million in revenues, accounting for only 0.3% of all book sales.

Table 8.7.3 Revenue from net sales of own and agency titles, by type

	1998-99	% of total	2000-01	% of total
	thousands		*thousands*	
Book sales only:				
Printed titles	2,066,548	97.9	2,116,759	93.9
Audio	13,505	0.6	10,154	0.5
CD-ROM	18,899	0.9	58,106	2.6
Online/e-books	5,143	0.2	5,836	0.3
Other (videos)	7,853	0.4	63,023	2.8
Total	**2,111,949**		**2,253,877**	

Source: Survey of Book Publishers and Exclusive Agents, Culture and Tourism Statistics Program, Statistics Canada.

26 *Net sales are the total revenues earned by the publisher or exclusive agent after they have accounted for all returns and any discounts.*

Internet sales, while still a small part of the business activity of book publishers, have begun to show gains. In 2000-01, publishers sold over $11.1 million dollars worth of titles over their own websites. This was a five-fold increase over sales of just $1.9 million in 1998-99. While still only 0.6% of publishing sales, it clearly presents a growing opportunity to reach consumers.

Periodical publishing

Periodical publishers generally use websites for subscriber relations but they have also found a myriad of other uses for this technology. In 1998-99, 920 (45%) of all Canadian periodicals had their own websites. Of those, 20% used them to generate advertising revenue and 16% were equipped to take and/or make payments over the Internet.

Another common use of websites by periodical publishers was as a vehicle for promotion (18%). Promotional activities include presenting selected highlights from the print version on the site (14%) and publication of a full virtual version of a print version online (6%). Other activities include subscriber/customer services (excluding subscriptions), advertising ancillary products for sale, soliciting advertising and content and/or authors. Just a few periodicals published only a virtual version online without producing a corresponding print version.

Heritage institutions

Heritage institutions, such as museums, archives, galleries, botanical gardens and heritage sites primarily use ICTs for planning and management purposes and for information and product dissemination. The most popular use of technology has been in the creation of websites; 48% of all heritage institutions had a website in 1999 (Table 8.7.4). This represents an increase of 27.2% over 1997. The second most popular activity was the use of computer-assisted collections management software (39%).

Heritage institutions also found other uses for ICTs but on a much smaller scale. In 1999, nearly six percent of these organizations used computer-assisted software for exhibition layout and floor planning. With respect to services to the public, 9.9% of heritage institutions made computers available for interactive information services while 9.5% produced public information products on diskette or CD-ROM.

Table 8.7.4 Use of ICTs by heritage institutions

	1995	1997	1999
		%	
Use of ICTs for planning and/or management purposes:			
Computer assisted exhibition layout/floor planning	4.5	5.2	5.6
Computer assisted collections management	28.5	34.6	39.1
Other	14.6	15.9	12.5
Use of ICTs for information and/or product dissemination:			
Website or homepage on the Internet	19.0	39.2	48.3
Products on diskette or CD-ROM	6.7	8.4	9.5
Interactive service/information	7.7	9.3	9.9
Other	6.1	8.4	9.1

Source: Survey of Heritage Institutions, Culture and Tourism Statistics Program, Statistics Canada.

The cultural industries of sound recording, book publishing, periodical and heritage institutions are moving, albeit slowly, towards the use of information and communications technologies for business and consumer interaction. The next few years will be crucial in determining to what extent these industries make use of ICTs and what the impact will be on their business operations.

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Part 4
CANADA AND THE WORLD

Chapter 9 CONNECTING THE WORLD - CANADIAN LEADERSHIP IN AN INTERNATIONAL CONTEXT

Invited contributions

Contents

Highlights

- Addressing the digital divide in developing countries is a top priority of the Canadian government.
- Canada has taken a leadership role in the Digital Opportunity Task (DOT) Force and the United Nations' ICT Task Force.
- Canada actively pursues initiatives aimed at ICT for development issues, such as: ePol-NET for national e-strategies and policy frameworks, Connectivity Africa and the Open Knowledge network to promote connectivity and local content.
- Canada fostered joint work at the working group level between both the DOT Force and the UN ICT Force, resulting in several collaborative initiatives.
- Canada established the *Action Plan of Quito* (ACAPAQ) and the *Institute for Connectivity in the Americas* to help spread Canada's successful connectivity model and to develop Information Societies in Latin America.
- The International Development Research Centre (IDRC) conducts ICTs for development (ICT4D) programming in Africa, Asia and the Americas.
- The IDRC's Acacia and Connectivity Africa projects are designed to help developing African nations develop their Information Society and are guided by regional contexts.
- In Asia, IDRC programming is geared towards helping the least-developed countries. Regional projects have included provision of Internet access, distance education, and rural and agricultural connectivity projects.

Chapter 9
CONNECTING THE WORLD - CANADIAN LEADERSHIP IN AN INTERNATIONAL CONTEXT

Invited contributions

9.1 A perspective from Industry Canada [27]

Through its five strategic objectives – innovation, connectedness, marketplace, investment and trade – Industry Canada (http://www.ic.gc.ca) aims to help Canadians contribute to the knowledge economy and improve productivity and innovation performance. The Department's policies, programs and services not only help to foster a dynamic and innovative Canadian economy, but also demonstrate commitment and leadership of a global nature. The Electronic Commerce Policy Branch writes about Industry Canada's policy and program initiatives to bridge the digital divide in developing countries.

> *"Information technology is extremely cost-effective compared with other forms of capital. Modest yet key investments in basic education and access can achieve remarkable results. Estonia and Costa Rica are well-known examples of how successful IT strategies can help accelerate growth and raise income levels. But even some of the least-developed countries, such as Mali and Bangladesh, have shown how determined leadership and innovative approaches can, with international support, connect remote and rural areas to the Internet and mobile telephony."*
>
> — ***Kofi Annan**, Secretary-General, United Nations*

The Information Society is for every country, every citizen. Digital opportunities provided by ICTs are fundamental to the improvement of all aspects of developing economies and their entry into the global marketplace. While ICTs are not a panacea for all development problems, they offer enormous opportunities to narrow social and economic inequalities and thus help achieve broader development goals, such as those set by the international community at the United Nations Millennium Summit (United Nations 2000). By facilitating the exchange of information and knowledge, by helping deliver education and health services, by stimulating civil society participation in a country's democratic process, and by helping small and large businesses explore new markets, ICTs greatly contribute to global social and economic enrichment.

Canada has done well domestically and continues to work on bridging the digital divides across various barriers such as age, income, gender, race, urban/rural geography and language. Industry Canada has acted as a catalyst amongst other government departments, the private and non-profit sectors in leading a national vision for digital inclusion and innovation. Through initiatives under the

27 *The views expressed here are those of the authors.*

Connecting Canadians Agenda such as the Community Access Program and SchoolNet, the ground-breaking work of the **Electronic Commerce Task Force** and, recently, **Canada's Innovation Strategy** and the **Broadband for Rural and Northern Development Program**, Canada has grown into a flourishing knowledge-based economy. Results achieved so far include: the distribution of 400,000 computers into schools and libraries, the connection of all of Canada's schools to the Internet, the development of Canada's SchoolNet repository of learning resources, and the establishment of 8,800 community access centres and 12 "Smart Communities" throughout Canada. The latest initiative is to pilot the introduction of broadband Internet access for the development of rural and northern communities.

Canada is also deeply concerned with the international aspects of the digital divide. It is a top priority of the Government of Canada to help developing countries overcome the digital divide as illustrated by the key initiatives announced at the Summit of the Americas in 2001 (Prime Minister of Canada 2001) and the G8 Summit in 2002 (Prime Minister of Canada 2002). It has always been Canada's policy to help the poor. However, the imperative is now even more crucial as the forces of globalization, technological development, and the scale of human activity, reinforce our fundamental interdependence with the rest of the world. Prosperity in the developing world helps anchor international economic stability and enables progress towards sustainable development. Reducing global poverty equates to a more prosperous world where nations are able to maintain more mature and mutually beneficial economic partnerships with Canada — partners in building the international system.

The leadership Canada has provided in the recent past — as Chair of the G8 Digital Opportunity Task Force, in its participation in the United Nations Information and Communication Technologies Task Force, and in the development of the *Action Plan of Quito* for the Americas — is a clear demonstration of our commitment. The next section illustrates policy and program initiatives which clearly demonstrate Industry Canada's commitment to making a difference in the developing world.

The Digital Opportunity Task Force: Africa and Beyond

The **Digital Opportunity Task (DOT) Force** was created by G8 Heads of State at the Okinawa Summit in July 2000 to identify concrete ways to bridge the digital divide between industrialized and developing countries, and to ensure that developing countries can fully participate in the global information society. The DOT Force represents both a unique model of international cooperation and a new way of responding to the challenges of development. The dynamic and productive partnership brought together committed stakeholders from G8 and developing country governments (Industry Canada's Deputy Minister was

the Canadian Government's representative on the DOT Force), private and not-for-profit sectors, and international organizations to conceive a forward-looking action plan designed to expand the use of digital technology and to universalize its benefits. Its report, *Digital Opportunities for All: Meeting the Challenge* (G8 DOT Force 2001), contained a vision of global development based on the power of ICTs to promote sustainable growth, advance social justice and strengthen democratic governance.

In less than one year, participation in the DOT Force reached well beyond its original membership to include almost 100 stakeholder organizations, spanning more than 30 countries. Through the work of its implementation teams, the DOT Force generated more than 20 major bilateral and multilateral initiatives, operating across a broad range of areas crucial to balanced development - access, governance, entrepreneurship, health and education. In designing and implementing these initiatives, DOT Force members also gave special attention to the needs of lesser developed countries, and particularly to Africa.

The DOT Force has created a series of initiatives aimed at forming the key building blocks of the information society for developing nations. As part of a Canadian package of initiatives in support of the G8 Africa Action Plan and in the context of Canada's leadership role in the work of the DOT Force, three initiatives have been created. Through the Canada Fund for Africa, these Industry Canada-led initiatives address key "ICT for development" areas: national e-strategies and policy frameworks, connectivity and the use and development of local content, and helping African entrepreneurs.

1. National E-Strategies and Policy Frameworks

One first step in creating digital opportunities for all countries is the formation of clear national e-strategies to manage the development of appropriate ICT regulatory, legislative and policy frameworks. African leaders have recognized the immense potential offered by ICTs, making them a priority area in their new vision called the *New Partnership for Africa's Development* (NEPAD).

> *"Now Mozambique wants to be known in the near and distant future for its commitment to the mastery and utilization of information and communications technologies for sustainable national development. Toward that end, my country has recently developed its national ICT policy, because we clearly see that ICTs have become an indispensable lever for a country's development."*
>
> — *His Excellency* ***Dr. Pascoal Mocumbi****, Prime Minister of Mozambique*

In the DOT Force Plan of Action endorsed by G8 Leaders at the Genoa Summit (2001) (G8 DOT Force 2001), a commitment was made to establish the **Global e-Policy Resource Network (ePol-NET),** designed to marshal global efforts in support of national e-strategies for development. With the participation of government worldwide, international organizations, the private sector, and the not-for-profit community, the ePol-NET will establish a focal point for bringing together providers of e-strategy information and expertise for the benefit of individuals, organizations and governments.

Championed by the Government of Canada, the planning of the ePol-NET has involved the full membership of the DOT Force and, through collaboration with the United Nations ICT Task Force, has involved a broader constituency from several developing countries and non-G8 countries, such as Ireland and Sweden. The initial pilot phase of the ePol-NET will consist of national and regional centres of expertise from various countries and international organizations such as: Canada, Ireland, Italy, Japan, United Nations Development Programme (UNDP), Organization for Economic Co-operation and Development (OECD) and the United Nations (UN) Economic Commission for Africa (ECA). These centres or nodes will provide a focal point to disseminate off-the-shelf information to developing countries' policy and regulatory experts. They will also aggregate or funnel the demand for more specific support, at the individual or institutional level. The design, governance and operation of the Network will be based on partnerships among the various countries and international organizations. Information on the ePol-NET is available on the website: http://www.epol--net.org.

In addition to planning and coordinating the implementation of the ePol-NET, Canada has committed $10 million (CDN) to the establishment of a **Canadian e-Policy Resource Centre (CePRC)** as Canada's specific contribution to the Network. The CePRC, which is being implemented by Industry Canada in partnership with the Canadian Centre for Management Development (CCMD), will serve as a focal point for the identification and funding of Canadian experts who will provide expertise and mentoring in support of national policy makers in Africa across a wide range of ICT policies and strategies in such areas as e-commerce legal and policy frameworks, telecommunications policy and regulation, Internet governance, e-government strategies, and the sharing of program experience in e-health, distance learning and community access. CCMD will host the CePRC Secretariat and will be responsible for managing the CePRC's operations.

The CePRC's Secretariat is being established to coordinate government expertise, facilitate knowledge exchange, receive international requests for expertise, identify and consult appropriate partner institutions, and provide overall management and administrative functions of the CePRC. Resources will be offered, on a cost-recovery basis, by various government departments and agencies, non-government organizations (NGOs) and the private sector.

The CePRC will also work on a bilateral basis with the UN ECA which forms the African regional node of ePol-NET. This node is also funded by the Canada Fund for Africa and serves as the focal point for aggregating demands coming from Africa. The African node, known as ePol-NET Africa, was launched at the ECA's Committee on Development Information meeting in Addis Ababa, Ethiopia on May 13, 2003. For more information, please refer to the following website: http://www.uneca.org/eca_resources/Speeches.

2. Connectivity Africa and the Open Knowledge Network

The Canada Fund for Africa is providing $12 million for the implementation of Connectivity Africa (CA) which aims to improve access to ICTs in Africa by applying Canadian expertise especially in relation to education, health and community development. CA was formally launched during the Acacia Conference "Networking Africa's Future" on April 14 of this year in South Africa. Managed by Canada's International Development Research Centre (IDRC) and co-sponsored in Africa by the UN ECA, its programming is closely tied to Acacia, IDRC's flagship ICT for development initiative in Africa. The two programs will balance Acacia's research and policy focus with Connectivity Africa's more explicit technology and innovation focus. More information is available on Connectivity Africa's website : http://www.connectivityafrica.ca.

CA will also work with the Open Knowledge Network (OKN), a civil society initiative which is receiving $3 million from the Canada Fund for Africa. The OKN is being developed under the leadership of OneWorld International and aims at promoting the creation and exchange of local content as widely as possible across the South. OKN will be publicly launched at the UN World Summit on the Information Society (WSIS), in Geneva, in December 2003. To access the OKN website, go to the following URL address:
http://www.openknowledge.net/.

3. Enablis

"The creation of Enablis represents a call to action to all those who can contribute towards creating digital opportunities. This is our chance to achieve a collective impact far beyond our individual capabilities."

*— **Charles Sirois**, Chairman and CEO, Enablis / Chairman and CEO of Telesystem Ltd. (Canada)*

Enablis is a not-for-profit organization formed in partnership with Telesystem Ltd. (Canada), Accenture (UK) and Hewlett-Packard (US) to help small and medium-size enterprises (SMEs) and entrepreneurs in developing countries leverage the power of ICTs for social and economic development. Through an initial $10 million (CDN) contribution from the Government of Canada, Enablis will encourage governments and entrepreneur support organisations (ESOs), including aid agencies and multilateral organizations as well as other NGOs and third parties, to take up the advantages of ICT-related entrepreneurship in pursuing sustainable social and economic development. It will also serve as a point of reference and expertise in the ICT/entrepreneurship area.

Enablis will focus primarily on entrepreneurial users of ICT with a high potential for transformational impact in African and other developing countries. Examples include those that promote better functioning of a local market, better access to local and global markets, set an example of how best to use ICTs to improve their internal efficiency and effectiveness, reduce costs of ownership of ICTs or the development of fulfillment infrastructure for ICT-enabled businesses.

Enablis will aim to support projects through a combination of funding assistance and in-kind support through products and services. Its range of services will include:

- advice to governments and policy makers on effective policies for ICTs, small businesses, trade, etc;
- loan financing for start-ups and SMEs;
- guidance, mentoring, and networking to facilitate strategic partnerships with global corporations and other SMEs; and,
- a variety of hardware and software products donated by large corporations.

United Nations Information and Communications Technologies Task Force

In March 2001, the Economic and Social Council requested UN Secretary-General, Kofi Annan, to establish a **United Nations Information and Communication Technologies (UN ICT) Task Force**. This initiative is intended to lend a truly global dimension and policy coherence to the multitude of efforts to bridge the global digital divide, foster digital opportunity and thus firmly put ICT at the service of development for all. It is the first body created by an intergovernmental decision of the United Nations in which members,

representing governments, civil society (including the private sector, not-for-profit foundations, NGOs and academia) and organisations of the United Nations system have equal decision-making power.

Canada is a lead financial contributor and bureau member of the Task Force. Canada has played a key role in harmonising the priorities and overall work plan of the Task Force with that of the G8 DOT Force. Specifically, Canada has fostered joint work at the working group level of both organisations, resulting in several collaborative initiatives by its members.

Under Canada's leadership, the UN ICT Task Force is developing a comprehensive conceptual framework which underlines the role that ICTs play in the overall development agenda. The analysis uses as a starting point the eight Millennium Development Goals endorsed by Heads of States at the UN Millennium Summit (year 2000) and maps ICTs against each one of these goals. The mapping process illustrates how, in each case, ICTs can help achieve the development goal. This analysis will be the subject of a major contibution to the World Summit on the Information Society.

Canada and Latin America

Telecommunications — Canada maintains extensive relations with Latin American countries in the field of telecommunications, both in multilateral forums and through bilateral relations.

The major multilateral forum is the **Inter-American Telecommunications Commission (CITEL),** which is an agency of the Organization of American States (OAS). Canada is a member of the Permanent Executive Committee of CITEL, which sets overall direction for the organization. It is also an active participant in CITEL's working committees, which strive to ensure that the region's communications networks function smoothly, and coordinate regional positions for presentation in global forums.

Bilaterally, Canada works together with key countries of the region to improve understanding and expand the operations of communications networks. One example would be the formal Memorandum of Understanding on cooperation with Mexico. Less formally, Industry Canada maintains regular contacts with most countries of the region to understand regulatory regimes and to promote Canada's open approach to regulation and standards. Canada has also done much to assist developing countries wanting to establish modern spectrum management systems.

Summit of the Americas — At the 2001 Quebec City **Summit of the Americas**, the hemisphere's leaders committed to expand cooperation in telecommunications in the region and assigned CITEL several specific tasks. Taking a broader view, leaders also issued a statement on "Connecting the Americas" recognizing the importance of Canada's *Connecting Canadians* experience for the development of an information society in the Americas. Leaders committed to making connectivity a reality in the region before the next Summit (nationally in 2005). To kick-start the initiative, Prime Minister Chrétien announced that Canada would provide $20 million (CDN) to create an Institute for Connectivity in the Americas.

Canada has led a process within the OAS to create a detailed document entitled the *Agenda for Connectivity in the Americas* and the *Action Plan of Quito* (ACAPAQ) to help countries understand the concept and the necessary steps to implement connectivity. Building on the acceptance of that document, Canada is now involving partners and agencies throughout the region to provide guidance and resources in support of the leaders' objectives.

Institute for Connectivity in the Americas — The Institute for Connectivity in the Americas (ICA) was announced at the 2001 Summit of the Americas as Canada's contribution to spreading its successful connectivity model. It is the forum for hemispheric innovation in the application of ICTs to strengthen democracy, create prosperity, and realize human potential. The ICA strives to create a true hemispheric community by connecting the citizens of the Americas and promoting hemispheric integration through innovative uses of ICTs.

As one of Canada's contributions to the 2001 Summit of the Americas, the ICA was created and provided with seed funding. The ICA builds on the success and experience of the Connecting Canadians Strategy and Canada's international development and ICT programs. Sponsored by the Department of Foreign Affairs and International Trade, the Canadian International Development Agency and Industry Canada, the ICA is currently being incubated at International Development Research Centre offices in Ottawa and Montevideo.

Connectivity Applications: Exporting Our Model

The "Connecting Canadians" strategy has gained attention around the world for its innovative and effective approach towards accelerating the adoption and commercialization of innovation processes and products related to the application of information and communication technologies. In particular, Canadian expertise in developing and implementing connectivity applications such as SchoolNet, the Community Access Program (CAP), Computers for Schools (CFS) and Smart Communities is being recognized worldwide. For example, Industry Canada's NetCorps Canada International program has been instrumental in placing IT

interns in South Africa to help them implement a SchoolNet initiative to connect classrooms to the Internet. To date NetCorps has placed some 1,000 IT savvy youth in over 70 developing countries to support the adoption of ICTs. Similarly, Industry Canada has received requests from Argentina, Bolivia, Jordan, Uruguay, Costa Rica, Guatemala, Mauritius, South Africa and other African countries to put in place a CFS program similar to Canada's that will refurbish and distribute surplus computers to libraries and schools in these countries. The CFS model has been successfully implemented in Colombia and Jordan.

Canada at the World Summit on the Information Society

The **World Summit on the Information Society (WSIS)** will be a major UN Summit that will bring together representatives from the highest levels of government, the private sector, civil society and NGOs. It will be held in two phases with the first taking place in Geneva from Dec 10-12, 2003, and the second in Tunis from Nov 16-18, 2005.

Canada is an active player in the WSIS process and has contributed $1 million to the International Telecommunications Union (ITU) special trust fund for WSIS. To date, Canada has taken the view that the WSIS should focus on poverty reduction and development, and should aim at broadening the understanding that Information and Communication Technologies (ICTs) are a fundamental tool for social and economic development and thus for helping achieve the UN Millennium Development Goals. To that end, WSIS ought to take into account the work of existing "ICT for development" initiatives (e.g. G8 Digital Opportunity Task Force, UN ICT Task Force).

Building on the work of these existing "ICT for development" initiatives and its own domestic experience, Canada believes that the work of the Summit should be guided by the following key principles:

- Promoting democratic government and governance;
- Creating an enabling environment through appropriate policies, laws, regulations and practices;
- Developing human capacity through education and training;
- Increasing access to communication networks and information services;
- Fostering the creation and preservation of local content;
- Building new partnerships, increasing international cooperation, and promoting cross-cultural dialogue; and
- Encouraging community involvement and empowerment.

Canada's experience suggests that, in order to build an inclusive information society, it is necessary to apply the principles set out above holistically, comprehensively and systematically to the main sectors of national development and global cooperation. Therefore, Canada favours a Plan of Action (Government of Canada 2003) that would include:

- Good Governance;
- National Development Strategies ("E-Strategies");
- Economic Prosperity;
- Education and Public Service; and
- Cultural Expression

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9.2 A perspective from the International Development Research Centre [28]

Rich Fuchs is the Director of Information and Communications Technologies for Development (ICT4D) at IDRC. In this piece, he describes ICT4D programming initiatives for Africa, Asia, and the Americas.

IDRC (http://www.idrc.ca) is a public corporation funded by the Canadian government to help communities in the developing world find long-term solutions to social, economic and environmental problems through research. The Centre aims to initiate, encourage, support and conduct research into the problems of developing regions of the world and into the means for applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions.

Poverty has never been about only the absence of material wealth. Living in a secure natural environment, freedom from the fear of predation, the ability to express your culture in its many forms, access to health and education, and the right to participate in governance processes — all are elements that help to define what poverty and wealth mean. The United Nations' World Development Index reflects these, and other, dimensions in its annual tally of who is "developed" and who is not.

Recently, global discussion has focused on a new type of poverty. The "digital divide" has found its way into our vocabulary for some time now. We use it to refer to just about anything that separates the technology and information "haves" from the "have-nots". Considering the policy interest on this issue, nationally and internationally, Statistics Canada has pioneered measurements and methodologies to help illustrate differential access and participation in the Information Society.

Another federal agency, the International Development Research Centre (IDRC), has been quietly helping the developing world deal with this issue long before this new vernacular for technology lag was coined. A federal Crown Corporation, IDRC has been involved with information and networks as a part of its development programming since its inception in 1970. In the beginning of the new century, IDRC now conducts ICTs for development (ICT4D) programming in Africa, Asia, and the Americas.

28 *The views expressed here are those of the author.*

Out of Africa

Inspired by the zeal, vision, and serious intent of its African colleagues, IDRC almost "bet the farm" on its commitment to ICTs for development. In 1995, the African Information Society Initiative (AISI) was disseminated in Addis Ababa on the campus of the Economic Commission for Africa. The AISI document is still an inspiration to read (Economic Commission for Africa 1996). One year later, in 1996, IDRC's Board of Governors adopted the Acacia Initiative (http://www.acacia.org.za) as the centre's single biggest budgetary program.

Consider all that has transpired since that time, seven years ago. In 1996 the term "digital divide" was not yet widely known. The Internet had only just become available to non-university subscribers. Personal Digital Assistants (PDAs) had not been invented and cell phones were big, clunky, luxury devices. It would not be until 2000 that the Digital Opportunities Task Force (DOTForce) would be established at the annual G8 meeting in Okinawa, Japan.

Today, while the technology sector in North America and Europe is sagging, a different scenario is emerging in Africa. A very real information revolution is occurring in Africa, although not everyone has noticed it yet. It does look and feel different from what happened in the North. But a revolution and transformation in the social and economic prospects for this continent are already well underway.

In Senegal, farmers learn about daily market prices from women in the Dakar markets using cell phones. They increase their incomes, expand their markets and, in the process, new information services and companies are born. Nothing like this has ever happened in the North. We have five generations of wires that have to be amortized: that has clouded our vision for the wireless world. But not in Africa! The African information revolution is a wireless one. Africans have the advantage of developing the tools, services and enterprises of a wireless economy, unfettered by twisted pair and coaxial cable.

Uganda has managed to become the most "wireless" country in all of Africa, with 98 percent of its population having cellular access. Three companies compete for market share. It is credibly reported that rural citizens now use this very same cellular technology to call open line radio programs to express their political views. And as we know, expressing those very same political views could have been lethal just a generation ago. Now Ugandans are moving this cellular technology up the value chain. Most recently, IDRC with its colleagues in HealthNet Uganda and Satellife, has been introducing PDAs, using wireless servers, into the health system.

In Mozambique, graduate students who have been trained in rural Sweden, are customizing rural connectivity platforms in the country. They are doing this in the context of an officially approved Information and Communications Technology Policy and Implementation Strategy that was approved by Mozambique's full Council of Ministers on June 27, 2002. When much of the rest of the developing world is struggling with becoming "e-ready", Mozambique is more than ready to go!

South Africa is arguably the African "technopole" in this revolution. Mobile operators invest, enter into commercial partnerships, and export their dynamic, expansive telecom capacity all over the continent. In less than two decades South Africa has been transformed from a pariah state under apartheid, to a liberation state under Nelson Mandela, to a new near-hegemonic economic and political power. Leading its new ascendance is a dynamic ICT sector that contributes to raising the GDP, together with other, more traditional sectors. Last year a young South African Internet millionaire took a trip on a Russian-made space shuttle. The world as we knew it is no more! No one could have imagined this in 1996!

IDRC operates two programs in Africa: Acacia (now in its second generation) and Connectivity Africa (http://www.connectivityafrica.org), a new initiative announced by the Prime Minister at the 2002 G8 meetings in Kananaskis. Funded by the Canada Fund for Africa, Connectivity Africa is a technology-oriented initiative. Its mandate is to work with Africans to identify regional solutions that involve the public and private sectors on a sustainable basis.

Its older "twin" Acacia is largely responsible for helping countries like Senegal, Mozambique, and Uganda accelerate their navigation of the Information Society. Senegal chairs the New Partnership for Africa's Development (NEPAD) initiatives on ICTs. Mozambique has a national integrated ICT development policy and Uganda has more cellular coverage than any other country on the continent. Acacia's principal focus is on appropriate and "pro-poor" policy formulation and developing local content in a digital domain.

IDRC believes that regional context must guide ICT developments. Most of Africa has yet to make a phone call. Responding only to elite and expatriate interests will do little to help Africa build and participate in its own Information Society. Spreading and animating interest and participation with both lagging and leading interests is IDRC's principal concern with its programming in Africa.

The Asian Tigers?

Many believe Asia will be the principal driving force of the next Information Revolution. China's massive demographics suggest the likelihood of this scenario. Add to this the compelling electronics manufacturing capacities of Taiwan, Japan and South Korea, Malaysia's success in developing its Multimedia Super Corridor, and India's burgeoning software design and programming sectors, and the Asian tigers' claws have greater and greater traction in information technologies and services.

A brief survey of some of the least developed countries in Asia – Laos, Cambodia, Vietnam, and Sri Lanka, to name a few – provides a very different picture. Per capita GDP in these countries ranks among the lowest in the world. Teledensities are similarly sluggish and the policy environment, while gradually opening, is still dominated by centrally planned systems that even the Soviet bloc abandoned more than a decade ago.

It was in this context that IDRC began its first programming with ICTs in the early 1990s. Beginning in 1994, IDRC helped launch the first Internet Service Providers (ISPs) in Vietnam (NetNam), Laos (LaoNet), and Cambodia (CamNet). Each of these ISPs was ahead of the curve in their respective societies. They were the first pebble in the pond of innovation of ICTs in each of these countries. While policy, the private sector, and new technologies have bypassed these early inroads, IDRC remains active in these least developed Asian countries.

In Vietnam, IDRC is now assisting Fisheries College No. 4, on the outskirts of Hanoi, to introduce distance education into its aquaculture and mariculture training programs for adult learners. Vietnam has one of the largest aquaculture sectors in the world. IDRC is helping Fisheries College No. 4 provide continuing learning to more than 300 aquaculturists that have completed the existing curriculum. Rather than traveling 50 kms to and from the College for advice and assistance, these fish farmers will use distance learning to facilitate how they integrate their new knowledge into their enterprises.

The University of Laos, serving an enrolment of 15,000 students, is only now developing access to the Internet that goes beyond one dial-up telephone line. With assistance from the Swedish International Development Agency (SIDA), a wireless broadband service is being developed. IDRC's assistance will connect the Laotian "central" Science, Technology and Environment Agency (STEA) with the new service at the university.

Having learned that pro-poor interests need to be concurrently involved with more metropolitan national ICT developments, IDRC's PAN Asia Networking program initiative (http://www.panasia.org.sg) has integrated a rural connectivity

project with this Laotian initiative. A local non-governmental organization (NGO) is leading the establishment of the first-ever rural telecentre in Luang Prabang, a UNESCO world heritage site with a growing tourist sector. The idea behind this approach is to link the "front" and the "back" of the e-markets in this developing country to help foster pro-poor policy, technology and market development outcomes.

IDRC's PAN Asia Networking has devolved its *Collaboratory* to a regional organization, the ASEAN Foundation. Headquartered in Jakarta, Indonesia, the ASEAN Foundation will now take on the role of further developing the incubation roles for regional e-commerce, web hosting, and electronic conferencing. It will also engender an entirely new approach to using online tools to assist with regional skills especially in the LCMV[29] countries.

IDRC's programming in Asia is now expanding to include a new office in New Delhi, along with its longstanding ICT4D bureau in Singapore. In 2003, IDRC's PAN Asia programming initiative also launched a second-generation partnership with the International Fund for Agricultural Development (IFAD). ENRAP II (Electronic Networking for Rural Asia Pacific) is assisting rural and mountainous regions of Asia to integrate ICTs into their agricultural planning and development.

PAN Asia has also maintained an ICT for Development R&D small grants program for almost a decade. This R&D fund is co-financed with the United Nations Development Programme (UNDP) and Asia's Industry Association for ISPs, APNIC (Asia Pacific Network Internet Centre). The Awards Panel, which includes ICT pioneers from different parts of Asia, meets twice each year and approves some US$300 thousand in R&D grants to the community, university, institutional, and private sectors. The awards include a wide range of applied research undertakings from diffusing ICTs into the industrial sector in India, to using "pedal power" as a back-up energy source for Internet access in rural Laos to policy research on definitions of universal access in the Philippines.

The PAN All Partners Conference was held in March 2003 in Vientiane, Laos after almost five years without partners' meeting. More than 200 of PAN Asia's partners gathered for four-and-a-half days to present papers, network, and develop a common vision for the future. Along with the existing programming directions, PAN Asia will respond to new regional needs for applied ICT research relating to Internet Governance, culturally and regionally relevant definitions of Intellectual Property, and regionally specific issues relating to women's participation in the Asian Information Society.

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29 *LCMV" is local parlance for Laos, Cambodia, Myanmar, and Vietnam, generally considered the least developed countries in the ASEAN region.*

The Asian region represents a very special challenge. It includes some of the most dynamic information "haves" and also some of the latest adopting "have-nots" on the planet. The capacities of nations, people, and institutions are diverse. How they work out their divides, imbalances, strengths and weaknesses will have much to teach the rest of the world about this common challenge that we all face. IDRC's PAN Asia Networking program initiative has helped to animate the Information Society in some of the least likely corners of the Asian region. The programming is now more geared to assisting least developed countries accelerate participation in the Information Society and build stronger linkages among regional technology engines and their slower-to-develop regional neighbours within a global context.

Only in the Americas?

Latin America and the Caribbean (LAC) represent a very different regional context within which programming for ICTs for development occurs. In general terms, a domestic, largely urban, market for ICT goods and services, along with Internet access and development, has already developed. National economies in the region operate within the context of the "hyper-power" of North America. The principal challenge for a development organization like IDRC is to animate participation and technology appropriation within the rural domains of the region, and to engender the constructive use of technologies by the urban poor.

Latin America is also characterized by compelling social and economic cleavages among corporate, state, community, and civil society interests. The common view, or sense of common-cause, that may be possible within an African or Asian context may pose a far greater challenge in the Americas.

In April 2001, at the Summit of the Americas, the Prime Minister announced the establishment of an Institute for Connectivity in the Americas (ICA-http://www.icamericas.net) to be hosted at IDRC. ICA represented an opportunity for Canada to share its leadership in connectivity in education, communities, and Internet access with the entire hemisphere.

The Institute for Connectivity in the Americas operates from IDRC's offices in Montevideo, Uruguay, and Ottawa, Canada. Its programming includes a focus on e-strategies, building and nurturing a "knowledge network" among ICT practitioners in the region, and supporting scalable, regional projects through social investments that leverage major contributions by larger multilateral and bilateral financial institutions. ICA has been "twinned" with IDRC's other long-standing PAN Americas (http://www.idrc.ca/pan) programming which has focused on the appropriation of ICTs among civil society organizations, principally in the Central American and Andean sub-regions.

Global Reach

IDRC operated ICT for development programming when many others believed this type of approach heretical. Now that same heresy is becoming orthodoxy. When the G8 established the Digital Opportunities Task Force, or DOTForce, IDRC served as Canadian Co-Chair. When the World Economic Forum established a similar programming direction, it too invited IDRC to Co-Chair. As the United Nations system now prepares for its World Summits on the Information Society (WSIS) in Geneva (2003) and Tunisia (2005), IDRC will be participating in the Canadian and global fronts.

IDRC remains a world leader in applied research and innovation on how information and communications technologies can be integrated into the development process. Its regionally decentralized programming approach helps to ensure that its work is locally relevant and grounded in regional institutional capacities and priorities. Its global programming helps to transmit best practices and new development approaches using these technologies from one region of the world to another. IDRC's programs act locally but think and deliver programs globally.

References

Economic Commission for Africa (1996) *Africa's Information Society Initiative (AISI): an action framework to build Africa's information and communication infrastructure*, Addis Ababa, Economic Commission for Africa, http://www.uneca.org/aisi/aisi.htm.

NOTES, METHODOLOGIES, AND DATA SOURCES

Notes and Methodologies

The statistical compilation of the ICT sector relied on the use of business data sources, and in particular surveys covering individual ICT sector industries rather than economy-wide vehicles. This entails a trade-off between the reliability and the timeliness of the estimates, as industry surveys are typically subject to lengthier time lags. Some variables of interest are not measured by industry surveys: R&D data come from the survey of industrial R&D activities, while GDP by industry data are compiled in the System of National Accounts.

In addition, NAICS has undergone revision from the original 1997 classification. Consequently, different statistical programs are at different stages of transition to NAICS 2002. For the most part, data presented here are based on the NAICS 1997 classification. For further information about concordance and revision of NAICS, consult http://www.statcan.ca/english/concepts/industry.htm.

The definition of the ICT sector requires some detailed industry information not currently available. Thus, the electronic precision equipment repair and maintenance industry (NAICS 81121) is not included in the sector's totals. This exclusion leads to a slight underestimation of the sector. Efforts are underway to close this gap.

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, Payroll 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. 10-3009XKB.

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.

Users should be aware that comparing 2000-2001 data on ISPs to previous years is subject to limitations. For the 1997 and 1998 reference years, basic information related to the industry, as represented by the NAICS97 online information services industry (514191), was collected under the Annual Survey of Software Development and Computer Services. However, content regarding ISPs was limited and a new annual survey vehicle was developed for reference year 1999 in order to provide more in-depth information on this new and rapidly evolving industry. Survey content was again enhanced for reference year 2000. The Annual Survey of Internet Service Providers and Related Services 2001, incorporates the new NAICS 2002 definition (Internet service providers, NAICS 518111).

With reference year 2000, major conceptual and methodological changes were incorporated into the Annual Survey of Manufactures (ASM). The survey universe was expanded to cover all manufacturing units. In addition to the incorporated manufacturing businesses over $30,000 in sales of manufactured goods and with employees, the new ASM also includes: all incorporated businesses under $30,000 that had employees; all incorporated businesses that did not have any employees regardless of their annual sales values; and all unincorporated businesses. The addition of these units added approximately 60,000 units. Despite the tremendous increase in the number of establishments, the majority are relatively small. These units account for less than 5% of the total revenue from the sale of manufactured goods.

The Annual Financial and Taxation Statistics for Enterprises are now presented on the basis of NAICS that differs markedly from the 1980 Standard Industrial Classification for Companies and Enterprises used until 1998. In addition, methodological changes, including the adoption of Statistics Canada's Business Register, have been implemented. While these changes will improve the quality and reliability of the data, they will affect the user's ability to relate and compare statistics to those produced prior to 1999. Total economy revenue data for reference year 1998 is therefore not strictly comparable to subsequent years.

Data sources

All data for the compilation of the ICT sector in Part one, the sectoral presentation in Part two, and the thematic analyses in Part three come from various statistical programs and databases in Statistics Canada. The international comparisons interspersed throughout the compendium are based on both OECD data and these countries' official statistical offices.

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, CANSIM II Tables 379-0017, 379-0020.

Employment

Annual Return, Cable Television, Statistics Canada, Catalogue No. 56-204, CANSIM II Table 353-0001.

Annual Survey of Commercial and Industry Machinery and Equipment Rentals and Leasing, Statistics Canada *(special tabulation)*.

Annual Survey of Internet Service Providers and Related Services, Statistics Canada, Catalogue No. 63-222.

Annual Survey of Manufactures, Statistics Canada, Catalogue No. 21-203, CANSIM II Table 301-0003.

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

Survey of Employment, Payrolls and Hours, Statistics Canada, Catalogue No. 72-002, CANSIM II Table 281-0024 *(special tabulation*).

International Trade

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

Trade Data Online, http://www.strategis.ic.gc.ca.

Canada's International Transactions in Services, Statistics Canada, Catalogue No. 67-203.

Revenues

Annual Return, Cable Television, Statistics Canada, Catalogue No. 56-204, 56-001, CANSIM II Table 353-0001.

Annual Survey of Commercial and Industry Machinery and Equipment Rentals and Leasing, Statistics Canada *(special tabulation)*.

Annual Survey of Internet Service Providers and Related Services, Statistics Canada, Catalogue No. 53-222, CANSIM II Table 354-0006.

Annual Survey of Manufactures, Statistics Canada, Catalogue No. 21-203, CANSIM II Table 301-0003.

Annual Survey of Software Development and Computer Services, Statistics Canada, Catalogue No. 63-222, CANSIM II Table 354-0005.

Annual Survey of Telecommunications, Statistics Canada, Catalogue No. 56-001 (1997-2001).

Quarterly financial statistics for enterprises, Statistics Canada, Catalogue No. 61-008, CANSIM II Table 180-0003.

Wholesale Trade Survey, Statistics Canada *(special tabulation)*.

Capital Expenditures

Capital and Repair Expenditures, Actual, Preliminary Actual and Intentions, Statistics Canada *(special tabulation)*.

Intramural R&D Expenditures

Industrial Research and Development, Statistics Canada, Catalogue No. 88-202, Statistics Canada *(special tabulation)*.

Other

Aboriginal Peoples Survey (APS), Housing, Family and Social Statistics Division, Statistics Canada.

Adult Criminal Court Survey, Canadian Centre for Justice Statistics, Statistics Canada.

Census of Agriculture, 2001, Agriculture Division, Statistics Canada.

Census of Population, 2001, Census Operations Division, Statistics Canada.

General Social Survey (GSS), Cycle 14, 2000, Housing, Family and Social Statistics Division, Statistics Canada.

Household Internet Use Survey (HIUS), 1997-2002, Science, Innovation and Electronic Information Division, Statistics Canada.

Labour Force Survey, Labour Statistics Division, Statistics Canada.

National Longitudinal Survey of Children and Youth (NLSCY), 2000, Centre for Education Statistics, Statistics Canada.

National Survey of Information Technology Occupations, 2002, Small Business and Special Surveys Division, Statistics Canada.

Programme for International Student Assessment (PISA), 2000, Centre for Education Statistics, Statistics Canada and OECD.

Sound Recording Survey, 1998 and 2000, Culture Statistics Programme, Statistics Canada.

Survey of Book Publishers and Exclusive Agents, 1998-99 and 2000-01, Culture Statistics Programme, Statistics Canada.

Survey of Electronic Commerce and Technology (SECT), 1999-2002, Science, Innovation and Electronic Information Division, Statistics Canada.

Survey of Heritage Institutions, 1995, 1997, 1999, Culture Statistics Programme, Statistics Canada.

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

Survey of Periodical Publishers, 1998-99, Culture Statistics Programme, Statistics Canada.

Workplace and Employee Survey (WES), 1999, Business and Labour Market Analysis Division, Statistics Canada.