7 Chapter 7

Information and Communications Technology Policy

Contents

In Canada and throughout the world, information and communications technologies (ICTs) have emerged as significant drivers of economic and social change. Much as the printing press and steam engines did in the past, ICTs are enabling general purpose technologies.[1]

What Are Information and Communications Technologies?

ICTs encompass a wide variety of products and services, including computers, software, communications equipment and networks, fibre optics, interactive video, satellite infrastructure and services, radio frequency identification technology, and a growing number of complementary devices for work, education, health and entertainment. The list of ICTs is ever-expanding. The Internet is increasingly the dominant ICT technology platform.

ICT investment is defined by Statistics Canada to include investment in computer equipment, communications equipment and software (which in turn is broken down into off-the-shelf, customized and own-account components). It is important to note that ICT investment does not include silicon chips embodied in other goods.

Statistics Canada defines **the ICT goods and services producing sector** as "the combination of manufacturing and services industries, which electronically capture, transmit and display data and information."[a]

[a] Statistics Canada, "Canada's Journey to an Information Society," Catalogue no. 56-508-XIE, December 2003, p. 3. Available online at: **http://dsp-psd.pwgsc.gc.ca/Collection/Statcan/56-508-X/56-508-XIE2003001.pdf**

In the private sector, ICTs are being used to change how businesses are organized, operate and manage relations with customers. In the public sector, ICTs are being used to change the way services are delivered and governments interact with citizens. In communities and throughout society, ICTs are being used to change how people learn, work, communicate, create and are entertained.

Telecommunications networks provide the infrastructure for linking ICTs and enabling these changes. The technology and market trends described in Chapter 1, The Need for Change, are creating an expanding range of opportunities for Canadians to generate wealth, improve the efficiency of public services and enhance the quality of their lives. At the same time, these trends are challenging policy makers to ensure that all Canadians have access to ICTs, and that the interests of citizens and consumers are protected in the rapidly transforming telecommunications environment.

[1] For a full exploration of the nature and economic impact of general purpose technologies, see Richard G. Lipsey, Kenneth I. Carlaw and Clifford T. Bekar, *Economic Transformations — General Purpose Technologies and Long Term Economic Growth* (Oxford, UK: Oxford University Press, 2005). These authors have written that general purpose technologies (GPTs) share some important common characteristics:

> They begin as fairly crude technologies with a limited number of uses and they evolve into much more complex technologies with dramatic increases in the range of their use across the economy and in the range of economic outputs that they help to produce. As they diffuse through the economy, their efficiency is steadily improved. As mature technologies, they are widely used for a number of different purposes, and have many complementarities in the sense of cooperating with many other technologies. (pp. 12–13)

The Panel believes the new policy and regulatory frameworks recommended in Chapters 2 to 6, the streamlined institutional arrangements recommended in Chapter 9, and the more open approach to foreign investment proposed in the Afterword will stimulate competition and strengthen market forces in the telecommunications sector. The Panel believes these forces will drive the Canadian telecommunications industry to develop world-class networks and services that fully integrate ICTs and make them available to Canadian businesses and consumers at competitive prices. At the same time, the Panel is persuaded that more is required to realize the full potential of ICTs.

A number of submissions to the Panel suggested that a national strategy is needed to ensure that Canada obtains maximum economic and social benefits from ICTs. In particular, several respondents suggested that we must make better use of ICTs to enhance the productivity and competitiveness of the Canadian economy, as well as to improve the quality and efficiency of government and public services. Because of the importance of these issues, a number of submissions proposed that the federal government should take responsibility for leading the development of a national ICT adoption strategy in partnership with other stakeholders.

The Panel agrees that it is essential for Canada to develop a national ICT adoption strategy. Consistent with the approach taken to the other issues it was asked to address, the Panel believes this strategy should rely on market forces to the maximum extent possible. Government intervention should take place only when market forces alone are unlikely to achieve economic and social objectives. As in the case of telecommunications regulation and broadband connectivity, government interventions that are part of Canada's national ICT adoption strategy should be well targeted, proportionate to their objectives, effective in relation to cost, and technologically and competitively neutral.

This chapter recommends how Canada should proceed to develop and implement a national ICT adoption strategy based on these principles. It is organized in three sections.

The first section examines the contribution of ICTs to Canada's productivity performance and long-term economic growth. It reviews the evidence that ICT investment fosters productivity growth throughout the economy. It documents recent Canadian ICT investment trends. It examines how the complementary investments that businesses make in ICT adoption through training and process innovation contribute to productivity at the level of individual firms.

The Panel believes the linkages it found between investment in ICT adoption and productivity growth are significant in light of the global economic challenges facing our country. Canada's overall productivity growth has fallen off significantly since 2000, and the Canada–U.S. productivity gap is widening. If these trends continue, Canada risks being squeezed into an increasingly uncomfortable economic niche between a large, highly productive U.S. economy and a number of large, emerging, low-cost economies.

To improve the productivity and competitiveness of our economy, the Panel believes Canada needs a national strategy to facilitate and promote the "smart adoption" of ICTs. By this, the Panel means that Canada's national strategy should focus on improving business productivity by encouraging complementary investments in ICTs, process improvements, technology applications and skills development. The Panel believes similar kinds of investments should be made by governments to improve the efficiency and quality of public services. In addition, policies must be put in place to ensure that electronic networks are secure, and that the rights of citizens and consumers are protected so they are able to experience confidence and trust in the online environment when using ICTs.

In the second section of the chapter, the Panel sets out the key ICT adoption issues facing Canada that were identified in submissions to the Panel, at the Whitehorse and Gatineau policy forums, in consultations with stakeholders and through its own research. On this basis, the Panel recommends that Canada's national ICT adoption policy should have the following six objectives:

- strengthening ICT adoption by Canadian businesses, particularly small and medium-sized enterprises (SMEs)
- strengthening the links between ICT sector research and development (R&D) and smart ICT adoption
- enhancing ICT adoption by governments
- promoting development of ICT adoption skills on a coordinated national basis
- improving security, trust and consumer confidence in the online environment
- achieving ubiquitous access to broadband networks and services.

Developing and implementing a strategy to achieve these objectives is a complex challenge. It requires the active engagement of the federal government, provinces and territories, the private sector, teachers and researchers, consumer representatives and community-based organizations. To mobilize these different stakeholders in a coordinated national effort, the Panel believes leadership must come from the highest level of the federal government. The Panel notes that many other countries have already adopted similar strategies.

To provide the necessary leadership, the Panel calls on the Prime Minister to mandate the Minister of Industry to:

- lead the development of a national ICT adoption strategy
- establish a high-level, independent National ICT Advisory Council with membership broadly representative of Canadian society and drawn from all regions of the country
- establish a National ICT Adoption Centre to support the work of the Advisory Council and the development of the national ICT adoption strategy.

The third section of the chapter proposes an ICT policy agenda for Canada. On the basis of its consultations and research, the Panel identifies a number of measures that could help achieve the first five objectives of the national ICT adoption strategy. These measures include an ICT adoption tax credit, a better coordinated and refocused approach to federal government ICT R&D activities, federal government leadership in the adoption of IPv6 (Internet Protocol version 6 — see later discussion), a nationally coordinated approach to ICT adoption skills development, and initiatives to increase security and consumer trust in the online environment.

The Panel recommends that the federal government should immediately proceed to establish an ICT adoption tax credit. It believes the other measures it proposes should be given further study by the National ICT Adoption Centre. Following review by the National ICT Advisory Council, detailed proposals should be submitted to the Minister of Industry with recommendations for appropriate action.

Measures to achieve the sixth objective of the national ICT adoption strategy — ubiquitous access to broadband networks and services — are discussed in Chapter 8, Connectivity: Completing the Job.

Investment, Productivity and ICTs

Productivity Trends in Canada

It is well established that productivity is the key driver of living standards, as measured by income per capita.[2] But the contribution of productivity goes well beyond increased output and incomes.

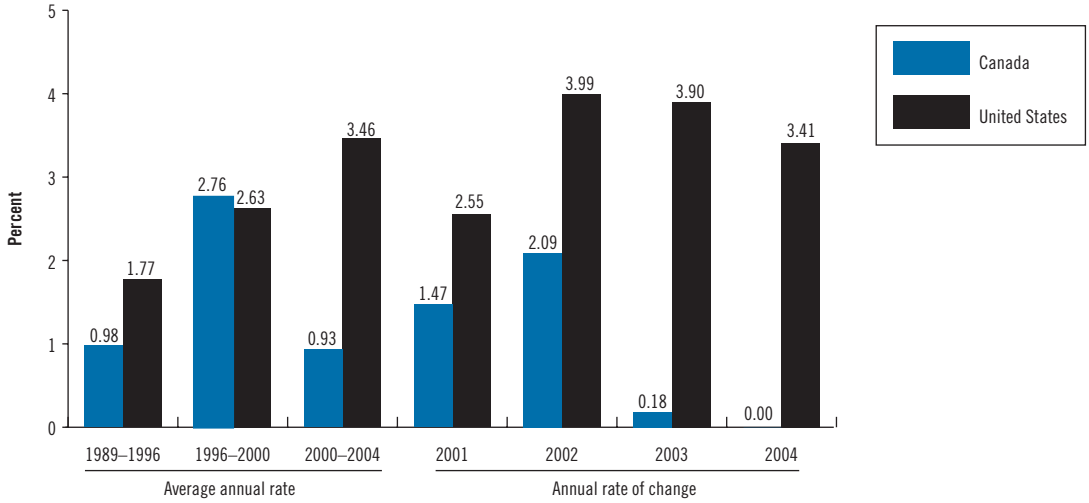
Productivity is as important for determining the economic and social well-being of Canadians as it is for determining the income of Canadians. Productivity gains can be used for more than just increases in private consumption. For example, they can be taken in the form of shorter working time, thereby providing opportunities for greater leisure. They can be used to enhance government services and programs (e.g. better health care and education systems and a more generous social safety net) that contribute to well-being by enhancing economic security and creating a more equitable society.

Canada's productivity growth has fallen off since 2000.

Canada's aggregate productivity growth has been weak in recent years. In 2003 and 2004, growth in output per hour in the business sector was essentially zero (Figure 7-1).

[2] Department of Finance Canada, *A Plan for Growth and Prosperity* (Ottawa: Finance Canada, November 2005), p. 24.

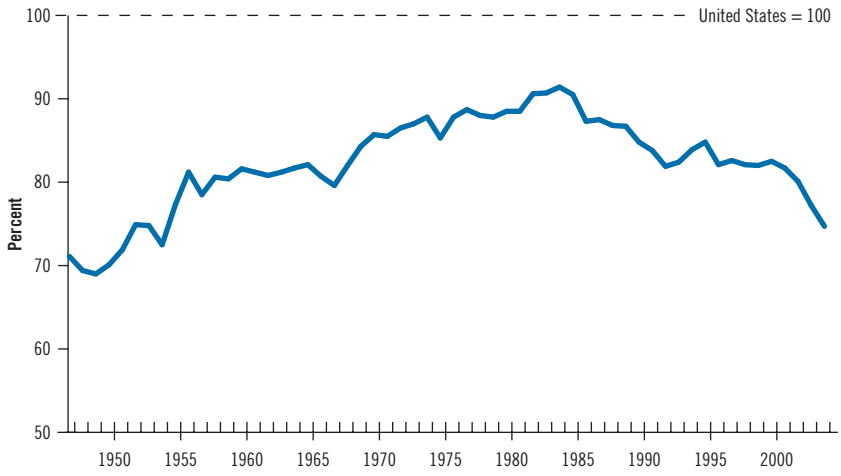
Figure 7-1. Comparison of Business Sector Growth in Output per Hour, Canada and the United States, 1989–1996 to 2004 (%)



Source: Statistics Canada (CANSIM Series V31185380); and U.S. Bureau of Labor Statistics (Series PRS84006093), February 16, 2006.

Since 2000, business sector growth in output per hour has increased at an average annual rate of 0.9 percent per year, down from 2.8 percent in the 1996–2000 period. In contrast, in the U.S., our major trading partner, labour productivity growth has been a very robust 3.5 percent per year since 2000. This much faster U.S. growth has led to a significant increase in the Canada–U.S. business sector labour productivity gap, from 18 points in 2000 to 25 points in 2004 (Figure 7-2).

Figure 7-2. Business Sector Output per Hour in Canada as a Share of the U.S. Level, 1947–2004 (%)



Source: Centre for the Study of Living Standards, *Aggregate Income and Productivity Database: Canada vs. United States,* Table 7a and Chart 3a. Available online at: **http://www.csls.ca/data/ipt1.asp**

Canada's productivity performance has also been poor from a long-run, international perspective. Canada ranked 17th out of 30 member countries of the Organisation for Economic Co-operation and Development (OECD) in terms of total economy labour productivity levels in 2004, down from third in 1950 and fifth in 1973.[3] The deterioration in Canada's productivity ranking over the 1973–2004 period reflected weak labour productivity growth in Canada relative to other countries. Since 1973, growth in output per hour in Canada has averaged 1.5 percent per year, the fourth lowest in the OECD.

There are many factors shaping Canada's recent productivity performance.[4] One important factor is ICT investment, whose growth rate expressed in constant dollars fell from 23.1 percent annually in the 1995–2000 period to 4.8 percent annually in the 2000–2004 period. In 2004, software was by far the largest ICT investment component, accounting for 47.8 percent of current dollar business sector ICT investment. Computers accounted for a 28.4-percent share, and communications equipment accounted for a 23.7-percent share.

The Productivity–ICT Relationship

Economists now generally agree that ICT investment fosters productivity growth. In the 1980s and first half of the 1990s, there was scepticism about the impact of ICTs on productivity. This situation was called the "productivity paradox," named after the U.S. economist Robert Solow, who once quipped that we see computers everywhere except in the productivity statistics. But by the second half of the 1990s, the paradox was resolved, at least in the eyes of economists, as productivity growth in both Canada and the U.S. picked up and was seen to be driven by ICT investment.

The relationship between Canada's ICT investment and productivity can be analysed at three levels: at the total economy level, at the industry or sector level and at the level of the individual firm. There is evidence at all three levels that ICT investment increases productivity, and it is most conclusive at the firm level.[5]

The OECD reports that the contribution of ICT capital to total economy productivity growth in Canada over the 1995–2003 period was 0.6 percentage points (one-third of productivity growth), up from 0.4 points in the 1990–1995 period.[6] Canada ranked seventh out of 19 OECD countries in the magnitude of this contribution. Australia was first at 0.9 points, followed by the U.S. at 0.8 points. At the industry level, a positive relationship has been found in Canada between the rate of growth of software investment and labour productivity growth. Industries such as information and cultural services that exhibit high rates of software investment growth also exhibit high productivity growth (Figure 7-3).

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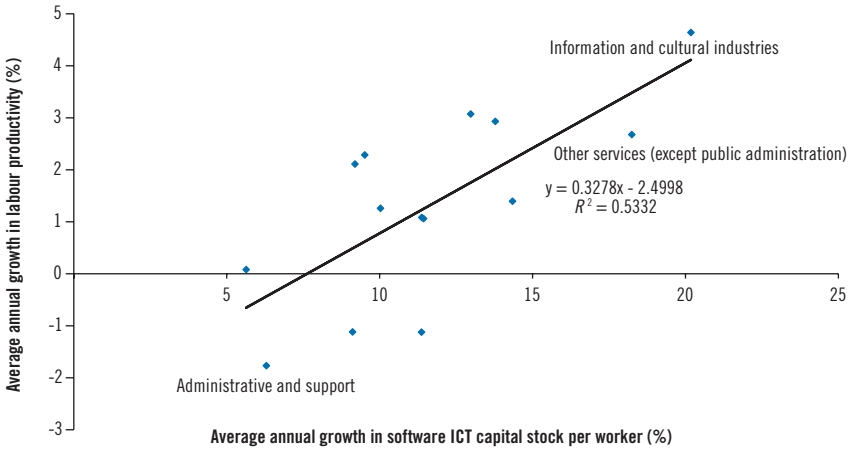
3 Organisation for Economic Co-operation and Development, *Compendium of Productivity Indicators* (Paris: OECD, 2005).

4 See Someshwar Rao, Andrew Sharpe and Jeremy Smith, "An analysis of the labour productivity growth slowdown in Canada since 2000," *International Productivity Monitor* 10 (Ottawa: Centre for the Study of Living Standards, Spring 2005) for a discussion of the reasons for the post-2000 productivity slowdown.

5 Centre for the Study of Living Standards, "The Relationship between ICT Investment and Productivity in the Canadian Economy: A Review of the Evidence," report prepared for the Telecommunications Policy Review Panel, August 2005, forthcoming as a Centre for the Study of Living Standards Research Report, April 2006.

6 OECD, *Compendium of Productivity Indicators*.

Figure 7-3. Relationship between Growth in Software ICT Capital Stock per Worker and Growth in Labour Productivity, Selected Industries, Canada, 1987–2004



Source: Centre for the Study of Living Standards, "The Relationship between ICT Investment and Productivity in the Canadian Economy: A Review of the Evidence," report prepared for the Telecommunications Policy Review Panel, August 2005, forthcoming as a Centre for the Study of Living Standards Research Report, April 2006.

ICT investments at the level of individual firms enhance productivity . . .

At the firm level, a number of rigorous studies have found strong evidence that network communications technology in particular has an effect on labour productivity. The strongest firm-level evidence of a link between ICT and productivity has been provided in a study using new plant-level data that found that computer network and computer inputs, even when they are separately incorporated, have a positive and significant relationship with U.S. firm-level labour productivity.[7]

Another study estimated the relationship between relative labour productivity growth and ICT use at the firm level in the Canadian manufacturing sector over the 1988–1997 period.[8] The results show that ICT use is positively related to relative labour productivity and that there appear to be almost no productivity gains from adopting a single technology, either hardware or software. The crucial explanatory variable is the use of network communications technology, which causes a positive impact of ICT use on relative labour productivity.

. . . along with complementary organizational changes.

Micro-level studies have also found evidence that investing in ICTs does not necessarily lead to cost reductions and higher productivity if it is not associated with organizational changes. For example, since ICTs are much more flexible than earlier technologies, they allow workers to modify their work practice, but the best practices that make the optimal use of the new capital are not always obvious.

7 B. K. Atrostic and S. Nguyen, "Computer investment, computer networks and productivity," Discussion Paper CES 05-01, U.S. Census Bureau, Center for Economic Studies, 2005.

8 John Baldwin and David Sabourin, "Impact of the adoption of advanced information and communication technologies on firm performance in the Canadian manufacturing sector," Research Paper Series 11F0019MIE, No. 174 (Ottawa: Statistics Canada, Analytical Studies Branch, 2001), p. 34.

Effective ICT investment often requires firms to spend additional resources in training their workforces and testing new ways of organizing production. These costs constitute investments in complementary intangible assets that add to the total stock of capital, even though they are included in current business expenses (and hence not in investment) in official statistics. One study reports that the ratio of intangible assets to ICT assets could reach 10 to 1, suggesting that complementary investments in organizational assets are considerable.[9] Additional support for the importance of complementary investments in leveraging ICT investment comes from a recent Finance Canada study that found ICT training is strongly related to the successful implementation of ICT.[10]

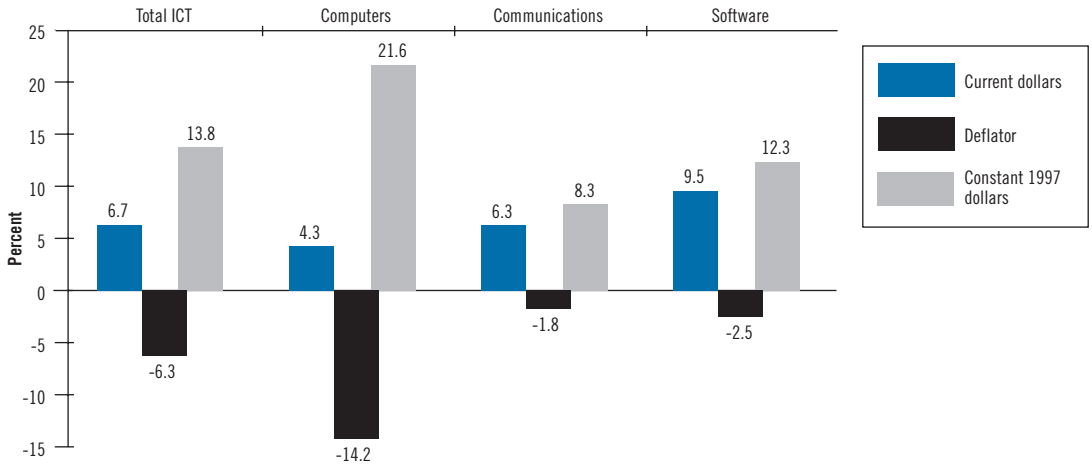
Trends in labour productivity are dependent on many variables other than ICT capital intensity, such as the economic cycle, R&D intensity, profitability and input prices. Moreover, the beneficial effects of growth in ICT capital intensity are likely to be felt with a lag. Nevertheless, there is consensus among economists that ICT, if properly implemented, is productivity enhancing.

ICT Investment Trends in Canada

Canadian ICT investment exhibits growth.

Real business sector ICT investment (measured in inflation-adjusted or constant dollars) grew at a 13.8-percent average annual rate between 1987 and 2004 (Figure 7-4). These figures reflect falling ICT prices because of large quality improvements in ICT products. The overall deflator for business sector ICT investment fell at a 6.3-percent average annual rate from 1987 to 2004. Current-dollar ICT investment increases were 6.7 percent per year.

Figure 7-4. Average Annual Rate of Change in Business Sector ICT Investment, Selected Components, Canada, 1987–2004 (%)



Source: Centre for the Study of Living Standards, based on data from Statistics Canada, February 2006.

9 Erik Brynjolfsson and Hitt Lorin, "Beyond computation: information technology, organizational transformation and business performance," *Journal of Economic Perspectives* 14 (no. 4, 2000), pp. 23–48.

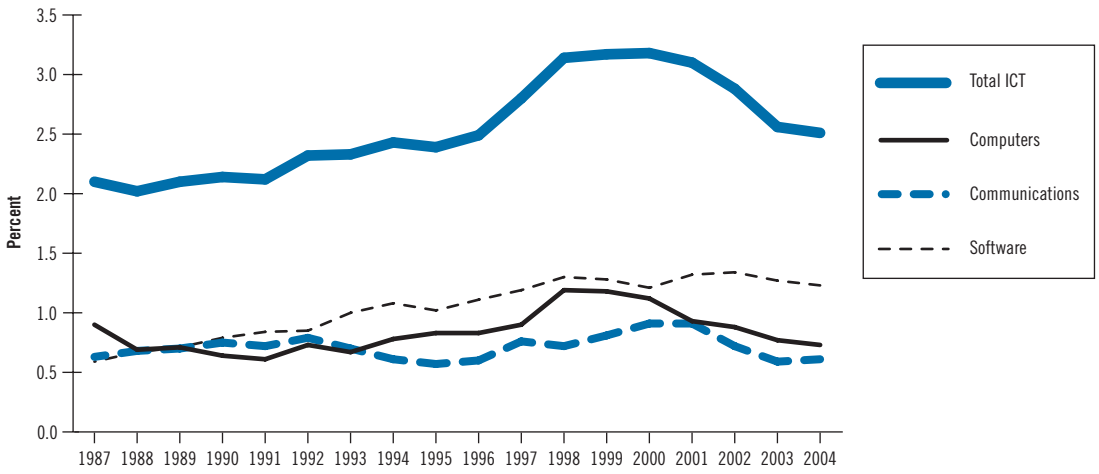
10 Julie Turcotte and Lori Whewell Rennison, "The link between technology use, human capital, productivity and wages: Firm-level evidence," *International Productivity Monitor*, no. 9 (Fall 2004), pp. 25–36. Available online at: **http://www.csls.ca/ipm/9/turcotte_rennison-e.pdf**

In constant-dollar terms, computer investment experienced by far the most rapid rate of increases, rising by 21.6 percent per year. But in current-dollar terms, software experienced the largest increase at 9.5 percent. The difference between constant-dollar and current-dollar trends is explained by the much larger fall in computer prices relative to software prices at 14.2 percent per year versus 2.5 percent per year, respectively.

Growth in Canadian ICT investment is largely accounted for by ICT software investment.

There has been an upward trend in the share of ICT investment in business sector gross domestic product (GDP) from 2.1 percent in 1987 to 2.5 percent in 2004 (Figure 7-5). The share was more than 3 percent from 1998 to 2002. All the increase can be explained by software, which increased from 0.6 percent of GDP in 1987 to 1.3 percent in 2004. The share of computers actually fell from 0.9 percent to 0.7 percent, while that of communications was stable.

Figure 7-5. Business Sector ICT Investment as a Share of Business Sector Gross Domestic Product, Current Dollars, 1987–2004 (%)



Source: Centre for the Study of Living Standards, based on data from Statistics Canada.

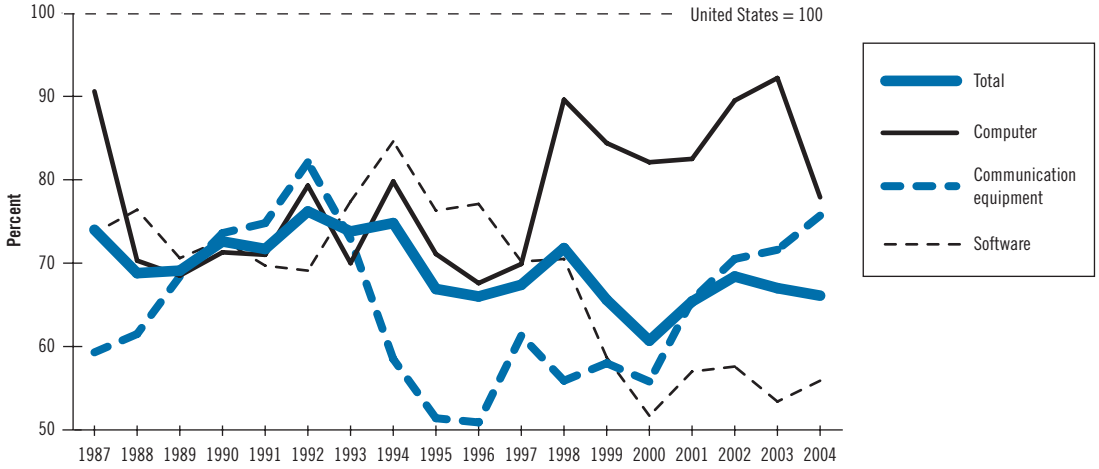
Note: The three components may not sum exactly to total because of the unavailability of data on the health care and social assistance industry used to compute business sector figures for computers, communications equipment and software.

ICT Investment Trends in International Perspective

Canadian ICT investment as a share of GDP is 66 percent of that in the U.S.

In 2004, the ratio of ICT investment to GDP for Canada's business sector was only 66 percent of that of the U.S. business sector (Figure 7-6). This was down from 75 percent in 1987. Canada's shortfall relative to the U.S. in total machinery and equipment investment as a share of GDP is largely accounted for by the ICT investment shortfall.

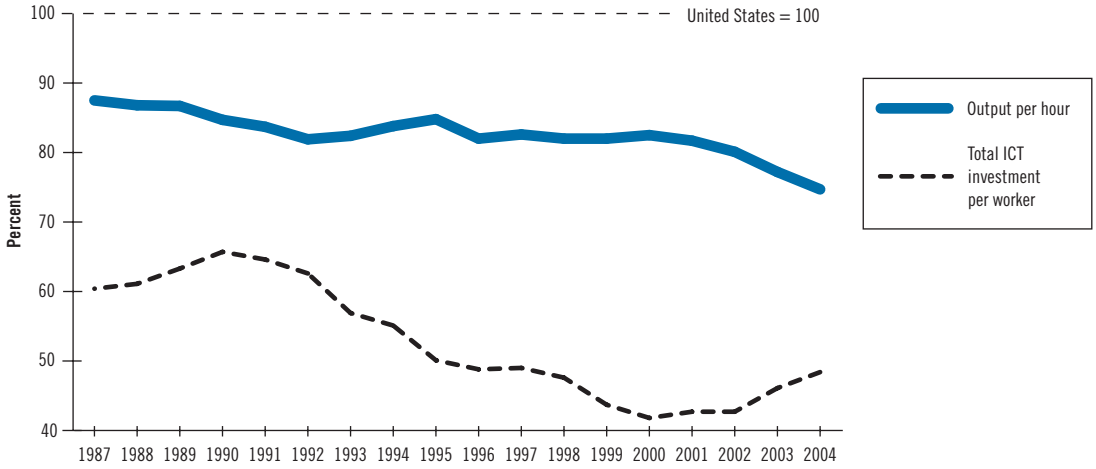
Figure 7-6. ICT Investment as a Share of GDP in the Canadian Business Sector Relative to the Levels in the U.S. Business Sector, Selected Components, 1987–2004 (%)



Source: Centre for the Study of Living Standards, based on Statistics Canada and U.S. Bureau of Economic Analysis data, February 2006.

Canada's ICT investment performance relative to that in the U.S. is even weaker when measured on a per-worker basis rather than as a share of GDP. In 2004, business sector ICT investment per worker in Canada was only 48 percent of that of the U.S. Moreover, this proportion has been on a strong downward trend from 60 percent of the U.S. level in 1987, a trend that corresponds with the decline in our relative productivity performance (Figure 7-7).

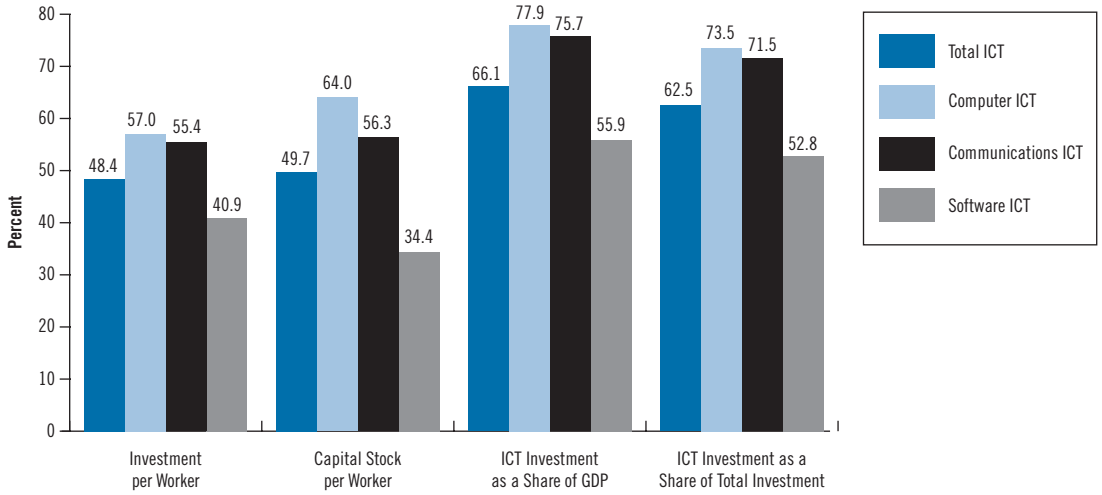
Figure 7-7. Output (GDP) per Hour Worked and Total ICT Investment per Worker in the Canadian Business Sector Relative to Levels in the U.S. Business Sector, as Measured in Current U.S. Dollars, 1987–2004 (%)



Source: Centre for the Study of Living Standards, based on data from Statistics Canada, U.S. Department of Labor, Bureau of Labor Statistics, and U.S. Department of Commerce, Bureau of Economic Analysis, February 2006.

The shortfall in ICT investment in Canada relative to that in the U.S. is found in all three ICT components. In 2004, computer ICT investment as a share of business sector GDP in Canada was 78 percent of its U.S. counterpart, followed by 76 percent for communications and 56 percent for software (Figure 7-8).

Figure 7-8. Canadian Business Sector ICT Investment Relative to Levels in the U.S. Business Sector, Various Measures and Components, 2004 (%)

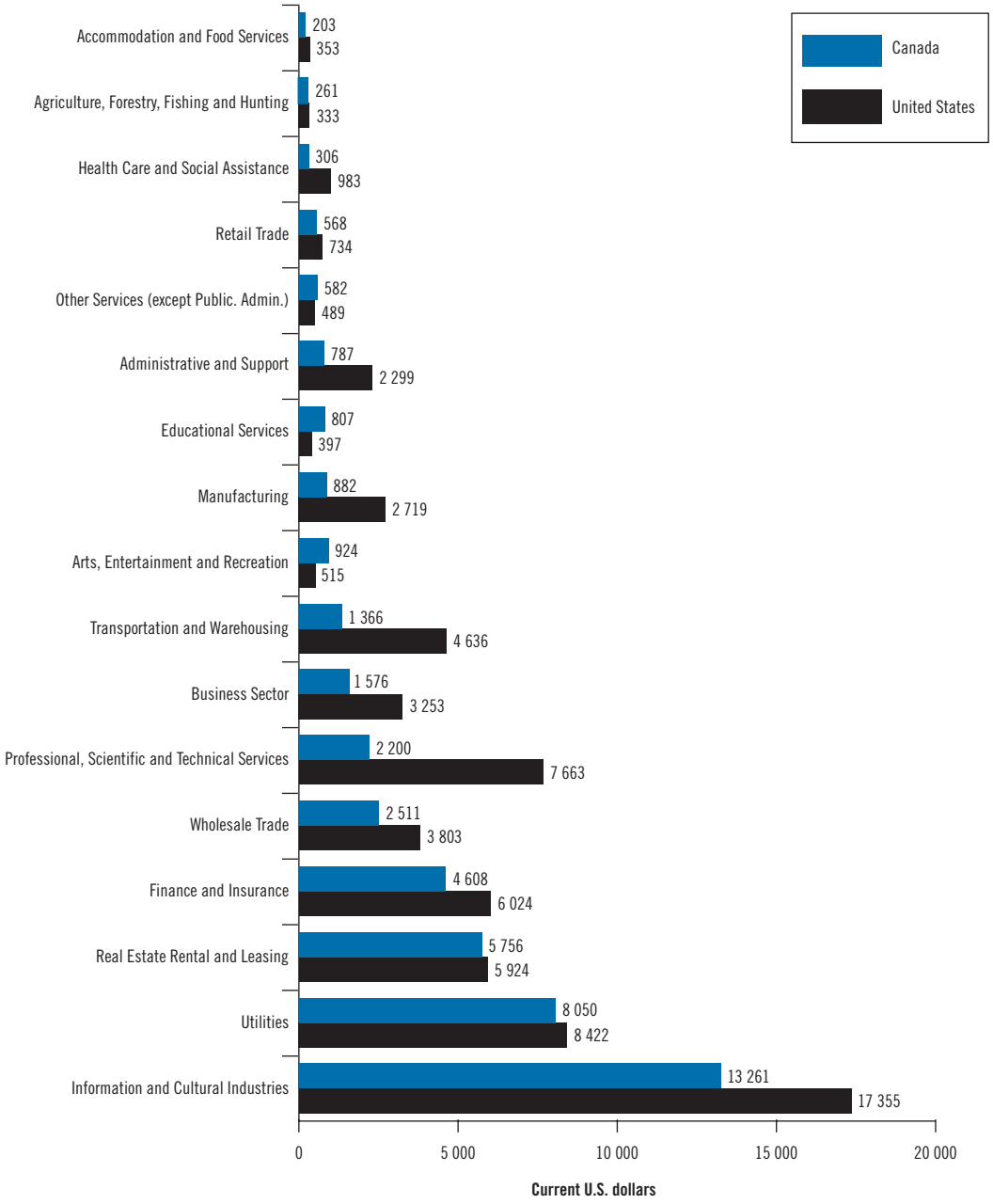


Source: Centre for the Study of Living Standards, based on data from Statistics Canada, U.S. Department of Labor, Bureau of Labor Statistics, and U.S. Department of Commerce, Bureau of Economic Analysis, February 2006.

U.S. ICT investment per worker is greater than Canada's in 13 of 16 industries.

ICT investment per worker varies greatly by industry (Figure 7-9), ranging in 2004 in Canada from a high of US$13 261 in information and cultural industries to a low of US$203 in accommodation and food services. Following the overall trend, U.S. ICT investment per worker exceeds that in Canada in 13 of 16 industries. The exceptions are arts, entertainment and recreation, educational services, and other services.

Figure 7-9. ICT Investment per Worker, Selected Industries, Canada and the United States, 2004 (current U.S. dollars)



Source: Centre for the Study of Living Standards, based on data from Statistics Canada, U.S. Department of Labor, Bureau of Labor Statistics, and U.S. Department of Commerce, Bureau of Economic Analysis, February 2006.

One recent study presented to the Panel found that lower ICT capital stock intensity in Canada explains 56 percent of the Canada–U.S. labour productivity gap in 2003.[11] This finding is important, as it serves as one indicator of the magnitude of the ICT investment challenge for Canada.

Canada's ICT investment performance internationally is average.

Canada's ICT investment performance is average by international standards. In terms of its share of ICT investment in non-residential fixed capital formation, Canada ranked eighth (a 20.3-percent share) out of 19 OECD countries in 2001. The U.S. ranked first with a 32.1-percent share.

In 2001, Canada also ranked eighth among OECD countries in terms of share of ICT investment in GDP (2.46 percent). The U.S. ranked first at 3.76 percent. For ICT investment per worker, Canada ranked ninth at $1133, or 42 percent of the U.S. level of $2724.

Why is Canadian ICT investment lagging relative to that in the U.S.?

Although Canada invests as high a percentage of its GDP as the United States, ICT investment accounts for a lower share of total investment in Canada than in the United States. A 2005 study has identified three key factors that contribute to the Canada–U.S. gap in ICT investment as a share of total investment[12]:

- Canada's lower employment shares in the high ICT intensity information and cultural industries and finance and insurance
- Canada's greater proportion of jobs in small enterprises that invest less per worker
- Canada's 20-percent-lower labour compensation, resulting in less substitution of ICT capital for labour and therefore less ICT investment.

Conclusions

On the basis of the research reported above and drawing on the many submissions made on the subject of ICT investment and ICT adoption, the Panel concludes that:

- Canada's overall productivity growth has fallen off significantly since 2000, and the Canada–U.S. productivity gap is widening.

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11 Mel Fuss and Leonard Waverman, "Canada's productivity dilemma: The role of computers and telecom," Appendix E-1 to Bell Canada's Submission to the Telecommunications Policy Review Panel, Ottawa, August 2005. Fuss and Waverman break down the 56-percent contribution for 2003 into 12 percent from capital deepening and 44 percent from ICT spillovers. The spillovers are in turn disaggregated into 2 percent from telecom penetration and 42 percent from information technology (IT) penetration. The IT penetration is further disaggregated into 31 percent from personal computer (PC) penetration (computers per capita) and 11 percent from digital/PC interaction. Similar results were obtained for 2000, although the overall ICT contribution to the productivity gap that year was somewhat higher at 60 percent.

12 Centre for the Study of Living Standards, "What explains the Canada–U.S. ICT investment gap?" Report prepared for the Information Technology Association of Canada (Ottawa: CSLS, December 2005). An abridged version of the report under the same title was published in the Fall 2005 issue of the *International Productivity Monitor,* available online at: **www.csls.ca**

- Weakness in ICT investment is an important contributing factor to Canada's weak productivity performance, in terms of both productivity levels and growth rates. Increased ICT investment therefore represents an opportunity for improved productivity performance at the economy-wide level.
- Investing in ICTs by itself is no guarantee of higher productivity. There is a substantial body of microeconomic research to suggest, at the level of individual firms, that productivity gains result when ICT investment is accompanied by complementary investments in organizational transformation, which involves many different investment areas, including business process re-engineering and employee training.

Making Smart ICT Adoption a National Priority

The Need for a National Strategy

The evidence presented in the previous section indicates that sustained business investment in ICTs is an important factor in productivity growth and international competitiveness. It also indicates that the "smart adoption" of ICTs through complementary investments in organizational redesign, process re-engineering and skills development makes the difference for individual firms and, through them, for the economy as a whole. Smart adoption of ICTs is important beyond the business sector. It is important for government, public sector institutions and organizations as well as civil society. It matters for the quality of life for individual Canadians and the communities in which they live.[13]

In the 1990s, Canada was a leader in developing strategies to promote network connectivity and electronic commerce. Today, Canada's leadership position is challenged. The 2004 Networked Readiness Index, produced by the World Economic Forum, ranks Canada 10th overall out of 104 countries, down from sixth in 2002 and 2003. Moreover, it ranks Canada 49th out of 104 countries in government promotion of ICTs and 42nd in making ICTs a national priority.[14]

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[13] In this same context, the Panel takes note of Canada's agreement to the final communiqué of the November 2005 World Summit on the Information Society and its unequivocal reaffirmation of support for the 2003 Geneva Declaration of Principles and Plan of Action, including:

> We reaffirm our desire and commitment to build a people-centred, inclusive and development-oriented Information Society, premised on the purposes and principles of the Charter of the United Nations, international law and multilateralism, and respecting fully and upholding the Universal Declaration of Human Rights, so that people everywhere can create, access, utilise and share information and knowledge, to achieve their full potential and to attain the internationally agreed development goals and objectives, including the Millennium Development Goals.

Second Phase of the WSIS, Tunis, Tunisia, November 16–18, 2005, Tunis Commitment WSIS-05/TUNIS/DOC/7. Available online at: **http://www.itu.int/wsis/docs2/tunis/off/7.html**

[14] World Economic Forum, *Global Information Technology Report 2004–2005*. Available online at: **http://www.weforum.org/site/homepublic.nsf/Content/Global+Competitiveness+Programme%5CGlobal+Information+Technology+Report**

What Other Countries Are Doing

Canada's major international competitors recognize the importance of advanced networks and ICT applications. In many cases, they have already established high-level national strategies and launched initiatives aimed at making their countries world leaders in ICT adoption. Selected examples of these national strategies follow.

The European Union

On June 1, 2005, the European Commission adopted the initiative *i2010: European Information Society 2010.* Its objective is to ensure that Europe's citizens, businesses and governments make the best use of ICTs to improve industrial competitiveness, support growth and the creation of jobs and to help address key societal challenges.

Ireland

Ireland's *New Connections: A Strategy to Realize the Potential of the Information Society* was launched in 2002 by the Prime Minister of Ireland. Its objective is to create a public policy environment that supports the development of an "information society" within Ireland; that is, a society that makes extensive use of ICTs. To implement the strategy, a new Cabinet-level position of Minister for the Information Society was created, and a new Cabinet Committee on the Information Society was established. It is chaired by the Prime Minister.

The United Kingdom

In March 2005, the U.K. Prime Minister endorsed a new *U.K. Digital Strategy*. The objective of the strategy is to make the U.K. a world leader in digital excellence and the first nation to close the digital divide. This was followed in November 2005 by a strategy for using ICTs to transform public services, for example, by delivering public sector services through mobile technology and digital TV.

Japan

In 2001, the Japanese government created an "IT Strategic Headquarters" with the mandate to promote policy measures for establishing an advanced IT network society in Japan. The Prime Minister of Japan heads this body and most senior Japanese government ministers are members. The IT Strategic Headquarters also includes representatives from the private sector and academia. Its most recent initiative is the 2004 "U-Japan strategy," which aims at boosting Japan's economy and society by fully integrating ubiquitous ICTs.

Australia

In July 2004, the government of Australia released a "Strategic Framework on Opportunities and Challenges for the Information Age." This strategy is intended to provide policy leadership and national direction in addressing the ICT challenges facing Australia. The strategy is guided by the Online and Communications Council, a ministerial forum that includes representatives of Australia's commonwealth, state and territorial governments. The council is chaired by the Australian Minister for Communications, Information Technology and the Arts. Its objective is to promote national ICT policy consistency through consultation and coordination.

South Korea

During 2004, the South Korean government launched "IT839," a national strategy to promote strong collaboration among information technology services, infrastructure and manufacturing. IT839 aims to provide eight new services (including terrestrial digital TV and Internet telephony), build three kinds of infrastructure (including IPv6) and foster nine new driving forces of growth (including next-generation mobile communications, home network services, and digital content for culture, education and health), as well as channel efforts into attaining a per capita GDP of US$20 000. South Korea's Informatization Promotion Committee (IPC), chaired by the Prime Minister, evaluates progress on the implementation of the master plan and recommends changes as required.

India

In 2004, India's Minister of Communications and Information Technology set out a national ICT agenda that includes bringing "cyber connectivity" to every citizen, ensuring migration to IPv6 in India by 2006, providing seamless communications connectivity to rural areas, promoting value-added services and micro enterprises at the village level, extending quality health care services to remote areas through telemedicine, and using ICTs to improve literacy through distance education.

The United States

As long ago as 1988, the U.S. Congress established the Technology Administration in the Department of Commerce, recognizing that technology and industrial innovation are central to the economic, environmental and social well-being of citizens of the United States. The mission of the Technology Administration is to maximize technology's contribution to economic growth, high-wage job creation and the social well-being of the United States. In 2001, the U.S. President issued an Executive Order on Critical Infrastructure Protection in the Information Age and established a National Infrastructure Advisory Council to provide advice on the security of information systems for critical infrastructure supporting other sectors of the economy, such as banking and finance, transportation, energy, manufacturing and emergency government services.

Key Issues

These examples from other countries reinforce a message the Panel received in a number of submissions and throughout its consultation process: a comprehensive national ICT adoption strategy is needed if Canada is to remain a global leader in the development and use of advanced networks and ICT applications. The Panel believes Canada should focus its strategy on using ICTs to help achieve the overall goals of telecommunications policy.

> **Recommendation 7-1**
>
> **Under the leadership of the Prime Minister, the federal government should develop a national ICT adoption strategy focused on using ICTs to increase the productivity of the Canadian economy, the social well-being of Canadians and the inclusiveness of Canadian society.**

On the basis of submissions received during its consultation process and its own research, the Panel identified six key objectives that must be attained to achieve the overall goals of the national ICT adoption strategy:

- strengthening ICT adoption by Canadian businesses, particularly SMEs
- strengthening the links between ICT sector R&D and smart ICT adoption
- enhancing ICT adoption by governments
- promoting development of ICT adoption skills on a coordinated national basis
- improving security, trust and consumer confidence in the online environment
- achieving ubiquitous access to broadband networks and services.

The first five of these challenges are described in the sections that follow. In its terms of reference, the Panel was specifically asked to provide recommendations on how to achieve ubiquitous broadband access. This topic is the subject of Chapter 8, Connectivity: Completing the Job.

Strengthening ICT Adoption by Canadian Businesses

As shown in Table 7-1, many Canadian businesses, both large and small, have already adopted one or more of the most basic ICTs, including personal computers, email and the Internet.

Table 7-1. ICT Use among Businesses, Selected Technologies, 2000–2004 (% of all firms)

Technology	2000	2001	2002	2003	2004
Personal computer	81.4	83.9	85.5	87.4	88.6
Email access	60.4	66.0	71.2	73.8	76.6
Internet access	63.4	70.8	75.7	78.2	81.6
Own website	25.7	28.6	31.5	34.0	36.8
Sell goods or services online	6.4	6.7	7.5	7.1	7.4
Purchase goods or services online	18.2	22.4	31.7	37.2	42.5
Value of sales over the Internet ($ millions)	7 246	10 389	13 339	18 598	26 438

Source: Statistics Canada, *Innovation Analysis Bulletin 7*, no. 3 (October 2005) Catalogue no. 88-003-XIE, p. 19.

However, Canadian SMEs[15] have lower adoption rates relative to large firms according to such indicators of basic ICT use as having a website or selling or purchasing online.[16] Table 7-2 shows the use of basic ICTs by firm size for 2001–2003. Overall, large firms have universally embraced these technologies, while a significant proportion of small firms have not done so.

[15] According to Industry Canada's *Key Small Business Statistics* (Ottawa: Industry Canada, July 2005), which is available online at: **http://strategis.ic.gc.ca/epic/internet/insbrp-rppe.nsf/en/rd01224e.html**:

> The size of a business can be defined in many ways, by the value of its annual sales or shipments, for example, or by its annual gross or net revenue, the size of its assets or the number of its employees. Many institutions define small businesses according to their own needs: the Canadian Bankers' Association classifies a company as "small" if it qualifies for a loan authorization of less than $250 000, while the Export Development Corporation defines small or "emerging" exporters as firms with export sales under $1 million. Industry Canada has often used a definition based on the number of employees: goods-producing firms are considered "small" if they have fewer than 100 employees, while for service producing firms the cut-off point is seen as 50 employees. Above that size, and up to 499 employees, a firm is considered medium-sized. The smallest of small businesses are called micro-enterprises, most often defined as having fewer than five employees. The term SME (for small and medium-sized enterprise) is used to refer to all businesses with fewer than 500 employees, while firms with 500 or more employees are classified as "large" businesses.

[16] The Panel recognizes that having a website is merely an indicator of ICT adoption, and is not always the best or necessary ICT adoption practice for all businesses. Moreover, as recently pointed out by Statistics Canada, many people may think of selling or purchasing online only in relation to retail sales to consumers. The current reality is quite different. In 2004, total online sales (retail and business-to-business) were estimated at $26.5 billion. Sales from business to business represented 75 percent of this total, or about $19.8 billion. Online wholesale trade has the highest value of online sales of any industrial sector, representing an estimated 23 percent of total online sales. See Mark Uhrbach "How business-to-business sales dominate e-commerce," Analytical Paper, Statistics Canada Catalogue no. 11-621-MIE2005033, November 2005.

Table 7-2. ICT Use among Businesses, by Firm Size, Selected Technologies, 2001–2003 (% of all firms)[a]

Technology and Firm Size	2001	2002	2003
Internet access			
Small	68	73	76
Medium	91	92	94
Large	94	99	97
All firms	71	76	78
Own website			
Small	24	27	29
Medium	57	62	66
Large	74	77	77
All firms	29	32	34
Sell goods or services online			
Small	6	7	6
Medium	12	13	14
Large	15	16	16
All firms	7	8	7
Purchase goods or services online			
Small	20	29	35
Medium	30	47	50
Large	52	57	61
All firms	22	32	37

[a] Statistics Canada defines small firms as having fewer than 20 employees, medium-sized firms as having between 20 and 99 employees, and large firms as having more than 100 employees for all industries except manufacturing. The upper limit for the medium-sized category in the manufacturing industry is 499 employees, while firms with 500 employees or more are defined as large.

Source: Statistics Canada, Survey of Electronic Commerce and Technology (SECT), 2004. Available online at: http://e-com.ic.gc.ca/epic/internet/inecic-ceac.nsf/en/gv00152e.html

The Canadian e-Business Initiative (CeBI)[17] — established in 2002 as a private sector-led partnership to further Canada's e-business success — has also documented that Canadian SMEs are lagging in the adoption of the advanced ICTs that are part of smart adoption. Its September 2004 *Fast Forward Report* stated[18]:

> While small businesses lead in customer-focused applications, they are reticent about adopting many of the more advanced e-business solutions. Although these solutions, such as e-procurement, supply chain management and human resources management, offer substantial potential for cost savings and profit enhancement, the majority of small firms do not utilize them.

The availability of advanced ICTs constitutes an opportunity for all Canadian business, both large and small. The complementary investments required for the effective adoption of ICTs, including adapting business concepts, value chains, organizations, supplier and customer relations, and employee training programs, constitute the challenge.

Surveys of Canadian industry undertaken by Statistics Canada, the CeBI, and other national and international research organizations reveal many impediments to ICT adoption by Canadian businesses. The direct acquisition cost of ICTs is nearly always at or near the top of the list of impediments cited by firms for the adoption of ICTs. However, many other impediments, in many respects, are more difficult to address. These are generally related to firm structure, operations, internal management capacity, the availability of people with the right skills, and access to critical information and knowledge for integrated technical and strategic decision making. Many of these impediments can be expected to fall more heavily on SMEs than on larger firms.

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17 The Canadian e-Business Initiative (CeBI) was launched in September 2002 as a private sector-led partnership that aimed to further Canada's e-business success by focusing on productivity, leadership and innovation.

18 CeBI, *Fast Forward 5.0: Making Connectivity Work for Canada* (Ottawa: Canadian e-Business Initiative, September 2004), p. 25.

Examples of Impediments to ICT Adoption by Canadian SMEs Identified through the Canadian e-Business Initiative

- SMEs have widely adopted stand-alone solutions (such as websites and email) that are relatively easy to implement, but have been slower to adopt integrated solutions (Internet business solutions or IBS) that are more difficult to implement.
- The cost savings from IBS are not uniformly realized by SMEs across all size and industry segments and many SMEs do not understand the business case for IBS adoption. SMEs do not have a clear strategy for implementing IBS. Planning is non-existent or *ad hoc*.
- Canadian SMEs are not fully integrated in supply chains of customers and suppliers. Participants in these supply chains are developing common standards for exchanging information and creating inter-organizational "virtual" processes for managing business operations.
- Smaller SMEs (fewer than 100 employees) lag larger SMEs (between 100 and 500 employees) across a number of dimensions, including adoption rates, internal capabilities and cost reduction benefits. Smaller SMEs appear to be the hardest to convince of the benefits of IBS adoption.
- Widespread availability of Internet business solutions specifically designed for the SME market is lacking.

Source: CeBI, *Net Impact Study Canada: Strategies for Increasing SME Engagement in the e-Economy* (2004). Available online at: **http://www.cebi.ca/Public/Team1/Docs/net_impact_english.pdf**

In Canada, a widely cited study analyses the results of a Statistics Canada survey of impediments to "advanced technology" adoption among Canadian manufacturers. Many of these advanced technologies either directly embody ICTs or are dependent upon them. As reported in Table 7-3, Canadian manufacturing businesses ranked "institution-related" factors (including R&D tax credits and capital cost allowance provisions) lower than such other categories of impediments as cost, labour and organization-related factors.[19]

[19] John Baldwin and Zhengxi Lin, *Impediments to Advanced Technology Adoption for Canadian Manufacturers,* Working Paper No. 173, Statistics Canada Catalogue no. 11F0019MPE, August 2001, p. 1.

Table 7-3. Impediments to Advanced Technology Use Cited by Canadian Manufacturing Establishments
(% of all firms)

Impediment	(%)
Cost-related	**68.5**
Capital	47.0
Equipment	53.0
Software development	17.5
Maintenance	12.4
Technology acquisition	27.9
Institution-related	**16.4**
R&D investment tax credit	7.7
Capital cost allowance	8.4
Regulations and standards	9.9
Labour-related	**28.8**
Skill shortage	20.2
Training difficulty	16.8
Labour contract	5.8
Organization-related	**20.9**
Difficulty in introducing change	13.0
Management attitude	7.9
Worker resistance	9.0
Information-related	**16.0**
Lack of information	10.4
Lack of service	7.7
Lack of support from vendors	8.6

Source: John Baldwin and Zhengxi Lin, *Impediments to Advanced Technology Adoption for Canadian Manufacturers*, Working Paper No. 173, Statistics Canada Catalogue no. 11F0019MPE, August 2001, p. 1. The Baldwin–Lin analysis is based on Statistics Canada's 1993 Survey of Innovation and Advanced Technology. The general picture they draw, and the findings reported in Table 2, are largely consistent with other more recent, although less detailed and comprehensive, surveys of impediments to Canadian business technology adoption.

The Panel believes overcoming these impediments and strengthening ICT adoption by Canadian businesses — particularly by the SMEs that provide a significant proportion of Canadian jobs — should be a fundamental objective of Canada's national ICT adoption strategy. It will not be possible to achieve the other goals of the strategy without the economic benefits that flow from smart ICT adoption, in terms of increased productivity, improved competitiveness, enhanced opportunities for product and service innovation throughout the economy, and new job opportunities.

Strengthening ICT R&D

The Panel believes, without a strong national ICT R&D base, Canada will lack the people, ideas, and knowledge networks to effectively shape and implement ICT adoption strategies throughout the Canadian economy. The Panel also believes, in the absence of a strong Canadian ICT R&D effort, Canada may find it increasingly difficult to position itself at the high-value-added, knowledge-intensive end of global and regional supply chains.

> "Capabilities maintained and fostered in Canada are available to supply technological and management expertise to the ecosystem of emerging ICT companies and to governments and companies in the broader private sector that are looking to benefit from the application of ICT to their own operations. Furthermore, the quality of teaching and mentoring available in Canada is enhanced, as are opportunities for cooperation among industry, government and universities."
>
> — Submission to the Telecommunications Policy Review Panel from the Information Technology Association of Canada.

As Table 7-4 shows, R&D spending by the ICT goods-and-services-producing sector accounts for an estimated 38 percent of total business R&D spending (current and capital) in 2004. The entire ICT-producing sector accounts for almost 41 percent of all full-time equivalent R&D personnel across all Canadian industries. Within the ICT-producing sector, the Canadian communications equipment manufacturing industry is the largest R&D-spending industry. It also represents 12.1 percent of total manufacturing and service industry R&D spending in Canada.

Table 7-4. Research and Development Expenditures and Personnel in ICT, 2001–2005[a]

	2001	2002	2003[p]	2004[p]	2005[i]
ICT Industries			millions of dollars		
Total R&D expenditures	**6 688**	**5 390**	**5 181**	**5 146**	**5 249**
Current	5 940	4 972	4 837	4 831	4 911
Capital	748	418	343	315	338
			full-time equivalents		
Total R&D personnel	**51 525**	**48 005**	**47 560**	**–**	**–**
Professionals	38 676	35 113	33 783	–	–
Technicians	10 149	9 441	9 293	–	–
Other	2 700	3 451	4 484	–	–
Non-ICT Industries			millions of dollars		
Total R&D expenditures	**7 632**	**7 976**	**8 210**	**8 484**	**8 599**
Current	6 880	7 285	7 594	7 813	7 967
Capital	753	692	616	671	632
			full-time equivalents		
Total R&D personnel	**64 113**	**65 403**	**68 733**	**–**	**–**
Professionals	34 833	35 576	37 013	–	–
Technicians	19 471	20 185	21 934	–	–
Other	9 809	9 642	9 786	–	–

[a] For the purposes of this table, Statistics Canada identifies the ICT sector as comprised of a subset of the North American Industry Classification System (NAICS) codes from various industries. According to Statistics Canada, the table presents the ICT sector industries in comparison with the non-ICT sector industry. This comparison indicates that the decline in R&D spending in 2002 was contained within the ICT group, whereas non-ICT industries show constant growth in all five years. The same can be said for R&D personnel: where ICT industries saw a decline of 7.7 percent, non-ICT industries increased their R&D personnel by 7.2 percent. ICT-based industries are found in a variety of industry groups, including manufacturing (NAICS 3333, 33411, 33421, 33422, 33431, 33441, 33451 and 33592), wholesale trade (NAICS 4173 and 41791), information and cultural industries (NAICS 5112, 517 to 518), real estate and rental leasing (NAICS 53242), professional, scientific and technical services (NAICS 5415) and other services (NAICS 8112). For a complete description of the NAICS, refer to Industry Canada, Canadian Industry Statistics, available online at: **http://fcv.ic.gc.ca/sc_ecnmy/sio/homepage.html**

[p] Preliminary estimates.

[i] Intentions for 2005 expressed during 2004.

Source: Statistics Canada, *Science Statistics*, Catalogue 88-001-XIE, June 30, 2005. Available online at: **http://www.statcan.ca/english/freepub/88-001-XIE/88-001-XIE2004010.pdf**

Increasing ICT sector R&D is important in itself, but even more so to the extent that it is linked to improving ICT adoption performance across the Canadian economy. However, there is little empirical evidence to date on the nature and extent of the linkages between ICT sector R&D in Canada and improved economic performance across all sectors of the economy.

To successfully frame and implement a national ICT adoption strategy, the Panel believes it is vital to understand the relationship between ICT R&D, on the one hand, and smart adoption of ICTs throughout Canada's economy and society, on the other. Without this understanding, it will be difficult for the federal government to provide more effective support to smart ICT adoption in the private and public sectors through better management and coordination of its R&D institutions and programs.

The Panel believes strengthening the links between ICT R&D and smart adoption of ICTs in the private and public sectors should be a second objective of Canada's national ICT adoption strategy.

Promoting ICT Adoption by Governments

In seeking to use ICTs to improve the quality of the services they provide to Canadian citizens and to enhance their efficiency, governments face challenges similar to those faced by businesses seeking to use ICTs to improve their productivity and competitiveness. To be smart adopters of ICTs, government departments and agencies also need to re-engineer processes, transform organizational structures and develop the skills of their employees. In addition, they face unique challenges in becoming smart ICT adopters arising from the legal and financial frameworks within which they operate, which are very different from those governing private businesses.

There are many international benchmarking studies of e-government performance across national jurisdictions. In general, Canada ranks well within the top 10 countries in all these benchmarking studies. For example, a commonly cited international benchmarking study of e-government is conducted annually by the private sector consulting firm Accenture. Its April 2005 annual benchmarking study ranked Canada number one of 22 countries for the fifth year in a row.[20] Even those studies that find some erosion in Canadian e-government performance over recent years are highly complementary of the progress being made.[21]

The Panel believes Canada's currently high international e-government ranking cannot be taken for granted, given the pace of social, economic and technological change as well as the rising expectations of Canadians for more responsive and more productive government.

In December 2003, the federal government received the final report of the Government On-Line Advisory Panel, *Connecting with Canadians: Pursuing Service Transformation*.[22] The GOL Advisory Panel was composed of representatives from across the public and private sectors and

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20 Accenture, *Leadership in Customer Service: New Expectations, New Experiences*, The Government Executive Series, 2005. Available online at: **http://www.accenture.com/xdoc/ca/locations/canada/insights/studies/leadership_cust.pdf**

21 United Nations, *UN Global E-Government Readiness Report: Towards Access for Opportunity*, UNPAN/2004/11 (New York: UN Department of Economic and Social Affairs, 2004), p. 28.

22 Government On-Line Advisory Panel, *Connecting with Canadians: Pursuing Service Transformation*, Final Report to the President of the Treasury Board of Canada (Ottawa: December 2003). Available online at: **http://www.gol-ged.gc.ca/pnl-grp/reports/final/final00_e.asp**

included representatives from civil society organizations and academic institutions. In its report, the GOL Advisory Panel provided the government with many specific recommendations on how to transform its services to improve the efficiency of its operations and provide higher-quality services to Canadian citizens and businesses. It also warned[23]:

> If the federal government does not transform its services, they will deteriorate in the face of rising demands resulting from demographic, economic and social trends. As services deteriorate, government will lose its relevance to Canadians.

Many submissions to this Panel were largely in agreement with the analysis contained in the GOL Advisory Panel report. The submissions were almost unanimous in the view that all governments in Canada have much to gain by way of their more effective adoption and deployment of ICTs for the delivery of public services, including in the areas of health, education and emergency preparedness.[24]

The Panel believes enhancing smart ICT adoption by Canada's different levels of government should be a third objective of the national ICT adoption strategy.

ICT Adoption Skills

A variety of skills are needed for smart adoption of ICTs. Some of these are technical, for example, the skills needed to design and develop ICT networks and applications. Others are managerial, for example, the skills needed to redesign business processes, supply chains and organizational structures, as well as the skills needed to manage people, financial and material resources, and relations with clients and customers in ICT-infused environments. Still others are the skills that employees, students, consumers, citizens and end-users increasingly need to interact using ICTs with organizations, communities of interest and each other.

Development of the various kinds of skills that Canadians need to be smart adopters of ICTs is a complex process involving different levels of government, primary, secondary and post-secondary educational institutions, public and private sector organizations, communities and voluntary organizations as well as families and individuals.

The Panel believes promoting the development of ICT adoption skills should be a fourth objective of Canada's national ICT adoption strategy. Coordinating a national effort will be a challenge. However, without a sound, coordinated approach to developing the skills needed for smart ICT adoption, the overall national strategy will not succeed.

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23 *Ibid.*

24 Canadian federal and provincial governments are investing significant resources in ICT adoption in each of these areas, including e-health. On September 11, 2000, in support of a First Ministers' agreement, the Canadian federal government announced that it would "invest $500 million immediately in an independent corporation mandated to accelerate the development and adoption of modern systems of information technology, such as electronic patient records, so as to provide better health care." As a result, the $500-million federal investment was granted in March 2001 to Canada Health Infoway Inc., a not-for-profit organization established earlier that year. Infoway's initial priority was to foster and accelerate the development and implementation of effective, interoperable Electronic Health solutions. On February 18, 2003, in support of the 2003 First Ministers' Accord on Health Care Renewal, the 2003 budget announced the provision of an "additional $600 million to Canada Health Infoway to accelerate the development of Electronic Health Records, common information technology standards across the country, and the further development of telehealth applications, which are critical to care in rural and remote areas. An additional $100 million was granted to Infoway in March 2004 to support the development of a pan-Canadian health surveillance system." For more information, see online at: **http://www.hc-sc.gc.ca/hcs-sss/ehealth-esante/index_e.html**

Improving Security, Confidence and Trust in the Online Environment

There are an increasing number of risks and vulnerabilities associated with ICT adoption. These risks include threats to the privacy of personal information, threats to the safety, reliability and security of networks, cybercrime and illegal content.

In relation to privacy concerns, the Privacy Commissioner of Canada described the challenge, in her annual report to Parliament tabled in November 2005, in the following terms[25]:

> We are entering a world where computing power will be present in the most ordinary day-to-day devices. If we are not careful, that power will be used to gather or broadcast personal information in ways that greatly diminish our privacy, not to mention our autonomy and human dignity. As transmitting devices are built into roadsides, licence plates, currency and books, we are hard-pressed to keep up with the potential privacy invasions and abuses.

Strengthening the Internet as a medium for electronic commerce requires countering spam (unsolicited email), spyware, phishing (electronic fraud and identify theft) and other harmful practices that were documented in the May 2005 report of the federal government's Task Force on Spam. The task force pointed out that these activities are a direct threat to the viability of the Internet as an effective means of communication and are therefore a threat to increasing economic prosperity, more efficient public services and the emergence of an e-economy that includes all Canadians.[26]

The Need for a Comprehensive Strategy to Fight Threats to the Internet

"The third major lesson the Task Force [on Spam] has learned is that the fight against spam is only part of a much larger battle now beginning against emerging and potentially much more serious threats to the Internet as a platform for communications and commerce."

— *Stopping Spam: Creating a Stronger, Safer Internet,* Report of the Task Force on Spam (Ottawa: May 2005).

The Panel noted that the federal government has taken a number of steps to build trust, confidence and security in electronic marketplaces and in the use of electronic communications in cooperation with other levels of government, the private sector and consumer groups. Major domestic initiatives have included:

- the *Personal Information Protection and Electronic Documents Act* (PIPEDA), which came into full effect on January 1, 2004

25 Office of the Privacy Commissioner of Canada, Annual Report to Parliament 2004 Report on the *Personal Information Protection and Electronic Documents Act*. October 2005. Available online at: **http://www.privcom.gc.ca/information/ar/200405/2004_pipeda_e.asp#top**

26 Industry Canada, *Stopping Spam: Creating a Stronger, Safer Internet*, Report of the Task Force on Spam (Ottawa: Industry Canada, May 2005). Available online at: **http://e-com.ic.gc.ca/epic/internet/inecic-ceac.nsf/vwapj/stopping_spam_May2005.pdf/$file/stopping_spam_May2005.pdf**

- the Code of Practice for Consumer Protection in Electronic Commerce, which was endorsed by federal, provincial and territorial ministers responsible for consumer affairs on January 16, 2004
- the Principles for Electronic Authentication, which Industry Canada announced in May 2004
- the national security policy, "Securing an Open Society," announced by the federal government in May 2004, which included a commitment to strengthening Canada's capacity to predict and prevent cyber-attacks.[27]

In addition to the domestic concerns addressed by these initiatives, the Panel noted that international cooperation is essential to ensure the creation of a global culture of trust and security. A number of examples of such cooperation were brought to the Panel's attention. For example, the OECD has developed guidelines for Online Privacy and Consumer Protection in the Context of Electronic Commerce. In addition, Canada, the U.S. and Mexico agreed to a Framework of Common Principles for Electronic Commerce under the March 2005 Security and Prosperity Partnership of North America.

Trust, confidence and security are necessary ingredients for well-functioning marketplaces online, just as they are in the physical world. The Panel believes creating an environment in which these conditions can flourish should be a fifth objective of Canada's national ICT adoption strategy.

The Need for Leadership

Developing a national ICT adoption strategy to meet these challenges will require strong leadership from the federal government. To successfully promote smart ICT adoption among Canadian businesses, communities and citizens, the federal government will need to secure the active engagement of different departments and agencies of the federal, provincial and territorial governments, the private sector, researchers and teachers, consumer representatives, and community-based organizations.

A Lead ICT Minister

The example of other countries suggests that national ICT adoption strategies are likely to be most successful when they are initiated at the highest levels of government and are supported at equivalent levels throughout society.

To provide the leadership that is necessary to promote effective national engagement, the Panel recommends that the Prime Minister should mandate the Minister of Industry with lead responsibility for developing and implementing a national ICT adoption strategy. This responsibility should be carried out in consultation and coordination with other ministers of the federal government, with provincial, territorial and municipal governments, and with high-level representatives of stakeholder groups.

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[27] Canada, Privy Council Office, *Securing an Open Society: Canada's National Security Policy* (Ottawa: PCO, April 2004), p. 26. Available online at: **http://www.pco-bcp.gc.ca/docs/Publications/NatSecurnat/natsecurnat_e.pdf**

Recommendation 7-2

The Prime Minister should mandate the Minister of Industry to develop and implement a national ICT adoption strategy in collaboration with key federal, provincial, territorial and municipal government colleagues as well as high-level representatives from the private, public and not-for-profit sectors, with the following objectives:

(a) strengthening ICT adoption by Canadian businesses, particularly small and medium-sized enterprises,

(b) strengthening the links between ICT sector research and development and ICT adoption,

(c) enhancing ICT adoption by governments,

(d) promoting development of ICT adoption skills on a coordinated national basis,

(e) improving security, confidence and trust in the online environment, and

(f) achieving ubiquitous access to broadband networks and services.

A National ICT Adoption Centre

In leading the development and implementation of a national ICT adoption strategy, the Minister of Industry will require support in the ongoing processes of issue identification, policy research and analysis, consultation, coordination, implementation and evaluation that are necessary for the success of any national strategy involving multiple stakeholders. The Panel therefore concludes that the Prime Minister should mandate the Minister of Industry to establish a National ICT Adoption Centre within Industry Canada.

Recommendation 7-3

The Prime Minister should mandate the Minister of Industry to establish a National ICT Adoption Centre within Industry Canada to

(a) benchmark Canada's performance in the adoption and effective use of ICTs,

(b) conduct policy research and analysis on issues related to ICT adoption in the private and public sectors, in order to inform discussions and support new initiatives related to ICT adoption,

(c) coordinate policies, programs and other measures aimed at promoting the smart adoption of ICTs within the federal government with the provinces to avoid overlap and duplication of effort,

(d) be a lead advocate for the effective use of ICTs, particularly among small and medium-sized enterprises, and

(e) manage the deployment of the U-CAN program (see Recommendation 8-4).

A National ICT Advisory Council

In the past decade, the federal government has made effective use of *ad hoc* advisory bodies composed of high-level representatives of governments, the private sector and other stakeholders to assist in the development and implementation of ICT policies and strategies on specific issues. This practice began in the 1990s with the Information Highway Advisory Council. More recently, it has been continued through the work of bodies such as the National Broadband Task Force, the Government On-Line Advisory Panel and the Task Force on Spam.

In 1996, the federal government also established an Advisory Council on Science and Technology to provide ongoing advice to the Prime Minister on the status and way forward for science, technology and innovation in Canada. In the course of its work, the Advisory Council on Science and Technology has addressed a number of the issues dealt with in this report, such as the relationship between innovation, technology and productivity as well as the adoption of advanced technologies and business practices.

After considering which of these models is best suited to supporting the development and implementation of a national ICT adoption strategy of the kind it is recommending, the Panel believes the most effective way for the Minister of Industry to obtain independent advice and secure the active engagement of stakeholders would be to establish and personally chair a high-level National ICT Advisory Council composed of leaders from the private, public and not-for-profit sectors.

Unlike previous ICT advisory bodies, which had specific missions and limited durations, the Panel believes the National ICT Advisory Council should be modeled on the Advisory Council on Science and Technology. It should be given the mandate to provide ongoing advice on a broad range of issues related to smart ICT adoption in Canada's economy and society, subject to periodic reviews of its effectiveness.

The council should be an independent source of advice and expertise to the Minister and should report annually on the implementation of the strategy. The members of the council should champion the development of the national ICT adoption strategy collectively and within their respective organizations.

Recommendation 7-4

The Minister of Industry should establish a high-level National ICT Advisory Council comprised of select federal, provincial and territorial ministers as well as leaders from the private sector, universities, research institutions, consumer groups and communities to provide ongoing advice on the development and implementation of the national ICT adoption strategy.

Components of a National ICT Strategy

In line with the general principles underlying its recommendations on telecommunications regulation in Chapters 2 to 6, on connectivity in Chapter 8, and on institutional reform in Chapter 9, the Panel believes the objectives of the national ICT adoption strategy should be achieved as much as possible through market forces. However, the Panel also believes government intervention is justified when economic or social objectives are unlikely to be achieved by market forces alone. Such intervention should be well targeted, proportionate to its purposes, effective in relation to cost, and technologically and competitively neutral.

Through its consultations and research, the Panel identified a number of areas where government action is required to help achieve the objectives of the national ICT adoption strategy. The Panel believes the general goal of such action should be to create an environment in which smart ICT adoption can flourish, either by removing impediments to smart ICT adoption in the private sector, or by promoting smart ICT adoption in the public sector. On the one hand, initiatives to encourage ICT adoption by Canadian businesses, strengthen computer security, and promote consumer trust and confidence in the online environment are examples of actions the Panel believes the federal government should take to remove impediments to ICT adoption and strengthen market forces. On the other hand, initiatives to enhance smart ICT adoption in government departments and agencies, focus federal government ICT R&D on adoption, and promote development of ICT adoption skills through education and training are examples of actions the Panel believes the federal government should take within its own area of responsibility and in cooperation with the provinces and territories.

In this section, the Panel proposes measures it believes the federal government should consider taking to help achieve the objectives of the national ICT adoption strategy. These proposals are based on advice the Panel received through consultations and its own research and analysis. With the exception of the ICT adoption tax credit proposed in the following subsection, the Panel did not have the time required to study these measures in the depth necessary to make recommendations, as has been done in other chapters of the report. However, the Panel believes these proposals should be given further study by the National ICT Adoption Centre. Following review by the National ICT Advisory Council, the centre should submit detailed proposals to the Minister of Industry with recommendations for appropriate action.

Measures to Strengthen ICT Adoption by Canadian Businesses

In light of the strong relationship it found between ICT adoption and increased productivity and in view of the current impediments to smart ICT adoption that were identified in submissions to the Panel and through its own research, the Panel believes the federal government should consider taking the following steps to encourage the smart adoption of ICTs by Canadian businesses.

An ICT Adoption Tax Credit

Canadian SMEs make a large contribution to the Canadian economy as measured by GDP, employment and exports[28]:

- The OECD has estimated that 43 percent of Canadian private sector GDP can be attributed to SMEs (here SMEs are defined as businesses with fewer than 500 employees).
- SMEs employ close to 6.7 million, or 65 percent, of all employees in the private sector. Fewer than 3000 businesses (0.3 percent of all employer businesses) have more than 500 employees.
- The proportion of small businesses that export is lower than the proportion of small businesses in the overall economy. Only 1.4 percent of small businesses export, while 27.0 percent of medium-sized and 37.7 percent of large businesses participate in exporting.

To continue making a substantial contribution to Canada's prosperity in a globally competitive economic environment, the Panel believes SMEs must overcome the impediments to ICT adoption that are identified in the preceding section of this chapter. In line with its general principles regarding the role of government when economic or social objectives are unlikely to be achieved by market forces alone, the Panel has come to the conclusion that well-targeted tax measures could incent SMEs to become smart adopters of ICTs.

The Panel notes that a number of arguments have been advanced in support of an adoption tax incentive for ICT investment and necessary complementary investments in training and business processing re-engineering. These include:

- externalities associated with ICT investment
- the fixed cost of innovation
- the higher marginal effective tax rate for ICT assets compared with non-ICT assets
- the identification of lagging ICT investment as a key contributor to the Canada–U.S. labour productivity gap.

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[28] The indicators of the contribution of small and medium-sized businesses to the Canadian economy are those reported in Industry Canada's report "Key Small Business Statistics July 2005," available online at: **http://strategis.ic.gc.ca/epic/internet/insbrp-rppe.nsf/en/rd00760e.html**. With respect to the contribution of SMEs to employment creation, the report states:

> Over the years, the relative contribution in terms of size varied greatly. During the period under review, each of the business size categories played the leading role at different times in net job creation in Canada. For six years, in 1996 and 1997 and from 2000 to 2003, small businesses made the greatest contribution to net job creation. On the other hand, at the beginning of this period, in 1994 and 1995, medium-sized businesses created the most jobs, and in 1998, 1999 and 2004, large businesses played the leading job creation role. Because both small and medium-sized businesses simultaneously shed jobs while large businesses created a large number of jobs, 2004 was an atypical year. The jobs created were concentrated in retail trade; administrative, waste management and remediation services; and accommodation and food services. A significant limitation of these data is that they are for a period when the economy was generally expanding, with only a mild downturn in 1995–96. In a more severe downturn or a recession, the percentage contributions to job creation (or loss) by smaller businesses may be quite different.

A network effect is a type of externality whereby the value of a good or service depends on the number of persons already owning that good or using that service. For example, as more and more persons are connected to the Internet, the value of the Internet to society increases as it becomes a more effective communications tool. There may still be undeveloped network effects in Canada related to ICTs. Since the societal benefits of these network externalities may exceed the private benefits, fiscal incentives for ICT investment could be justified as a way to ensure that the level of ICT investment is sufficient for network effects to be fully exploited.

If the price of ICT investment goods is greater than their marginal cost, firms may underinvest in them. A recent survey of the literature on investment concluded that because of the need to cover the fixed costs of innovating, the price of machinery and equipment, which included ICT assets, is indeed higher than the marginal cost, resulting in underinvestment in competitive markets.[29] Because innovative firms charge a price higher than the marginal cost for investment goods, the rates of innovating and diffusion may be low relative to a social optimum. Public policy measures that favour ICT adoption may thus be justified from the perspective of economic theory.

A high tax rate on ICT assets will discourage investment. The marginal effective tax rate (METR) on ICT assets in Canada in 2005 was 46.7 percent, well above the rate for machinery and equipment excluding ICTs, which was 32.0 percent.[30] This higher rate largely reflected the short-lived nature of ICT assets, as firms in a number of provinces (Ontario, British Columbia, Manitoba, Saskatchewan and Prince Edward Island) pay provincial sales tax each time an asset is purchased. Fiscal incentives that level the playing field between different asset types by reducing the METR on ICT assets would result in a more efficient allocation of resources and foster productivity growth.

It is widely recognized that the level of aggregate labour productivity in Canada is significantly below that in the United States. A recent study[31] estimates that the lower ICT capital stock in Canada accounted for 56 percent of the Canada–U.S. labour productivity gap in 2003, with lower spillovers from information technology penetration the most important component. This evidence suggests that, to reduce the Canada–U.S. labour productivity gap, Canada may need to increase the degree of information technology penetration to U.S. levels. Fiscal incentives on ICT investment could play an important role in this regard.

The Panel believes the important role played by SMEs in the Canadian economy, the magnitude of the ICT adoption challenge they face, the positive externalities associated with ICT network effects, and the need to level the playing field between ICT investments and investments in other types of assets justify the use of tax incentives to encourage SMEs to acquire advanced ICTs and make the complementary investments necessary for their effective adoption.

29 Aled ab Iorwerth, "Machines and the Economics of Growth," Finance Canada Working Paper 2005-05, March 2005.

30 Estimates prepared by Finance Canada.

31 Fuss and Waverman, "Canada's productivity dilemma."

The Panel notes that tax credits are widely used fiscal measures whose effectiveness is well recognized.[32] The federal government currently has a tax credit for R&D and for investment in Atlantic Canada. Manitoba and Saskatchewan have introduced tax credits to offset the provincial sales tax on machinery and equipment.

The Panel also believes the federal government should continue to ensure that Canada's taxation regime is internationally competitive. In this regard, it notes that ICT tax credits already exist in other countries, such as Japan, South Korea and Spain, as well as in a number of U.S. states, including California, North Carolina, Maine and New York.

There are a number of possible tax measures that could be introduced to incent investment in and effective use of ICTs by SMEs. The Panel considered a number of possible tax measures and concluded that an ICT adoption tax credit would be the most appropriate measure. The main reason for this choice is that, unlike the capital cost allowance, tax credits can be applied on an incremental basis; that is, to additional ICT investment beyond a baseline. This means that the tax incentive affects investment behaviour at the margin, and therefore does not needlessly subsidize ICT investment that would take place in its absence.

The Panel believes an ICT adoption tax credit should apply to both software and complementary expenditures related to effective ICT use, such as training and business process re-engineering, as well as to hardware. Since both these former types of expenditures are usually expensed, they are not affected by capital cost allowances. For this reason, a tax credit approach was chosen over an accelerated CCA approach.

Recommendation 7-5

The federal government should introduce an ICT adoption tax credit targeted at small and medium-sized enterprises and having the following features:

(a) it should apply to investments in ICT assets and to complementary expenses related to ICT adoption,

(b) it should define ICT assets broadly as including computers, communications equipment, software and computerized manufacturing equipment,

(c) complementary expenditures related to the effective adoption of ICTs such as costs related to ICT training, organization change and process re-engineering necessary for ICT adoption should be eligible for the tax credit,

(d) in order to increase its effectiveness and reduce the associated tax expenditures, the ICT adoption tax credit should apply only to incremental ICT adoption costs, and

(e) the credit should be fully refundable when no tax is payable.

[32] Jacek Warda, "Incentives for ICT Adoption: Canada and Major Competitors," Study prepared for the Information Technologies Association of Canada, July 2005.

Other Measures to Help Improve ICT Adoption by SMEs

Because many of the organizational impediments to ICT adoption by SMEs are within their control, the Panel believes it is largely the job of the private sector to remove these impediments. At the same time, the Panel believes government can potentially play a critical enabling role through targeted programming for SMEs in such areas as helping connect SMEs with firms and experts that can facilitate ICT adoption, helping develop mechanisms for dissemination of ICT adoption best practices, and helping measure, benchmark and report on national ICT adoption progress by SMEs.

If an ICT adoption tax credit is developed, helping connect SMEs with intermediary firms and experts in ICT adoption could help SMEs capture the full benefits of that measure.[33]

Governments can act to help overcome barriers to ICT adoption arising from weaknesses in both information generation and diffusion within commercial markets. Measures to address the inadequacies of the information that firms use in their ICT investment decisions would be consistent with the widely accepted role of government in addressing information failures. In fact, many foreign governments have initiated programs pertaining to the acquisition and dissemination of information in a variety of ICT adoption areas. To take one among many examples, the Netherlands plan, *Competing with ICT Competencies Action Plan*, sets out an extensive ICT information dissemination program for SMEs, summarized in Table 7-5.

Table 7-5. Netherlands' Government Action Line for Raising ICT Awareness among Small and Medium-sized Enterprises, 2004–2007

Objective	Target
Targeting the leading SMEs:	
60 seminars reach:	2500 companies
80 workshops reach:	1280 companies
400 individual consultations reach:	400 companies
Targeting the SMEs that follow technology:	
24 seminars reach:	480 companies
70 workshops reach:	700 companies
200 individual consultations reach:	200 companies

Source: Kingdom of the Netherlands, Ministries of Economic Affairs and Education, Culture and Science, *Competing with ICT Competencies Action Plan: Direction and Returns in the ICT Knowledge Chain* (The Hague: May 2004), p. 21. Available online at: **http://appz.ez.nl/publicaties/pdfs/040105.pdf**

[33] Pierre Hadaya, "Determinants of the future level of use of electronic marketplaces among Canadian firms," Proceedings of the 37th Hawaii International Conference on System Sciences, 2004. Hadaya underlined the importance of intermediary firms and experts in determining the future level of use of electronic marketplaces. Drawing on data collected from 1200 senior managers in Canadian firms, Hadaya found that intermediary firms and experts play a highly influential role in determining the future level of use of electronic marketplaces.

The Panel notes that Canadian federal government departments are already an important source of market-relevant information for SMEs, but there is no single point of focus and little coordination of effort with respect to improving the ICT adoption performance of SMEs through information dissemination. The Panel believes the National ICT Adoption Centre should develop proposals to remedy this situation.

Measures to Strengthen ICT R&D

Given the gaps in our current understanding of the relationship between ICT R&D and ICT adoption, the Panel believes the National ICT Adoption Centre should investigate these linkages and develop proposals for strengthening them, with particular emphasis on measures to improve the focus and coordination of federal government ICT R&D activities so that they contribute more effectively to smart adoption of ICTs throughout Canada's economy and society. In developing these proposals, the Panel suggests that the centre address the following issues.

Improving Coherence and Focus in Federal ICT R&D Programs

The Panel believes Canada should work toward greater coordination and alignment of federal government R&D programs, such as those described in the box below, as well as between government, industry and university ICT-related R&D efforts. In addition, Canada needs to greatly improve the quality and availability of data on the levels of federal government ICT R&D support for various technologies and industry sectors. Only on the basis of such data can decisions be made on what specific program, institutional or policy changes would improve the level and quality of Canadian ICT R&D.

The Panel believes the effectiveness of federal financial support for ICT sector and ICT adoption research could be improved through such actions as:

- collecting and evaluating data on federal direct and indirect financial support for R&D funding for the ICT sector, including that made through intramural research and federally funded foundations
- working with industry, educational and research institutes, along with strategic advice from the National ICT Advisory Council, to establish ICT-specific R&D benchmarks and objectives
- working with other federal government departments to align federal government financial support with identified gaps in ICT research effort and thereby help achieve the ICT R&D benchmarks and objectives.

Federal Government Institutions Supporting ICT R&D

The **National Research Council Canada** (NRC) is one of Canada's leading R&D organizations. It provides specific support for the Institute for Information Technology (NRC-IIT).

The **Natural Sciences and Engineering Research Council of Canada** (NSERC) supports both basic university research through grants and project research through partnerships among universities, governments and the private sector.

Precarn Incorporated is a national consortium of corporations, research institutes and government partners supporting and funding innovation in intelligent systems.

CANARIE Inc. is a not-for-profit corporation whose mission is to accelerate Canada's advanced Internet development and use by facilitating the widespread adoption of faster, more efficient networks and by enabling the next generation of advanced products, applications and services to run on them.

The **Communications Research Centre Canada** (CRC) is an agency of Industry Canada and is the government's primary laboratory for research and development (R&D) in advanced telecommunications, including satellite and terrestrial wireless communications, rural and remote broadband access and broadcast technologies.

Canada Foundation for Innovation (CFI) is a government corporation that funds research infrastructure to strengthen the capacity of research institutions in Canada. The CFI has established a National Platforms Fund to finance High Performance Computing Infrastructure, and through its various programs has supported research in the fields of information technology and telecommunications systems, among others.

Smart R&D Infrastructure

The emergence of the Internet as a primary driver of social and economic change has had a fundamental impact on ICT adoption by businesses, governments, communities and citizens. As discussed in Chapter 1, telecommunications networks over the past five years have evolved from primarily providing communications services (whether fixed or mobile, voice, text or multimedia) to providing a transactional infrastructure that supports access to a range of e-commerce, entertainment and knowledge-based content and services. At the same time, the adoption of ICTs by both business and individuals has entered a new phase in which the formerly separate infrastructures of the ICT environment (distinct hardware and software installations controlled by individual organizations or households) and the network (the technological means by which common carriers link organizations and individuals) are beginning to merge.[34]

[34] Google is an example of a web-based platform that provides applications, such as mail, calendaring and maps, that used to be desktop-based on individual PCs but are now network-based.

To provide Canadian citizens and businesses with a full range of innovative applications and services in this new, merging and emerging ICT environment, Canada's next-generation telecommunications networks must be fully interoperable. Moreover, they must support the requirements of increasingly interdependent applications and transactional processes. As businesses and other organizations are recognizing the productivity gains brought about by adopting ICTs and re-engineering their business structures, they are also recognizing a new need to coordinate their new networked information technology infrastructures and business processes across organizational boundaries.

Just as Canadian businesses will become increasingly reliant on an intelligent ICT infrastructure in order to function effectively within globally interoperable supply chains, so R&D in Canada is equally reliant on an intelligent, shared ICT infrastructure to support innovation across the full range of research domains. Commercialization of the results of research is also dependent on both researchers and businesses having access to an intelligent ICT infrastructure based on common standards and protocols that support web-based, service-oriented architectures.

In order for Canadian organizations to successfully make this transition, the Panel believes the federal government must help support and coordinate R&D efforts that will add to the development of a next-generation smart ICT infrastructure to support increasingly interdependent business processes and industry R&D.

Measures to Enhance ICT Adoption by Government

The Panel strongly supports the overall conclusion of the final report of the Government On-Line Advisory Panel that the federal government should demonstrate leadership in using ICTs.[35]

A number of submissions to the Panel suggested that the federal government should take a leadership role in the adoption of advanced ICTs. The attention of the Panel was drawn to many different models that are used internationally to improve technology uptake through government procurement. These approaches include aggregating demand, supporting early stage prototype development and testing, creating early market demand, and strengthening and developing linkages between key institutions for deploying and diffusing advanced ICTs.

In line with its general principle of relying on market forces to the maximum extent feasible, the Panel believes the federal government should ensure that its procurement policies strengthen the competitive position of Canadian companies at home and abroad, without sheltering them from foreign competition. The Panel also believes, while government procurement may in specific cases help improve Canadian ICT adoption performance, it is not the only policy instrument and may not always be the most effective one.

[35] Since the delivery of the GOL Advisory Panel's report, the operational management of the Government On-Line Initiative has been transferred to Public Works and Government Services Canada, while the responsibilities for the policy side of GOL remained with the Treasury Board of Canada Secretariat. According to the 2005 GOL Annual Report, this change recognized that investments in the electronic channel and online service delivery have evolved from "special project status" to normal business for the federal government.

The Panel believes the federal government should be a lead adopter of technologies that promise to bring broad economic and social benefits to Canadians, both directly by enabling the delivery of quality government services, and indirectly through widespread demonstration effects throughout the economy. One example of such a technology is Internet Protocol version 6, or IPv6.

Internet network addresses are used to help send information from one computer to another over the Internet by routing the information to its final destination. The protocol that enables the administration of these addresses is the Internet Protocol (IP). The most widely deployed version of IP is version 4 (IPv4). However, IPv4 has several limitations, which IPv6 has been designed to overcome. In addition to dramatically increasing IP address space, IPv6 provides greater flexibility and functionality, improved routing of data, enhanced mobility features, easier configuration capabilities, improved quality of service and greater security.[36]

The Panel notes that other governments are moving to adopt IPv6:

- In 2003, the U.S. Administration established the development of secure and robust Internet mechanisms as important goals because of the nation's growing dependence on cyberspace, and identified migration to IPv6 as a key contributor to the achievement of these goals. In June 2005, the U.S. Administration set June 2008 as the date by which U.S. government networks must be using IPv6.
- In 2001, the government of Japan set a national goal of realizing an Internet environment equipped with IPv6. It continues to vigorously pursue this goal and is currently engaged in model verification experiments, including verification of effectiveness of IPv6 in various application environments and reliability of the IPv4–IPv6 transition models.
- The European Union has established a task force with a mandate to initiate country/regional IPv6 task forces across Europe and to seek cooperation around the world. The EU task force and the Japanese IPv6 Promotion Council have forged an alliance to foster worldwide deployment of IPv6.[37]

The Panel believes IPv6 is an excellent example of the type of technological advancement that the federal government should take the lead in adopting.

Measures to Promote ICT Adoption Skills

The Panel believes the Minister of Industry should seek the advice of the National ICT Advisory Council on how the federal government should facilitate and promote ICT adoption skills in the private and public sectors and throughout Canadian society on a coordinated national basis, in partnership with the provinces and other stakeholders.

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36 U.S. Government Accountability Office, *Internet Protocol Version 6: Federal Agencies Need to Plan for Transition and Manage Security Risks*, GAO-05-845T (Washington, DC: GAO, June 29, 2005). Available online at: **http://www.gao.gov/new.items/d05845t.pdf**

37 *Ibid.*

The following sections set out some of the issues that the Advisory Council and the Minister may wish to consider in relation to these objectives.

ICT Adoption for Improved Community Development

Physical access to ICTs at the community level, together with improved broadband network connectivity, is a prime means for spreading the social and economic benefits of information technology. A new generation of ICT applications allows communities to adapt ICTs to their own situations, develop local content, and access and use content created by others. However, none of this will happen in the absence of e-literacy and technology skills at the community level.

The Panel believes a vibrant ICT private sector not only is important for creating opportunities throughout the economy, but also is an engine for building e-literacy and ICT technology skills at the community level. In addition, the Canadian Research Alliance for Community Innovation and Networking noted in its submission to the Panel that community networks and other community-based organizations provide both technological and social infrastructures for ICT access, adoption and use. Community networks also act as important sources of local economic development and innovation. Through training programs, for example, they help ensure that all Canadians, particularly those most at risk of being left behind, have the necessary skills to participate in the networked economy.

ICT Adoption for Improved Delivery of Public Services

During 2002, the Commission on the Future of Health Care in Canada (the Romanow Commission) and the Final Report of the Senate Standing Committee on Social Affairs, Science and Technology (the Kirby Report) both recommended increased government spending on ICT adoption in the health sector.[38] The federal government has provided significant funding for the development of health care information systems designed to improve patient care and health care delivery in all regions of the country. In the field of education, Canada was the first country in the world to connect all of its public schools and libraries to the Internet. Online learning has also been a focus of attention for the provincial and territorial governments' Council of Ministers of Education.[39] The challenge raised in many submissions to the Panel is how Canada can improve and accelerate progress in e-learning, e-health, and other areas of broad social interest and importance.

As with business, the challenge facing the providers of health care, education and other public services is the re-engineering of existing service models in light of the possibilities that are opened up by ICTs and the Internet, and also the redesign of their delivery systems and organizational structures to fit these new service models to capture the economic and social benefits.[40]

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[38] See Commission on the Future of Health Care in Canada, *Building on Values: The Future of Health Care in Canada,* Final Report (Ottawa: November 2002). Available online at: **http://www.hc-sc.gc.ca/english/care/romanow/index1.html**. See also Canada, Senate, Standing Committee on Social Affairs, Science and Technology, *The Health of Canadians — The Federal Role*, Final Report (Ottawa: October 2002). Available online at: **http://www.parl.gc.ca/37/2/parlbus/commbus/senate/com-e/SOCI-E/rep-e/repoct02vol6-e.htm**

[39] See Council of Ministers of Education, *Communiqué*, October 6, 2005. Available online at: **http://www.cmec.ca/releases/press.en.stm?id=37**

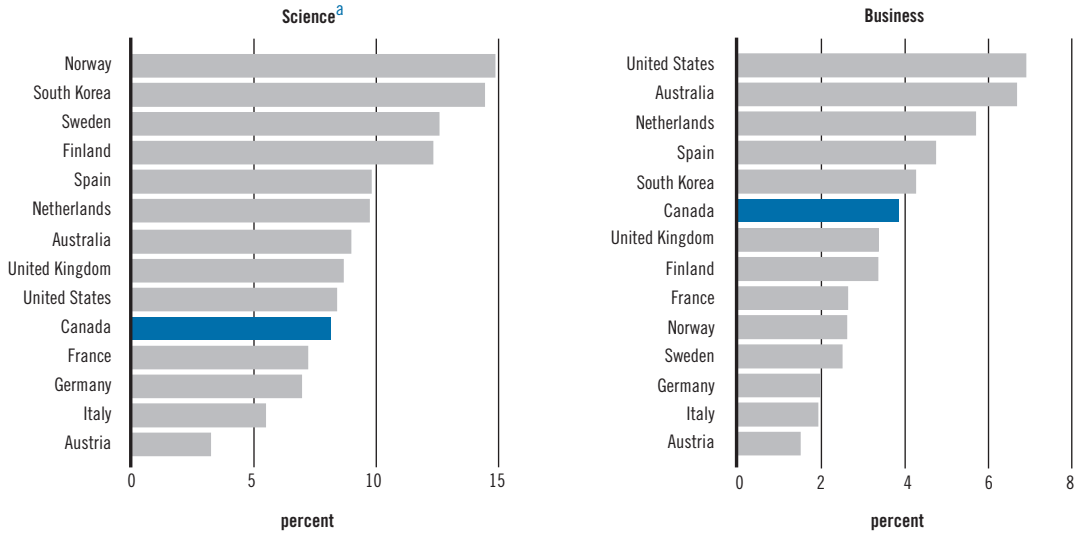
[40] "The Challenge of Change: Building the 21st Century Economy," Conference Background Paper for e-Commerce to e-Economy: Strategies for the 21st Century, September 27–28, 2004, Ottawa. Available online at: **http://www.e-economy.ca/epic/internet/inec2ee-ceace.nsf/en/home**

E-literacy, Skills and Learning

A high-quality post-secondary education system is essential to provide the skills and abilities required in an increasingly ICT-driven marketplace. Canadians are well educated by international standards: 51 percent of Canadians aged 25–34 have some post-secondary education, the highest level in the OECD. Canada is well ahead of the U.S. with respect to college-level attainment but not as successful with respect to university attainment.

When comparing the proportion of youth with a university degree in science, Canada lags slightly behind the U.S., which ranks in the middle of OECD countries (Figure 7-10). However, when comparing the proportion of youth with a university degree in business, Canada lags far behind the U.S., which leads the OECD rankings. In addition, a number of submissions noted that there is a low and declining rate of enrolment in computer studies and engineering programs at Canadian colleges and universities (Figure 7-10).

Figure 7-10. Percentage of 25–34-year-olds with a University Degree, Selected Countries, 2003 (%)



[a] Science includes life sciences, physical sciences, mathematics and statistics, computing, engineering, agriculture and health.

Source: Organisation for Economic Co-operation and Development, *Education at a Glance: OECD Indicators — 2004 Edition* (Paris: OECD, Centre for Educational Research and Innovation, 2004).

The Panel believes people with strong science and business backgrounds are often the key link between ICT research and its adoption in the marketplace. More generally, a well-educated workforce with a well-balanced skill set is critical for integrating enabling technologies with business strategy, organization and operations. The Canadian Software Human Resource Council has underlined this challenge area in its call to Canada to build an information technology-capable workforce.[41]

In Canada, the U.S. and other foreign jurisdictions, increasing attention is being paid to ensuring that curriculum development across diverse disciplines integrates and applies ICT skills and knowledge.[42]

Lifelong Learning

Technological innovation in the workplace, including the adoption of new technologies and work processes, is creating new demands in the workforce for current members who lack a strong educational base and regular skills training. Canada does not compare well when it comes to firm investment in workplace training by individuals. For example, 31 percent of Canadian workers participated in employer-sponsored training, compared with 35 percent for the U.S. and 45 percent for the United Kingdom.[43] Employees in small and medium-sized enterprises are only half as likely to receive formal training as those in large enterprises.

The Panel believes the federal government should continue to work with other levels of government in Canada and the private sector to encourage a culture of lifelong learning and help employers enhance ICT related workplace skills.

Measures to Promote Security, Confidence and Trust in an Online Environment

Notwithstanding the steps that have already been taken in Canada and internationally to promote security, confidence and trust in the online environment, the Panel heard from many stakeholders that there is much room for further work in such areas as privacy and protection of personal information with respect to transborder data flows, computer security, and consumer policy and regulation.

The following sections set out some of the issues that the Minister and the Advisory Council may wish to consider in developing measures to improve security, confidence and trust in the online environment.

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41 Canadian Software Human Resource Council June 2005. Available online at: **http://www.shrc.ca/site_map.html**

42 See, for example, the curriculum development work of the Association for Information Systems (AIS) undertaken with the participation of many academic institutions from around the world, including from several Canadian universities. One focus of this work has been to design model curricula based on a strong, increasing demand for university-trained graduates who can meet the changing needs of the information economy. The AIS model curricula are available online at: **http://www.aisnet.org/Curriculum/**

43 OECD, *OECD Employment Outlook: 2003 — Towards More and Better Jobs*, p. 242, Table 5.1. Available online at: **http://www.oecd.org/dataoecd/62/57/31775229.pdf**

The Protection of Privacy and Personal Information in International e-Commerce

The Public Interest Advocacy Centre, the Canadian Internet Policy and Public Interest Clinic, the Consumers Association of Canada, and the National Anti-Poverty Organization wrote in their joint submission to the Panel[44]:

> Another key area of policy development is protecting the privacy of Canadians. To date Canadians' privacy has been fairly well protected while using traditional telecommunications. This confidence is under stress. To reassure Canadians, who manifestly want more privacy protection in regard to telecom, the Panel should make privacy policy development a priority.

The Panel agrees that privacy policy development should be made a priority. The forthcoming parliamentary review of PIPEDA would be an appropriate opportunity for the full consideration of privacy issues within the context of rapidly changing technologies and increasingly networked domestic and international economies.

Without prejudging the scope or outcome of the parliamentary review of PIPEDA, the Panel believes one issue that deserves attention is the relationship between policies aimed at protecting privacy and personal information, on the one hand, and policies aimed at promoting the efficiency of e-commerce markets and ICT-enabled business operations, on the other, by facilitating the free flow of data across borders. The Panel believes there is a pressing need for information and analysis on this subject from a Canadian perspective, which should be made available in time for the parliamentary review of PIPEDA.

PIPEDA provides some protection for personal information on Canadians that is transferred to foreign jurisdictions. However, PIPEDA is primarily an instrument of domestic regulation. It is not designed to influence other governments' policies with respect to privacy and the protection of personal information, including information on Canadians that may be held within their borders as a result of e-commerce transactions.

To ensure that Canadians' rights are protected at home and abroad, the Panel believes the federal government should continue to work with other countries to develop international mechanisms for enforcement and regulatory cooperation in the area of privacy and protection of personal information.

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44 Public Interest Advocacy Centre, Canadian Internet Policy and Public Interest Clinic, Consumers Association of Canada, and National Anti-Poverty Organization, "Comments of the consumer groups to the Telecom Policy Review Panel," Ottawa: August 15, 2005. Available online at: **http://www.telecomreview.ca/epic/internet/intprp-gecrt.nsf/vwapj/Consumer_Groups-Submission.pdf/$FILE/Consumer_Groups-Submission.pdf**

Computer Security

Existing and emerging computer security threats are significant and show no sign of diminishing. The Panel has been informed that Industry Canada is developing proposals for countering these threats by implementing the recommendations of the Task Force on Spam, establishing the National Cyber Security Task force, and working in close cooperation with other countries. The Panel is highly supportive of this work and believes Canada must respond as quickly and effectively as possible to existing and emerging computer security threats. It also believes the private sector should play a larger role in achieving this objective.

Consumer Policy and Regulation

The Panel notes that considerable work has been done in recent years to create an environment in which consumers can be confident that businesses they deal with online are reliable and will not misuse their personal information, and that their transactions are secure. The Panel also notes that business-to-consumer (B2C) issues are a subset of a much broader range of ICT-related consumer issues. As described in a comprehensive 2004 report on consumer trends from Industry Canada's Office of Consumer Affairs[45]:

> Technological change — by its pace and scope — is transforming the marketplace. Technology has increased consumer choice, both in the form of entirely new products and services and in terms of a more diverse price/quality mix. But the challenge of keeping up with new technological applications and product information is affecting consumers' ability to navigate the marketplace. Rapid product turnover raises consumer issues such as the trouble and expense of upgrades, the risks borne by early adopters, and the potential for confusion — and costs — related to competing standards.

Federal, provincial and territorial governments share responsibility for the protection of consumers in Canada. The federal government is responsible for national marketplace standards and for ensuring a fair, efficient and competitive marketplace for producers, traders and consumers.

Through a variety of different initiatives, all levels of government have encouraged the private sector to develop market-based approaches to building consumer trust and knowledge, such as voluntary codes and standards, and redress approaches. However, to date, these initiatives have been largely *ad hoc* and there have been few rigorous studies evaluating their effectiveness. Moreover, the proliferation of voluntary codes — sometimes covering the same product areas — suggests a need to consider more formal approaches to recognizing and endorsing codes to ensure they have greater credibility with consumers.

The Panel is concerned that, across federal, provincial and territorial levels of government in Canada, consumer protection legislation has generally not kept pace with ICT-driven marketplace changes. The Panel also notes that there is no national consumer education and awareness program to enable consumers to navigate and safely operate within a marketplace that is increasingly information intense and vastly more complex than it was, even 10 years ago.

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[45] Industry Canada, Office of Consumer Affairs, *The Consumer Trends Report* (Ottawa: Industry Canada, 2004). Available online at: **http://strategis.ic.gc.ca/epic/internet/inoca-bc.nsf/en/ca02084e.html**

Other Components

As mentioned previously, the Panel presents recommendations regarding the sixth key component of the national ICT adoption strategy — measures to achieve ubiquitous access to advanced broadband networks and services — in the next chapter.

In addition to the six strategic components proposed by the Panel on the basis of submissions it received and the research it conducted, the Panel expects that the National ICT Adoption Centre and Advisory Council will identify additional components that should be included in the strategy. In particular, the Panel anticipates that new strategic challenges will arise and that new policy issues will emerge as the ICT adoption initiatives proposed here begin to be implemented, and as the new telecommunications regulatory framework recommended in this report begins to support the transformation not only of Canada's telecommunications and ICT networks, but also of the businesses, governments, public service organizations and communities that increasingly depend on them.

Implementing the strategy set out in this chapter is therefore only the beginning of a long-term commitment to becoming smart adopters of ICTs throughout Canada's economy and society, and to becoming world leaders in maximizing the benefits of ICTs in every area of life.