

CANADA

General policies

Economies everywhere are being shaped by two fundamental trends: rapid evolution towards a globally integrated economy based on market principles and a revolution in information and communications technology, that has put knowledge, information, and innovation at the cutting edge of economic progress and social development. In a knowledge-based economy/society, success depends less on a nation's natural endowment and more on its skills and innovative capabilities. The federal government has made a major commitment and investment in promoting innovation. The Prime Minister's Advisory Council on Science and Technology (ACST) provides expert, external advice to government on ways to better integrate innovation into all facets of the economy and on how science and technology could best contribute to the government's agenda of increased growth, improved productivity and jobs.

The "connectedness agenda" is a key priority for the Canadian government. The September 1997 Speech from the Throne set the goal of making Canada the most connected country in the world by making the information and knowledge infrastructure accessible to all Canadians by the year 2000. This commitment was renewed in the October 1999 Speech from the Throne. Work on this agenda includes six pillars, which are promoting and ensuring Canadians' access to a world-class information infrastructure; encouraging the development of smart communities; developing Canadian digital content; putting governments on line; branding a connected Canada to the world; and making Canada a world leader in electronic commerce.

Electronic commerce

The Final Report of the Information Highway Advisory Council (September 1997) recommended that "strengthening the emerging role of the Internet as a platform for electronic commerce should be the central economic strategy for promoting the knowledge-based economy". Subsequently, the Canadian government embarked on an ambitious programme to create a hospitable environment for electronic commerce in Canada and encourage Canadian businesses and organisations to move quickly to benefit from these new technologies and business models.

Canada set a goal of becoming a world leader in electronic commerce by the year 2000 and has implemented supporting strategies both domestically and internationally. Domestically, Canada released The Canadian Electronic Commerce Strategy in September 1998, presenting a broad ten-part agenda based on four themes: building trust in the digital market place, clarifying market rules, strengthening the information infrastructure and realising opportunities. Canada has the foundation for a world-class electronic commerce framework, with policies or legislation on key issues such as cryptography, consumer protection, tax neutrality, privacy, E-signatures, public key infrastructure and standards.

Canada has consistently emphasised the global dimension of electronic commerce, stressing the need for international co-operation to realise electronic commerce's full potential. The government has actively participated in international forums where electronic commerce issues are studied, discussed and negotiated. Canada was honoured to host the OECD Ministerial on Electronic Commerce in October 1998, an event that made real progress and generated significant momentum in the global effort to support electronic commerce. Canada will continue to work in venues such as the WTO, ITU, APEC, WIPO, WCO, UNCITRAL, ISO and the OECD.

The government's electronic commerce strategy emphasises the need for vision, speed and partnerships. The federal government has worked closely with provincial governments and municipalities to promote electronic commerce, and many of these jurisdictions are developing comprehensive electronic commerce strategies of their own. The government has continued to solicit the advice and views of the private sector, meeting with *ad hoc* advisory groups and most recently participating in the work of the Canadian E-business Opportunities Roundtable, a group of senior representatives from the business sector and academia.

Canada assigns high priority to encouraging electronic commerce. In the most recent Speech from the Throne (October 1999), the government confirmed its commitment to "accelerate the adoption of electronic commerce" ... and to "take steps to make Canada a centre of excellence for electronic commerce and encourage its use throughout the economy".

Year 2000

To provide leadership and advice on how to reduce Year 2000 computer risks, the government formed the Task Force Year 2000. Comprised of chief executive officers from major Canadian industrial sectors, its mandate was to assess the nature and scope of the challenge in Canada and the state of industry preparedness to deal with issues related to Y2K. The work of the Task Force has continued through its Secretariat within Industry Canada. Three national surveys have been conducted by Statistics Canada and an extensive national communications campaign has been conducted involving the distribution of over 20 million documents, national advertising, a 1-800 call centre, a Web site and hundreds of cross-Canada seminars and conferences.

Government demonstration and development projects

The 12 October 1999 Speech from the Throne underlined the government's commitment to making government a model user of new technologies to improve services to Canadians. "By 2004, our goal is to be known around the world as the government most connected to its citizens, with Canadians able to access all government information and services on-line at the time and place of their choosing."

Offering electronic ways of conducting business with the government will achieve three key objectives: improve service to Canadians (convenience, faster service, a citizen-centred orientation and greater cost-effectiveness), serve as a catalyst for electronic commerce and create a government for the twenty-first century.

Most governments in Canada have taken the first step of providing information on line, and many have launched basic interactive services such as subscriptions, messaging, feedback and responses to simple inquiries. Few governments, however, have launched fully integrated and interactive services that tailor content and functionality to client needs.

The federal government has started to lay the groundwork for electronic service delivery by initiating the integration of services horizontally across the federal government and vertically with other levels of government, by providing a common, reliable and secure information technology infrastructure in order to support service delivery goals, a single point of access and increasing network traffic and by removing the legal uncertainties surrounding the use of electronic commerce, through Bill C-6, the Protection of Personal Information and Electronic Documents Act, and a policy encouraging choice and innovation in cryptographic security products.

Standards

Standards play an increasingly important role in improving market operations and promoting growth and trade. Common technical and operational standards can reduce the cost and complexity of utilising information networks and thereby facilitate access to the knowledge-based economy for both businesses and consumers. The effectiveness of national standards efforts – at the firm level, in domestic standards bodies and within organisations at the international level – can make an important contribution to economic competitiveness and to the development and use of electronic commerce.

Several Canadian organisations play important roles in electronic commerce standards formulation and implementation.

- CSA International, formerly the Canadian Standards Association, is Canada's largest provider of integrated services for standards development, product certification and testing and management system registration.

- The Standards Council of Canada (SCC), a federal Crown Corporation, promotes efficient and effective standardisation and through its advisory committees contributes to standards work nationally and internationally. It is the national body representing international standards efforts in the International Organisation for Standardisation (ISO).
- The Telecommunications Standards Advisory Council of Canada (TSACC) is an industry-government partnership formed in May 1991 to develop strategic directions for standardisation in information technology and telecommunications. As such it plays a central role in the design and implementation of electronic commerce standards in Canada and internationally. TSACC Working Groups have prepared two documents dealing with this area: a "Canadian Standards Roadmap" for the telecommunications infrastructure and computer networks and the "Electronic Commerce Applications Roadmap" which addresses technology enablement of business functions and related software.
- The Electronic Commerce Council of Canada (ECCC) is a not-for-profit voluntary standards organisation that has taken a lead role in the introduction and promotion of electronic commerce standards on an industry sectoral level.

Federal R&D programmes

Most federally funded research and development (R&D) in information and communications technologies is performed through governmental research centres and partnerships with industry and universities.

Canadian Network for the Advancement of Research, Industry and Education (CANARIE)

CANARIE is a private-public sector partnership intended to accelerate Canada's advanced Internet development and use by facilitating the wide adoption of advanced networks and next generation applications and services.

In 1997, CANARIE created CA*net II, a national broadband network that gave the Canadian research community the ability to develop exciting next-generation applications suitable for broadband networks of the future and not possible on the public Internet.

CANARIE is now investing CAD 55 million to create CA*net3, the world's first national optical R&D Internet. Offering up to 40 gigabits/second data transmission rates, this network will provide unparalleled capability to conduct collaborative work in advanced networking applications research and ultra-high-speed information exchange. Network-related R&D on other access technology, namely wireless and optical and network management application tools, is also funded through CANARIE.

As part of the CAD 78 million Advanced Application Development Programme, CANARIE also stimulates the development and demonstration of national scale, sector-wide advanced applications, technologies and services. The key sectors of focus are electronic commerce, learning, telehealth and the emerging sector of intelligent systems.

CANARIE operates a CAD 8 million dollar shared-cost R&D funding programme, Advanced Network Applications, Services and Technologies (ANAST), to support application development in three streams: SchoolNet Caching, Advanced End-to-End Applications and Advanced Network Technology. The programme assists business, universities, schools and research institutions in developing innovative applications for high performance networks.

Another CANARIE initiative is the CAD 25 million Learning Programme which acts as a catalyst for Canada to become a world leader in the use of advanced, broadband networks in the development and delivery of education and training. The specific programme goals are to encourage innovative projects that will develop advanced applications and reduce structural barriers to the effective use of broadband networks in this sector.

National Research Council

The National Research Council (NRC), an agency of the Government of Canada, is Canada's premier R&D organisation. Two of NRC's 16 institutes, the Institute for Information Technology (IIT) and the Institute for Microstructural Sciences (IMS), are dedicated to R&D in the ICT domain. Much of the R&D in these two NRC institutes is performed in collaboration with Canadian companies and universities. By transferring leading-edge technologies to companies in the ICT sector, NRC helps to improve Canadian industrial competitiveness in a global economy.

The IIT performs R&D in the areas of software and systems with a focus on: the application of artificial intelligence and other advanced technologies to knowledge management, decision making in complex situations and communication in heterogeneous networked environments; software engineering; digital 3-D imaging and virtualised reality to model environments and enhance communications. The IIT also operates a co-ordinating office for C3.ca, a national high-performance computing programme that promotes and co-ordinates effective shared use of computing power located at universities and R&D sites distributed across Canada.

The IMS provides national leadership in the development of enabling and emerging technologies related to the future hardware component requirements in ICT: wireless communications (*e.g.* RF-MEMS, GaN and InP microelectronics); optical communications (*e.g.* DWDM R_x and T_x , Si-based photonics, thin film filters); multimedia (*e.g.* acoustics, projection display); exploratory (*e.g.* nanotechnology, molecular electronics).

As part of their role in assisting the innovation process in Canada, the two institutes jointly operate an Industry Partnership Facility which has been constructed to provide a nurturing environment for new start-ups in the ICT sector. In addition to having space in the facility to operate their businesses, these new companies have access to NRC's advanced research equipment and the opportunity to collaborate with NRC researchers.

NRC also operates an Industrial Research Assistance Programme (IRAP) which assists SMEs across Canada in R&D leading to new products and processes. Approximately 35% of IRAP's resources are in direct support of ICT-related R&D.

Communications Research Centre (CRC)

The Communication Research Centre (CRC) is the federal government's primary laboratory dedicated to advanced communications R&D. Its research programmes provide a technical basis for the development of regulations and standards in support of telecommunications and broadcasting public policy. Key research areas include radio sciences, terrestrial wireless, broadcast technologies, satellite communications systems, broadband network systems, and microelectronic and optical technologies. Demonstrations of new and emerging technologies and applications are an important aspect of CRC's work. CRC has a strong tradition of technology transfer to industry and has been responsible for the creation of more than 60 companies. It runs the CRC Innovation Centre to provide small high-technology companies with access to CRC's technologies, research expertise and unique laboratories.

Pre-Competitive Applied Research Network (PRECARN)

PRECARN is an industry-driven, not-for-profit consortium, national in scope, which sponsors, manages and disseminates the results of long-term, pre-competitive research projects in the area of intelligent systems and robotics. Over its ten years of existence, PRECARN has engaged over 1 200 individuals and 100 companies in a suite of major research projects at the leading edge of intelligent systems and robotics research. Innovations from these intelligent systems projects have generated substantial economic benefits. The intelligent systems sector in Canada is growing at a rate of 10% per year, with over 250 suppliers of products and services with revenues of over CAD 3.8 billion. 40% of the firms in the sector were founded since PRECARN's research programme began in 1990.

Technology Partnerships Canada (TPC)

In partnership with the private sector, TPC invests in high-risk, near-market development and demonstration projects across Canada. TPC invests an annual base budget of CAD 300 million in priority areas such as environmental technologies, biotechnologies, aerospace and defence, advanced manufacturing and leading-edge information and communications technologies.

Networks of Centres of Excellence (NCEs)

A major initiative of the federal government is the NCE Programme, which has operated successfully for ten years. NCEs are unique partnerships among industry, universities and government designed to connect excellent research with industrial know-how and practical investment. The NCE Programme was made permanent by the federal government in 1997, with an annual budget of CAD 47.4 million. On 16 February 1999, the government announced that the NCE Programme budget would be increased by CAD 90 million over the next three years, starting in 1999-2000. Five of the 15 NCEs are IT related. A short description of each follows.

The Institute for Robotics and Intelligent Systems (IRIS) is a federal NCE, founded and managed by PRECARN. Its research programme is carried out at 21 universities across Canada. IRIS brings together basic research results with industry applications in four key sectors of the Canadian economy: natural resources, health care, manufacturing and information technology.

The Canadian Institute for Telecommunications Research (CITR) is a non-profit research organisation which carries out market oriented pre-competitive research in photonic devices and systems, broadband wireless communications, ATM network resources management, broadband services, mobile and personal communications, and broadband satellite communications.

Micronet – Microelectronic Devices, Circuits and Systems – primarily focuses on pre-competitive research dealing with the development of microelectronic-enabling technologies for personal communications and information-based systems. The programme ties together research work in microelectronic devices, circuits and systems in a co-ordinated and vertically integrated manner.

The Canadian Institute for Photonics Innovations (CIPI) integrates a challenging and ambitious research programme in the following five areas: nanotechnology for photonics, engineering of photonic devices, photonics for information technology, ultrafast photonic technology and precision photonic measurements.

The Geomatics for Informed Decisions Network (GEOIDE) addresses four goals: *i*) to better exploit Canadian Geomatics infrastructures such as the new GPS infrastructure (Canadian Spatial Reference System) and Canadian Satellite technologies such as RADARSAT; *ii*) to develop tools and technologies for decision making and information dissemination; *iii*) to co-ordinate long-term fundamental research in multidisciplinary pan-Canadian teams; and *iv*) to broaden the range of applications served by Geomatics technologies.

Technology diffusion

Given the increasing importance of information and knowledge in the information age, governments are concerned that all Canadians have the opportunity to participate in the economic and social benefits. Yet there is evidence of a digital divide between the information "haves and have-nots". There is a strong and documented relationship between household income and educational level of the head of household and the use of the Internet. In 1998, higher income households were nearly five times more likely than lower income households to be regular users of computer communications. The penetration rate for households where the head has a university degree (68.1%) was more than five times the rate for households in which the head did not complete high school (12.6%). Another issue of concern to policy makers is that of barriers to access for those located in rural and remote areas.

Several government programmes help encourage the diffusion of computers and the Internet to public access sites such as schools, libraries and communities.

SchoolNet

Canada's SchoolNet is a collaborative initiative designed to promote the effective use of information technology in learning and foster the development of the skills Canadians need in order to compete in the knowledge-based economy. On 30 March 1999, through SchoolNet's collaboration with ministries of education, school boards, education associations, schools, teachers, students, parents and the private sector, Canada became the first country in the world to connect its schools and public libraries to the Internet.

SchoolNet continues to work with the provinces and the private sector to extend connectivity from schools to the classroom by 31 March 2001. This will result in 250 000 connected computers, an equivalent of one per classroom. SchoolNet's future direction is to provide classrooms with access to multimedia service capabilities. Through the SchoolNet Web site, educators and learners have access to more than 1 000 exciting, innovative, award-winning, Internet-based educational resources, services and learning tools from a single platform. By 2001, users will be able to access over 20 000 online learning projects.

The Computers for Schools (CFS) Programme

The programme aims to increase access to information technology for Canadian youth in a learning environment by collecting, refurbishing and delivering surplus computers, donated from both the public and private sectors, to schools and public libraries. CFS is directed nationally by Industry Canada and is delivered through a series of contribution agreements with provincially incorporated not-for-profit organisations.

CFS also provides Canadian youth with the opportunity to gain hands-on technical experience in refurbishing computer equipment. CFS has delivered more than 160 000 refurbished computers to schools and libraries across Canada. The programme is on target to meet the goal of providing 250 000 computers by 31 March 2001.

Smart Communities

The Smart Communities initiative is partnering with communities and local industry to support pilot projects that use ICTs to link people and organisations together, stimulate productivity and innovation, foster demand for high technology goods and services and address local economic and social needs. A series of Smart Communities demonstration projects will be launched across Canada and on-line learning tools developed to support new Smart Communities. Over the next three years, a competitive process will select pilot communities with the interest and capacity to become "smart" by developing ICT-based applications and services to support economic development and to enrich community life. The lessons learned in the course of these demonstration projects will advance the use of ICTs at the community level across Canada.

VolNet

The Voluntary Sector Network Support Programme (VolNet) is a new federal government programme to improve the voluntary sector's access to information technology and to the related skills and tools that would help it play a stronger role in Canadian society. The Programme's goal is to offer Internet connectivity, including computer equipment, new information technologies, network support and Internet skills development to 10 000 voluntary organisations by 31 March 2001.

Community Access Programme

The Community Access Programme (CAP) is a federal government initiative administered by Industry Canada. The overall objective is to provide Canadians with affordable, convenient public access to the Internet, at the community level. In collaboration with provincial, territorial and municipal governments,

the private sector and not-for-profit organisations, CAP has established over 4 200 public access sites in rural and remote communities across Canada. CAP's goal is to establish up to 10 000 public access sites in rural and remote and urban communities across Canada by 31 March 2001.

Human resources

Access to a skilled workforce is one of the most critical issues in the knowledge-based economy and in the ICT sector. The Speech from the Throne (October 1999) indicated that over the next two years, the government will work with its partners to enable skills development to keep pace with the evolving economy. The work will be led by the sectoral councils, which bring together representatives from business, labour, education and other professional groups to address human resource issues in important areas of the Canadian economy.

The ICT-relevant sectoral council is the Software Human Resource Council (SHRC). Its aim is to maximise the supply and quality of new entrants in the industry, track trends in software human resources, integrate the education and training continuum, promote national standards and certification, encourage young Canadians to consider the world of software careers as a future option and promote life-long learning. Existing initiatives to maximise the supply of quality new workers in the ICT sector include the National IT Youth Internship programme, the IT Professional programme, and the Software Development Worker Pilot project.

The NRC has also developed internship programmes. The Science and Technology Internship programme gives technology-based SMEs the opportunity to hire a recent graduate for six months and use their skills to develop company's technology (up to 45 internships are available each year). A similar programme, the Science Collaborative Research Internships, is also available for SMEs involved in collaborative research with the NRC and CRC (up to 490 internships available each year). Both programmes are offered through NRC's Industrial Research Assistance Programme (IRAP) and will run up to March 2001.

Another key initiative is the creation in September 1998 by the Prime Minister's Advisory Council on Science and Technology of an Expert Panel on Skills to advise on the critical skills needed in a number of sectors, including ICT.

URLs

Advisory Council on Science and Technology: <http://acst-ccst.gc.ca>.

Canadian Institute for Photonics Innovations (CIPI): <http://www.cipi.ulaval.ca/>.

Canadian Institute for Telecommunications Research (CITR)

Canadian Network for the Advancement of Research, Industry and Education (CANARIE): <http://www.canarie.ca>.

Communications Research Centre (CRC): <http://www.crc.ca>.

Community Access Programme: <http://cap.ic.gc.ca>

Computers for Schools: <http://www.schoolnet.ca/cfs-ope>.

Cryptography Policy Framework Discussion Paper and Consultation: <http://strategis.ic.gc.ca/crypto>

Electronic Commerce: <http://strategis.ic.gc.ca/SSG/mi05426e.html>.

Electronic Commerce Canada: <http://www.ecc.ca>.

Geomatics for Informed Decisions Network (GEOIDE): <http://www.geoide.ulaval.ca>.

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Statistics Canada, "Getting connected or staying unplugged: The growing use of computer communications services", feature article in *Services Indicators*, 1st Quarter 1999.