

Invest in Canada

2012

Wireless

Communications

Canada's competitive advantages

Foreign Direct Investment in Canada's wireless communications sector

- Foreign direct investment (FDI) in Canada's information and communication technologies (ICT) industry reached an accumulated \$19.94 billion in 2011. (Source: Foreign Affairs and International Trade Canada, Trade and Economic Statistics (2012))
- Approximately 70 foreign companies established greenfield FDI projects in the communications sector in Canada between 2003 and 2011, with over 20 foreign companies establishing greenfield FDI projects in wireless technology subsectors. (Source: fDi Markets database, fDi Intelligence, Financial Times Ltd (2012))

RECENT INVESTMENT EXAMPLES

Alcatel-Lucent

In 2011, Alcatel-Lucent announced the addition of 200 employees to its 3,000 strong Kanata research and development (R & D) campus. More than half of Alcatel-Lucent's global research related to Internet protocol (IP) is done in Kanata. The R & D centre specializes in optical, Wideband-CDMA wireless, security and network access technologies. Alcatel-Lucent Canada is at the forefront of mobile broadband with its Long Term Evolution (LTE) Connected Car concept.

Ciena

In 2011, Ciena announced a \$900 million investment over five years. Ciena will expand its R & D operations in Ontario, increasing staff by 353 for a total of 1,320 positions. Ciena chose Ottawa as its focal point for global R & D efforts in combined optical and ethernet technologies.

Cisco

Cisco announced, in 2011, an investment of \$401 million over 5 years in its R & D facilities, creating 300 jobs in Ontario. Cisco's current R & D focus is on next-generation routers. In 2012, Cisco launched BizCloud in Canada, accelerating the adoption of a private cloud by businesses and government agencies.

Tech Mahindra

In 2011, Tech Mahindra opened an Innovation Centre for Mobility Solutions in Toronto. The Innovation Centre will initially provide device certification services.

Avaya

In 2010, Avaya announced a \$165 million investment project, focusing on next generation unified communications and collaboration technologies. Since acquiring Nortel Enterprise Solutions in 2009, Avaya has increased its R & D spending in Canada by 25%.

Unless otherwise noted, all values in this publication are in Canadian dollars.

FOREIGN INVESTORS IN CANADA

Akamai Technologies
Alcatel-Lucent
Alpine Access

Amdocs
Avaya
Belden
Cavium
Ciena
Cisco
Deutsche Telekom
Ericsson
France Telecom
Hexagon
HP
Huawei
IBM
JDS Uniphase
LSI
Microsemi
Nokia
Nokia Siemens Networks (NSN)
Novatel Wireless
NVIDIA
On4 Communications
Semtech
Siemens
SiGe Semiconductor
SAP
Tech Mahindra
Teledyne DALSA
Tellabs
ZTE

Wireless innovation in Canada

INNOVATION SNAPSHOT

- Between 2003 and 2011, 6,589 wireless technology related patents were granted by the United States Patent and Trademark Office to investors based in Canada. (Source: fDi Benchmark estimates based on United States Patent and Trademark Office (2012))
- Preliminary gross domestic expenditure on R & D in Canada in 2011 was an estimated \$30 billion, one of the highest levels in the world.
- Industry support is provided through the Communications Research Centre Canada (CRC), as well as programs offered under the Centres of Excellence for Commercialization and Research (CECR), and the National Research Council (NRC). (Source: Statistics Canada, Research and Development Expenditure (2012))

Case Study: QNX Software Systems - Research in Motion

QNX (RIM) won Best of CES 2012 Award, in the Car Tech category. The QNX concept car, based on a Porsche Carrera, is equipped with an array of advanced features, including one-touch Bluetooth smartphone pairing based on Near Field Communications (NFC); ultra HD voice technology; front-seat media control of rear-seat tablets; and a dynamically reconfigurable digital instrument cluster.

Case Study: Ericsson

Ericsson, one of Canada's largest R & D investors, employs more than 3,000 in Montréal and Kanata. The Montréal facility is Ericsson's largest R & D centre outside of Sweden. Research at that location is primarily focused on multimedia software and solutions. The Kanata facility is focused on R & D relating to LTE. Ericsson is currently working with Rogers to deploy an all 4G/LTE network across Canada.

Case Study: Sierra Wireless

Sierra Wireless won a 2011 GSMA Global Mobile Award for Best Mobile Innovation for Utilities. The award recognized EDMI's EWM100 modem for smart metering applications, which uses Sierra Wireless AirPrime wireless modules to provide robust cellular communications. More recently, Sierra Wireless launched the industry's smallest cellular solution for machine-to-machine (M2M) communications.

Case Study: Mitel Networks

Mitel won a Unified Communications 2011 Product of the Year Award from INTERNET TELEPHONY magazine. Mitel won for its Unified Communicator Advanced (UCA) Mobile system, which allows users to have a seamless in-office experience, anywhere using any device, while enabling IT departments to better cope with security and control issues.

Case Study: Rogers Wireless Innovation Centre

Rogers Communications and Wavefront launched the Rogers Wireless Innovation Centre, in Vancouver, to help technology innovators develop and commercialize products. It will showcase the capabilities of Canada's first LTE network along with the latest wireless innovations and technologies, including M2M solutions.

LEADING CANADIAN COMPANIES

Aastra Telecom
Accedian Networks
BelAir (Ericsson)
Bell Mobility
BLiNQ
Bluecat Networks
Bridgewater
BTI Systems
DragonWave
EION Wireless
EXFO
GLENTEL
Hemisphere GPS
iBWave
International Road Dynamics (IRD)
KORE Wireless
Layer7 Technologies
Miranda Technologies (Belden)
Mitel Networks
NovAtel (Hexagon)
Polar Mobile
Poynt
QNX Software Systems (RIM)
QuickPlay Media
Redknee
Redline Communications
Research in Motion
Rogers Wireless
Sandvine (Siemens)
Sierra Wireless
Star Solutions
Telus Mobility
Tranzeo
Vecima Networks
WiLAN
Wmode

Canada's wireless communications industry

Canada is strongly positioned to meet growing international demand for wireless technologies.

ICT is one of the four priorities of the Canadian government's science and technology strategy and there is a national digital economy strategy supporting this initiative. (Source: Industry Canada, "Government of Canada Launches National Consultations on a Digital Economy Strategy" (2010)) This strategy aims to help the ICT sector create new products and services, accelerate the adoption of digital technologies, and improve cyber-security practices.

Canada has a proud history of leadership in wireless communications;

- In 1901, Marconi received the first transatlantic wireless message at Signal Hill overlooking St. John's, Newfoundland and Labrador.
- Canada was the first country in the world to establish its own domestic geostationary communication satellite network.
- Pioneering work in remote, wireless patient monitoring has been conducted in Canada.

This success continues as Canada is now home to a quarter of North America's fastest growing wireless companies. (Source: Deloitte, Technology Fast 50 Programme (2011))

The wireless communications services industry in Canada generated \$16.9 billion in revenues in 2009. (Source: Ovum Consulting, The Benefit of the Wireless Telecommunications Industry to the Canadian Economy (2011)) The Canadian telecom services market is expected to generate revenue of \$43.5 billion in 2012, with wireless data becoming the fastest growing segment. (Source: Electronics Industry Market Research and Knowledge Network, Canadian Telecom Service 2011-2016 (2012)) Canada's strengths in Next Generation Networks (NGN), M2M, and cloud computing applications are encouraging many international companies to invest in Canada.

Recent policy measures removed foreign investment restrictions for telecommunications operators with less than a 10% share of the Canadian market. This, combined with caps applied to the next spectrum auction, scheduled for 2013, will enable new entrants to compete to bring the latest 4G LTE mobile networks to Canadians. (Source: Industry Canada, Harper Government Takes Action to Support Canadian Families (2012))

Testimonial

"We look forward to remaining in the Ottawa area, one of North America's leading R & D hubs."

Mark Henderson, Chief Executive Officer, Ericsson

"[Canada] is quite good for a business environment, compared to the United States. It is a very flexible culture and at the same time there is very good talent in human resources."

Sean Yang, President, Huawei Technologies

CANADA'S KEY STRENGTHS IN WIRELESS COMMUNICATIONS

More than 300 wireless and telecommunications companies in Canada spend over \$6.2 billion annually on R & D. (Source: To access Canadian ICT R & D expenditures, visit Industry Canada, ICT Sector Intramural R–D Expenditures) Canada's deep expertise in wireless covers many areas:

Next Generation Networks (NGN)

- **Transmission technologies:** BLiNQ, Alcatel-Lucent, and Ericsson focus their R & D efforts on LTE solutions.
- **Backhaul communications:** DragonWave, EION and Rugged Communications provide world class services. BelAir Networks (Ericsson) developed the first switched mesh technology.
- **Infrastructure testing:** Dyaptive (JDSU) is a world leader in wireless test beds. Its software defined radio (SDR) solution allows carriers to simulate thousands of simultaneous connections.
- **Microelectronics and Photonics:** Teledyne DALSA developed the imaging sensors used by NASA's Mars rovers.

Machine-to-Machine (M2M)

Canada boasts key industry leaders including Sierra Wireless, one of the top three global manufacturers of M2M cellular embedded modules; QNX (RIM), with its leading embedded operating system; and Kore Wireless's platform layer for M2M operations. Notable Canadian M2M strengths include:

- **Intelligent transportation systems (ITS) and connected vehicles:** QNX, Intelligent Mechatronic Systems (IMS) and Intrinsic Software are driving innovation.
- **Fleet and asset tracking:** From large to small: International Road Dynamics (IRD) weighs transport trucks using advanced weigh-in-motion technology; Sendum is a leading developer and manufacturer of miniature location devices.
- **Billing mobile payments:** MasterCard identified Canada as second worldwide for readiness to adopt mobile-payments. RedKnee, Telepin, Payfirma and hyperWALLET are at the forefront of the industry.
- **Video:** Companies such as Cognivue, Dejero and March Networks are industry leaders in intelligent imaging, video transmission, and video surveillance.

Cloud Computing

- **Analytics and mobile computing:** IBM launched a \$42 million IBM Compute Cloud Centre in Toronto in 2011, one of the most advanced computing facilities in the world.
- **Enterprise cloud services:** Huawei, TELUS and Carleton University signed a \$1.4 million deal in 2011, establishing a research laboratory dedicated to enterprise cloud services. Huawei eventually plans to employ more than 500 people at the R & D centre, which it expects to be one of the fastest growing in its global structure.

SKILLS AND RESEARCH

ICT accounts for one third of all Canadian private sector R & D. (Source: Industry Canada, Canadian ICT Sector Profile, (2011)) The Government of Canada encourages R & D through generous Scientific Research and Experimental Development tax incentive programs. Five, of the 10 Canadian companies that spend more than \$200 million on R & D, are operational in the wireless sector. (Source: Research Infosource, Canada's Top 100 Corporate R & D Spenders (2011)) In 2011/12, Research In Motion remained Canada's top corporate R & D spender, devoting nearly \$1.6 billion to research. (Source: Research In Motion, Fiscal Year 2011/2012 Annual Financial Report, (2012)) This research has focused on new product development such as the BB10.

Canada's ICT workforce is highly educated; 84% of all workers have university or college training and 71% hold a post-secondary graduate degree. (Source: Information and Communications Technology Council, Analysis of the labour force survey data for the information technology occupations, 2000-2010 (2011)) In 2011, Canada's ICT sector employed an estimated 556,000 people. (Source: To access Canadian ICT job statistics, visit Industry Canada, Canadian ICT Sector Profile)

Canada has a world-class higher education system with 22 Canadian universities appearing in the Top 500 Academic Ranking of World Universities 2011, and six universities appearing in the Top 100 Academic Ranking of World Universities in Computer Science. (Source: Shanghai Jiao Tong University, Academic Ranking of World Universities (2011)) In 2010, a total of 1.2 million students were enrolled in Canadian universities in degree-related programs. Canadian universities conduct \$10 billion of research annually. (Source: Association of Universities and Colleges of Canada (2010)) Wireless technology research centres in Canada include:

- 4D labs (Simon Fraser University)
- Wireless Networking Research Laboratory (University of Calgary)
- National Institute for Nanotechnology (University of Alberta)
- Emerging Communications Technology Institute (University of Toronto)
- Institute for Knowledge Innovation and Technology (University of Toronto)
- Photonics Research Laboratories (McMaster University)
- Centre for Research in Photonics (University of Ottawa)
- Telecommunications & Signal Processing Laboratory (McGill University)
- Microelectronics Research Chair (Université de Sherbrooke)

Testimonial

“Ontario's workforce is highly skilled, with a great education base, both at university and preparation for university. Ontario has long been globally recognized as a centre of excellence for IT innovation.”

John Chambers, Chief Executive Officer, Cisco Systems

Wireless communications clusters

British Columbia

Key strengths:

Vancouver is a global leader in the convergence of digital media, wireless, and mobile, generating over \$3 billion in annual revenues from 1,150 companies. Vancouver has a large pool of talent supported by such institutions as the University of British Columbia, Simon Fraser University, and the NRC Herzberg Institute of Astrophysics.

Leading companies:

Wavefront, GLENTEL, Star Solutions and Vecima Networks.

Alberta

Key strengths:

Alberta has two growing microelectronics clusters in Edmonton and Calgary. Leading research facilities supporting the Edmonton cluster include the University of Alberta, the NRC National Institute for Nanotechnology, the NanoFab research facility, nanoAlberta, and the Alberta Centre for Advanced MNT Products (ACAMP).

In Calgary, research in the wireless and technology sector is fuelled by the University of Calgary, TRILabs and TECTERRA.

Leading companies:

Hemisphere GPS, Wedge Networks and Novatel Wireless. Key Canadian companies in this cluster include ANT, WMode, Poynt, Mob4Hire, Blackline GPS and Baseband Technologies.

Micro and nanotechnology MEMS companies in Edmonton include Norcada, Harding Instruments, Preciseley and Scanimetrics.

Quebec

Key strengths:

Montréal's cutting-edge digital-media hub represents a large percentage of the city's 5,000 ICT companies, which generate a combined \$9 billion in annual revenue. The greater Montréal area's four universities and seven other institutes of higher learning provide companies in this cluster with the skilled workforce they need.

The Microelectronics Innovation Centre in Bromont is a global centre of excellence in microchip packaging technologies and MEMS. The \$218 million facility is a partnership between Teledyne DALSA Corporation, IBM Canada, the Université de Sherbrooke and the Governments of Quebec and Canada.

Leading companies:

Ericsson has been chosen by Hydro-Québec as the prime integrator for the broad deployment of its smart metering pilot project. Leaders in telecom equipment, microelectronics and photonics include Wavesat, EXFO, Miranda Technologies (Belden) and Ultra Electronics.

Ontario**Key strengths:**

Ontario's industry develops a broad spectrum of apps and solutions for platform developers, business-to-business (B2B), and consumer markets. The University of Toronto's communications research institute, NANOnetwork, York University, and the University of Ontario's Institute of Technology all have strong track records of producing highly skilled employees and outstanding research.

Kitchener-Waterloo's top-ranking universities, University of Waterloo and Wilfrid Laurier, develop talent that can pursue careers in the 800 technology companies in the area. Research facilities that support this hub include Communitel, the Accelerator Centre, the Waterloo Institute for Nanotechnology, the Centre for Wireless Communication, and the Centre for Automotive Research.

In Ottawa, the wireless sector is supported by Invest Ottawa; the CRC; and the NRC's Institute for Information Technology and Canadian Photonics Fabrication Centre. Local talent is drawn from the University of Ottawa, Carleton University and Algonquin College.

Leading companies:

Ontario hosts many telecommunications multinationals including: Avaya, Alcatel-Lucent, Bridgewater Systems (Amdocs), Ciena, Cisco, Ericsson, Huawei and ZTE. Canadian leaders include: Polar Mobile and XMG Studio, DragonWave, Mitel, and QNX Software Systems (RIM). Canada's "Technology Triangle" in Ontario's Kitchener-Waterloo area is the headquarters of world-renowned RIM.

Canada's cost advantages

Advantage: LABOUR COST SAVINGS

Based on a typical wireless technology centre, companies can make labour cost savings by locating in Canadian cities compared to Tokyo and cities in the U.S.

Annual labour costs (\$ million)

This chart shows total labour costs for a wireless technology centre with a total head count of 30 people. Labour costs include employee salary plus statutory employer social security contributions. Private healthcare costs are also included for U.S. and Canadian cities.

Location	Unit value
Tel Aviv	1.8
Shenzhen	2.3
Montréal	2.4
Espoo	2.5
Vancouver	2.6
Toronto	2.7
Stockholm	2.7
Kitchener-Waterloo	2.8
Calgary	2.8
Dallas	2.9
San Diego	2.9
Paris	2.9
Chicago	3
Seattle	3.1
Tokyo	4

Source: fDi Benchmark Database, fDi Intelligence from the Financial Times (2012)

Advantage: COMPETITIVE OFFICE COSTS

Canada is highly cost-competitive for office rental costs. Costs are significantly lower than in Europe and Asia.

Office rent per square foot per annum (\$)

This table shows the cost per square foot of prime Grade A office space in each location.

Location	Unit value
Kitchener-Waterloo	15
Montréal	21
Espoo	23
Toronto	23
Dallas	25
Calgary	26
Ottawa	26
Tel Aviv	27
San Diego	29
Seattle	34
Vancouver	34
Chicago	38

Shenzhen	49
Stockholm	63
Paris	98

Source: fDi Intelligence based on Cushman & Wakefield (Q4 2011)

Canada's competitive advantages

Advantage: NETWORK READINESS

Canada is well positioned to exploit the opportunities offered in ICT, ranking ninth globally in network readiness, ahead of major Asian and European countries.

Networked Readiness Index (Rank 1-7)

This chart shows competitor locations and their overall network readiness, defined as a measure of their propensity to exploit the opportunities offered by information and communications technology. (1= worst; 7= best)

Location	Unit value
Sweden	5.94
Finland	5.81
U.S.	5.56
Canada	5.51
South Korea	5.47
Germany	5.32
Japan	5.25
Israel	5.24
France	5.12
Ireland	5.02
China	4.11

Source: World Economic Forum Global IT Report 2012

Advantage: ICT EXPENDITURE

Canada is committed to supporting the development of its ICT industry, with expenditure on ICT (expressed as a percentage of GDP) higher than in many European countries and China.

ICT expenditure (% GDP)

This chart shows each country's expenditure on ICT as a percentage of GDP in 2009. ICT expenditures include computer hardware; computer software; computer services; and communication services and equipment.

Location	Unit value
U.S.	6.96
Japan	6.89
Canada	6.72
Finland	6.49
Netherlands	6.23
Sweden	6.22
China	5.77
Germany	5.41
France	5.13
Ireland	5.08
Israel	5.05

Source: World Bank World Development Indicators (2009)

Canada's competitive advantages

Advantage: INTERNET SPEEDS

Canada offers the fastest average download speeds compared to other major competitors in the U.S. and Asia. Vancouver and Calgary offer faster average download speeds compared to Seattle, San Diego and Tokyo.

Average download speeds (Mb/s)

This chart shows the average download speed of each city in 2012 as measured in Mb/s.

Location	Unit value
Vancouver	15.07
Espoo	14.73
Calgary	14.65
Seattle	13.69
Kitchener-Waterloo	12.44
San Diego	12.09
Ottawa	12
Toronto	11.64
Tokyo	9.94
Montréal	9.85
Chicago	9.28
Tel Aviv	7.63
Dallas	7.43
Shenzhen	5.46

Source: fDi Intelligence from the Financial Times Ltd based on Ookla Net Index (2012)

Advantage: WIRELESS INNOVATION

Most Canadian cities have more wireless communication related patents registered than Paris, Stockholm and Shenzhen.

Number of patents in wireless technology

This chart shows the estimated number of wireless technology related patents granted between 2003 and 2011 by the United States Patent and Trademark Office to inventors based in each city.

Location	Unit value
Espoo	978
Ottawa	939
Toronto	712
Tel Aviv	547
Kitchener-Waterloo	497
Vancouver	433
Montréal	367
Shenzhen	354
Paris	329
Stockholm	266
Calgary	262

Source: fDi Intelligence estimates based on the United States Patent and Trademark Office (2012)

Canada's competitive advantages

Advantage: FAVOURABLE CORPORATE INCOME TAX

Canada offers among the most attractive corporate income tax levels of any comparable country. Companies locating in Canadian cities can expect to pay lower corporate income taxes than in the U.S., France and Japan.

Corporate tax (%)

This chart shows the corporate income tax rates payable by companies. Figures are expressed as tax payable as a percentage of companies' gross profit.

Location	Unit value
Espoo	24.5
Vancouver	25
Tel Aviv	25
Shenzhen	25
Stockholm	26.3
Toronto	26.5
Montréal	26.9
Paris	33.3
Dallas	35
Seattle	35
Tokyo	38.01
San Diego	40.7
Chicago	41.2

Source: KPMG (Country and Canadian Provinces 2012); The Tax Foundation (U.S. States 2011)

Advantage: OUTSTANDING QUALITY OF LIFE AT AN AFFORDABLE COST

Canadian cities offer the highest quality of life in the world. Vancouver was rated the most liveable city in the world by the Economist Intelligence Unit in 2011 and also tops the fDi Intelligence index. Canadian cities are the highest ranking when considering both quality of life and cost of living.

Attractiveness of cities

This chart shows the overall attractiveness of cities based on combining their quality of life and cost of living, with a 50% weight attached to each.

Location	Unit value
Vancouver	100
Calgary	96
Montréal	95
Toronto	95
Ottawa	91
Stockholm	88
Kitchener-Waterloo	84
Tel Aviv	81
Espoo	79

Tokyo	75
Paris	75
Seattle	74
Shenzhen	73
San Diego	72
Chicago	67
Dallas	63

Source: fDi Intelligence from the Financial Times (2011) Vancouver = 100

Invest in Canada to achieve global excellence

A welcoming business environment

Canada is the best place to do business in the world.

Source: Forbes Magazine, October 2011.

A growing economy

Canada has been the top performer among the G-7 in GDP growth over the 2008 to 2011 period.

Source: Consensus Economics, April 2012.

A highly educated workforce

Canada has the highest proportion of post-secondary graduates among members of the Organization for Economic Co-operation and Development (OECD).

Source: Education at a Glance 2011, OECD.

Financial stability

Over the past four years, Canada's banking system has repeatedly been declared the soundest in the world.

Source: Global Competitiveness Report 2009-2012, World Economic Forum (WEF).

Low tax rates

Canada's combined federal-provincial statutory corporate income tax rate of 26% is more than 13% below the U.S. and among the lowest when compared to G-7 countries.

Source: Department of Finance Canada and the OECD Tax Database 2012.

Scientific research and experimental development

Canada offers some of the most generous R & D tax incentives in the industrialized world, with combined federal and provincial tax credits that can currently save foreign investors, on average, up to 30 cents on the dollar invested in R & D in Canada. Canada also has the seventh lowest costs in R & D-intensive sectors (up to 10.7% lower than the U.S.).

Source: Department of Finance Canada and KPMG Competitive Alternatives, 2012.

NAFTA

The North American Free Trade Agreement (NAFTA) gives investors access to nearly 457 million consumers and a combined continental GDP of about US \$17.2 trillion.

Canada continues to seek more free trade agreements with economic and emerging powers to increase trade and investment.

Source: World Bank, World Development Indicators Database, 2012.

A great place to invest, work, and live

Canada is one of the most multicultural countries in the world, home to world-class universities, a universal health care system, and clean and friendly cities. Canada has the highest quality of life among G-7 countries and consistently ranks among the world's top countries in Human Development.

Source: Statistics Canada; United Nations Human Development Report, 2011; OECD Better Life Index, 2011.