



Government
of Canada

Gouvernement
du Canada

Cluster Development: The Experience in Canada

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Definition: Industrial Clusters

“Broadly defined, an industry cluster is a loose, geographically bounded collection of similar and/or related firms that together create competitive advantages for member firms and the regional economy.”

(Barkley and Henry, Sept., 2001, Clemson University Report)

Canada: Basic Indicators



- Area : 10 million km²
- Population: 32 million
 - 90% reside within 160 km of US/Canada border
- GDP: US \$ 87.5 billion (~Y 103.2 trillion)
- GDP per capita: US \$ 27,700
 - Japan : GDP US \$ 3.45 trillion (Y 407 trillion)
GDP per capita US \$ 27,200
- GDP Growth rate: 3.9% (1997-2002)

Canada's Innovation Strategy



Goal: to be recognised as one of the most innovative countries in the world

The Innovation Strategy

- Two reports released:
 - *Knowledge Matters: Skills and Learning for Canadians*
 - *Achieving Excellence: Investing in People, Knowledge and Opportunity*
- Objectives
 - assess the national challenge
 - propose national goals, targets and federal priorities
 - leverage complementary commitments
 - track progress

Toward an Innovative Future

- **Canada's Challenges**

- **The Knowledge Performance Challenge**

Promote the creation, adoption, and commercialisation of knowledge.

- **The Skills Challenge**

Ensure an adequate supply of people who create and use knowledge.

- **The Innovation Environment Challenge**

Build an environment of trust and confidence, where the public interest is protected and marketplace policies provide incentives to innovate.

- **The Communities Challenge**

Stimulate innovation at the local level, through the development of world-class clusters and innovative communities.



Philosophy : Community Matters

”In a world of global competition, sources of competitive advantage are becoming increasingly localised... True competitive advantage is found within our communities.”

Michael Porter

“Communities need to break down the walls that separate organisations, institutions, sectors, jurisdictions, neighbourhoods, or people. Only if communities are strong in terms of the united efforts of their residents can they attract and hold job-creating businesses whose ties reach many places.”

Rosabeth Moss Kanter

“World Class, Thriving Locally in the Global Economy”

The Communities Challenge

- **Goals:**

- Governments at all levels work together to stimulate the creation of more clusters of innovation at the community level.
- All levels of government, federal, provincial, territorial, municipal, co-operate and supplement their current efforts to unleash the full innovation potential of communities across the country.

- **Targets :**

- By 2005, ensure that high-speed broadband access is widely available to communities.
- By 2010, develop at least 10 internationally recognised technology clusters.
- By 2010, significantly improve the innovation performance of communities across the country.

Communities Challenge

- The elements of Canada's national innovation system come together in communities.
- Large Urban Centres:
 - Innovation thrives in industrial clusters – they're internationally competitive growth centres
 - Common feature is one or more institutions devoted to R&D
 - Canada can do more to stimulate the development of world-class clusters
- More Innovative Communities:
 - Innovation can also thrive in smaller communities, including rural & "First Nation" communities
 - But many lack the networks, infrastructure, investment capital or shared vision to live up to their innovative potential



Communities Challenge: Priorities for Action

- Support the development of globally competitive industrial clusters.
- Strengthen the innovation performance of communities:
 - Support smaller communities in developing and implementing innovation strategies.
 - Work with partners to advance a private sector solution to further the deployment of broadband, particularly for rural and remote areas.

Canada's Major Communities



Almost All Large Canadian Cities Have Completed Cluster Studies

- Toronto, Ontario (population: 4.7 million)
 - aerospace; automotive; apparel & textiles; biomedical & biotech; business & professional services; financial services; food & beverage manufacturing; IT and telecom; media; tourism (Feb 2000)

(www.city.toronto.on.ca/business_publications/tocompetes_fullreport.pdf)
- Montréal, Quebec (population: 3.4 million)
 - pharmaceuticals; biotechnology/life sciences; information technology (especially telecom); aerospace; logistics & distribution; call centres

(www.mtltv.org/img/2001-Rapport-ang-F-PDF.pdf; www.montrealinternational.com)
- Vancouver, British Columbia (population: 2.0 million)
 - advanced technology; tourism; finance, insurance, real estate; films; clothing; mining, oil & gas; forestry, contracting and developing; business services (July 2002)

(www.vancouvereconomic.com/whatsnew/news/pdf/vedc-report-clusteranalysis.PDF)

Almost All Large Canadian Cities Have Completed Cluster Studies

- Ottawa-Gatineau, Ontario/Quebec (population: 1.1 million)
 - telecom; microelectronics; software & communications; professional services; tourism; life sciences, photonics (1999)
(www.ottawaregion.com/clusters/index.asp)
- Calgary, Alberta (population: 951,000)
 - oil & gas; IT and wireless-telecom; tourism, arts & entertainment; transportation, warehousing & logistics; geomatics; health & agricultural biotech (May 2001)
(www.calgary-promote.com/html/promoting_calgary_inc/c-prosperity/cprosperity.html)
- Edmonton, Alberta (population: 938,000)
 - advanced manufacturing; agriculture & forest products; biomedicine & biotechnology; engineering & technical services; information & media services; oil, gas & chemicals; tourism & entertainment; transportation & logistics (Dec 2000)
(www.ede.org/EDECCorporate/clusters/clusters/index.asp)
(www.ede.org/EDECCorporate/clusters/media/full_report_blueprint.pdf)

Some Smaller Cities have also adopted Cluster Approaches to Economic Development

- Halifax, Nova Scotia (population 360,000)
 - focus on key clusters: offshore energy; ICT; life sciences
 - development of business-led economic development organization (Halifax Partnership)
 - collaboration with other cities (Halifax-Moncton Growth Corridor)
- Saskatoon, Saskatchewan (population 225,000)
 - focus on ag-biotech
 - incubator/R&D facility (Innovation Place) generates more than US \$1.3B in farm income
- Regina, Saskatchewan (population 193,000)
 - new cluster-based strategy announced Sept 2002
 - focus on information technology; energy; environment; environmental industries; film & multimedia; agribusiness; steel & manufacturing
 - RREDA: “...we see an industry-led strategy based on clusters as the only way to develop the economy of Regina and region.”
- Sherbrooke, Québec (population 153,811)
 - development of specialized research and training institutions for environmental tech
 - focus on microelectronics, health and bio-med research, new industrial materials

Some Lessons Learned So Far

- Focus on building knowledge-economy assets
- Commercialise research performed at least in part within the community
- Build from existing strengths. Expand into emerging growth areas
- Focus on only a few clusters
- Develop specialised institutions and networks
- Involve all parts of the community in the effort
- Find and engage several local champions
- Recognise the importance of strategic planning
- Recognise the importance of partnerships
- Sustained effort and stable, long-term financial commitments are needed

The Case of Timmins, Ontario: Population: 43,686

- With historical roots in mining and forestry, Timmins has prepared a study of these 2 clusters as part of their economic development strategy.
- Timmins also uses its strengths and competencies to move into newly emerging areas:

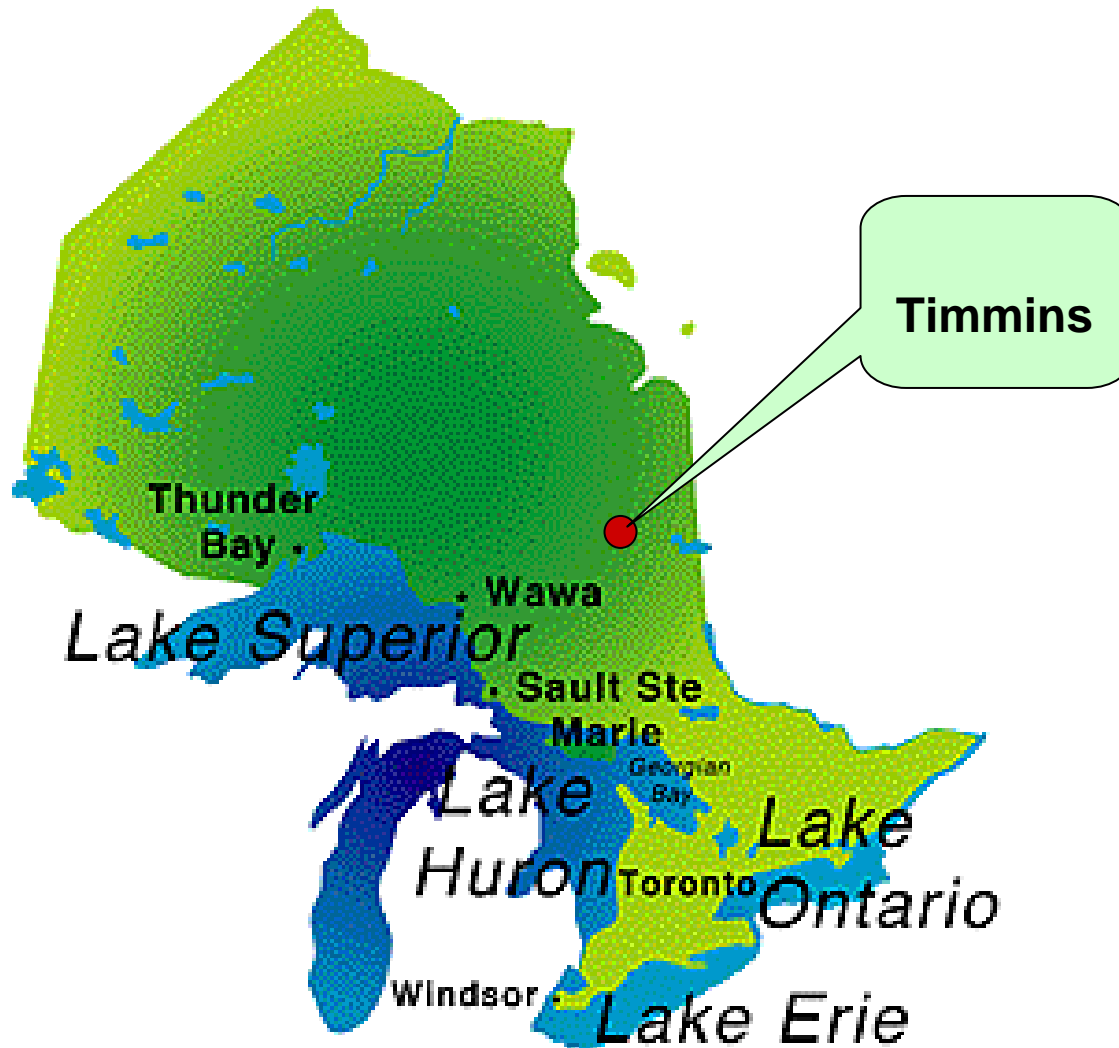
Cold-Weather Testing:

“In Timmins, we know that cold weather is a valuable commodity and our consistently cold winters provide ideal conditions for testing product performance.”

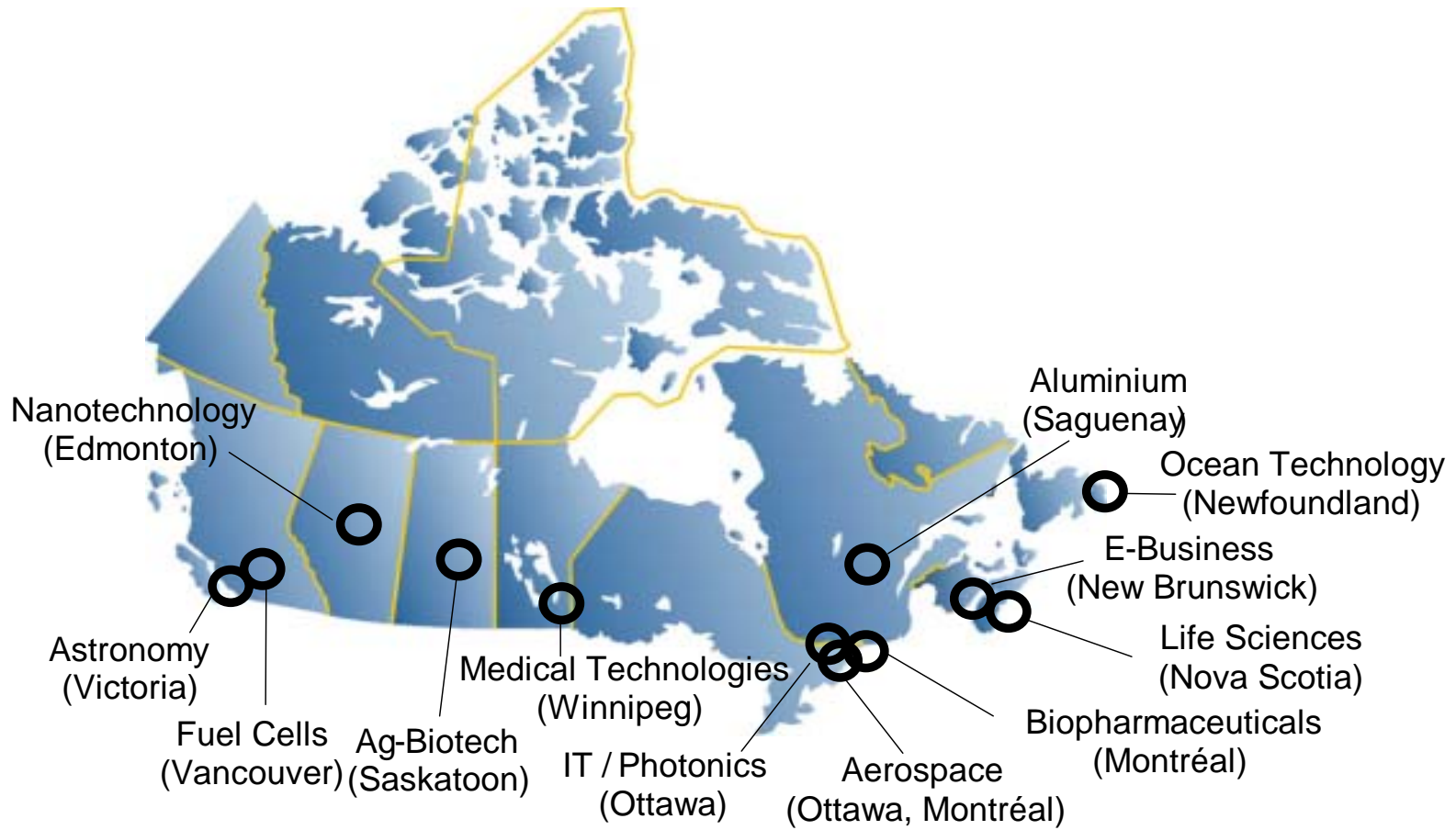
- Recognising the importance of community engagement and financial commitment:

“Building Our Future is not the first attempt at economic development undertaken for Timmins. However the strategic team planning partners represent a team of government, community agencies & private industry that has never before been assembled to support economic development. The partners are committed to ensuring that financial and other resources are available to pursue the opportunities that have been identified to date.”

Timmins, Ontario



NRC's Investments in Clusters

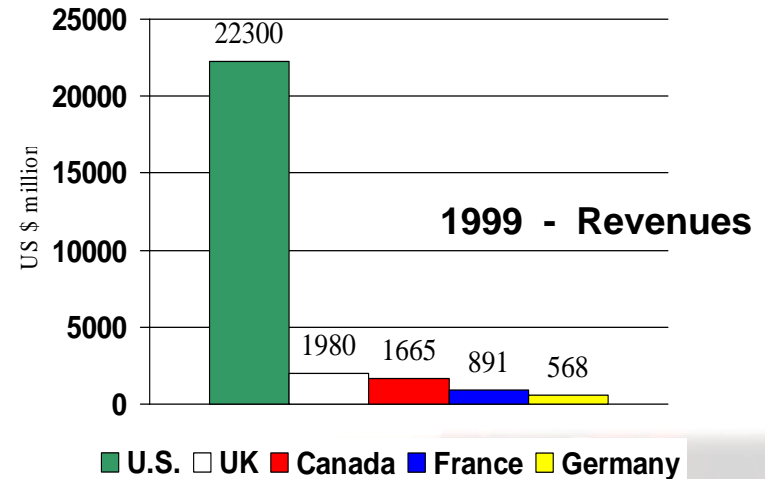
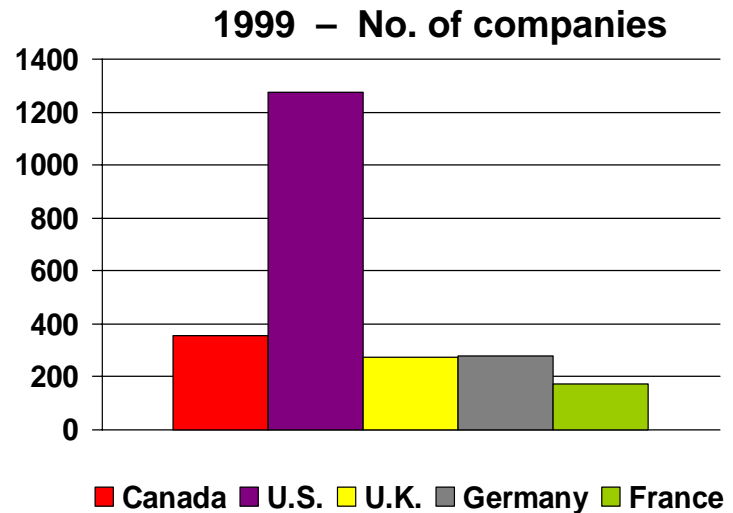


- Social Sciences and Humanities Research Council
- US \$1.7 million over 5 yrs beginning in 2001 for academics and graduate researchers to study: “Innovation Systems and Economic Development: The Role of Local and Regional Clusters”
 - Goal: to investigate process of cluster development in both mature and emerging sectors, in both metro and non-metro settings
 - How do local networks of firms interact and enable firms to make transition to more innovative and knowledge-intensive forms of production? Role of ‘Local Social Capital’?
 - Detailed Case Studies/Cross-Region Comparative Analysis
 - Biotech/Bio-medical (6 regions)
 - Photonics/Wireless (4 regions)
 - Food/Beverage/Wine (2 regions)
 - Auto/Steel/Aerospace (2 regions)
 - Culture/Multi-media (3 regions)
 - Wood Products (1 region)
 - Information Technology (2 regions)

- **Biotechnology & Life Science Clusters**
- **IT/Photonics Clusters**
- **Nanotechnology Clusters**

Canada's industry compares well with those of larger nations

- Ranking 2nd (after the U.S.A.) in number of core biotechnology companies, having > 400
- Ranking 3rd after the U.S.A. and U.K., in biotechnology revenues
- Ranking **first** in biotechnology R&D expenditures per employee

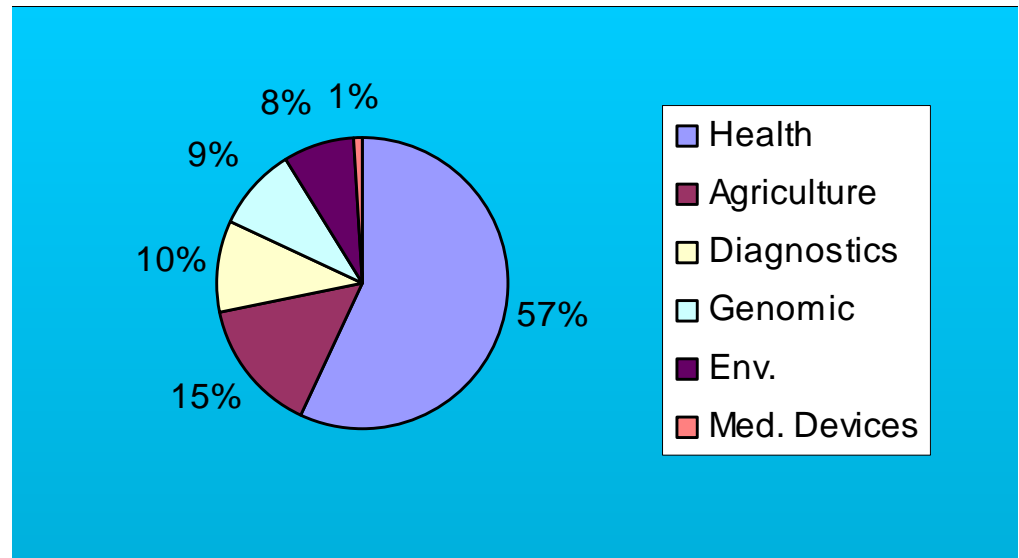


Canada's Biotechnology Industry

Canada's biotechnology industry is diverse and growing rapidly

- Distribution of the industry's 400 core biotechnology companies:

- 57% in health
- 15% in agriculture
- 10% in biodiagnostics
- 9% in genome
- 8% in environment
- 1% in medical devices



- > 400 companies in 2001; 86 public companies in 2001
- 90% of total Canadian industry revenues come from biotechnology sales

Canadian Biotechnology Clusters

Areas of expertise

- **Health**

Montreal, Toronto, Vancouver,
Quebec City, Halifax, London,
Edmonton

- **Agriculture**

Guelph, **Saskatoon**

- **Environment**

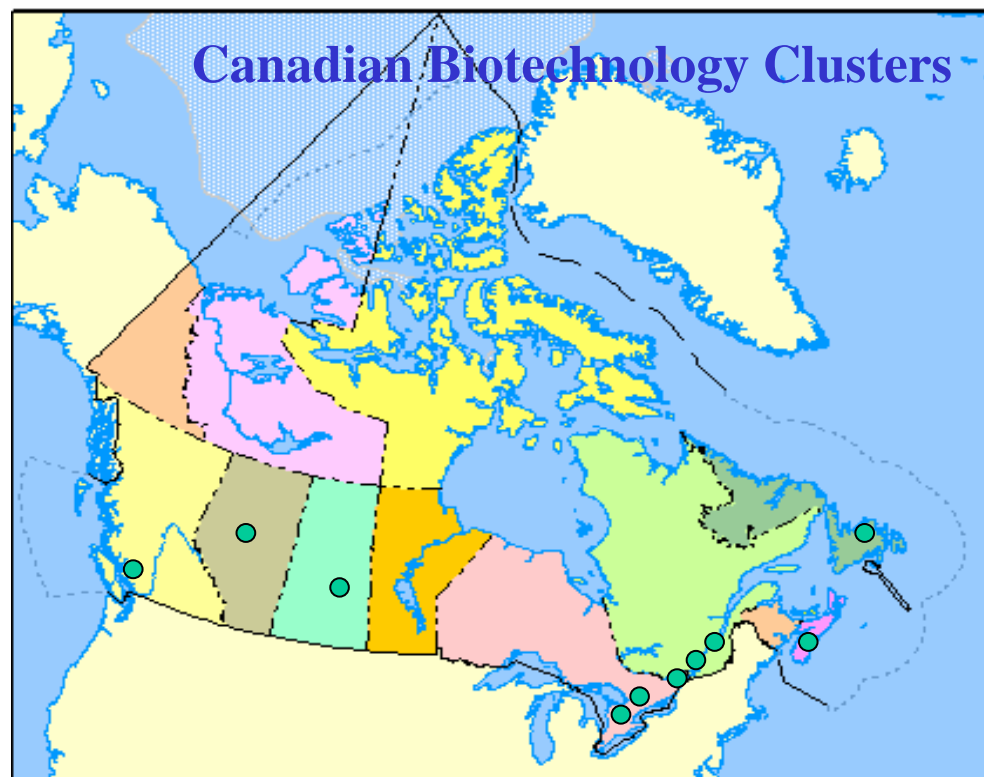
Montreal, Toronto, Vancouver

- **Aquaculture**

Halifax, St. John's

- **Industrial Processes**

Vancouver



Internet address: <http://strategis.ic.gc.ca/Bioclusters>

Health biotechnology clusters

- **Montréal highlights:**
 - Over 145 health-related biotech companies
 - Presence of large multi-national pharmaceutical companies (Merck-Frosst, Schering, Aventis Pharma, Pfizer, Wyeth-Ayerst, Bristol-Myers Squibb, Abbott), NRC's Biotechnology Research Institute, Institut Armand Frappier, and 3 university research centres
 - Research in molecular biology, genetics, immunology, neuroscience and bioethics
- **Toronto highlights:**
 - ~ 110 biotech companies plus leading research hospitals, institutes
 - Research in oncology, cardiovascular diseases, CNS disorders, gene therapy, autoimmune diseases, tissue regeneration
 - The University of Toronto and its affiliated research institutions comprise the 4th largest medical R&D community in No. America
- **Vancouver highlights:**
 - 3rd largest cluster with over 70 biotech companies
 - Over 70% of the cluster focused on health research

Investments in biotechnology research

- **Canadian Institutes of Health Research: US \$426 million budget.**
- **Genome Canada: US \$197 million federal support.**
- **Canada Foundation for Innovation: US \$2.1 billion budget.**
- **Canada Research Chairs: US \$595 million.**
- **Technology Partnerships Canada: US \$ 173 million invested.**
- **The National Research Council has 5 biotech institutes and is presently creating a National Institute for Nanotechnology.**

Canadian Government Investment in Biotechnology Research

Canadian ICT Sector – 2001 Figures

- Share of GDP 6.2%
- Employment >15 million
- Revenues US \$78 billion
- R&D expenditures (intentions) US \$3.5 billion
- Share of private sector R&D 46%
- Exports-ICT goods & services US \$20.1 billion



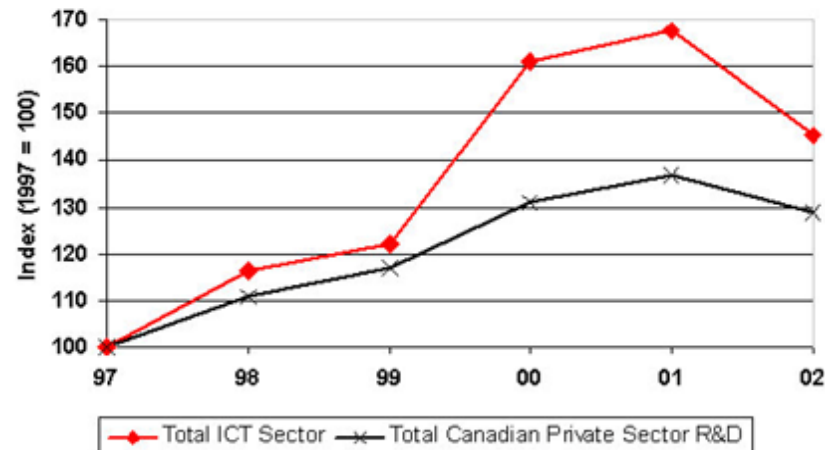
ICT in Canada

- 75% of all backbone internet traffic in No. America carried on Canadian products
- First to deliver 10 gigabit/sec systems
- Largest designer worldwide, manufacturer of optical components
- 1999 'Info World Product of the Year' - the Blackberry - a wireless communications device
- > 80% of the world's animation and special effects software comes from Canadian companies

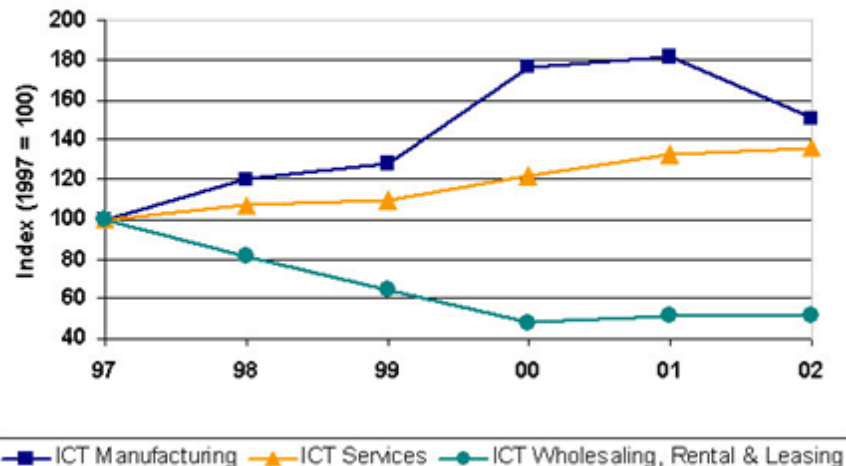
ICT Sector in Canada

- Canadian private sector R&D expenditures US **\$7.28 billion** in 2002, down 6.1% from 2001
- ICT : **largest** private sector R&D performer
- ICT private sector R&D expenditures: US \$ **3.4 billion**

Indexed Growth in R&D Expenditures for the ICT Sector and the Canadian Private Sector, 1997-2002



Indexed Growth in R&D Expenditures by ICT Segment, 1997-2002



ICT/Photonics Cluster in Ottawa/ Montreal



Alcatel
Calian Technology
Cisco
Cognos
Corel
Communications Research Centre
Crosskeys
Jetform
Teleglobe
Lucent
Microelectronics

Ottawa

Mitel
Mosaid
National Research Council
Nortel Networks
Nokia
Philsar Semi.
QNX Software
JDS Uniphase
Siemens
Tundra Semiconductor

ICT/ Photonics Cluster in Ottawa

- Employs 80,000
- 1200 technology companies
 - Including major ICT players like Alcatel, CISCO, Lucent, Nortel, Siemens etc.,
- 17% growth rate/year
- US \$9.75 billion in exports
- 90% private sector ICT R&D in Ottawa
- Ottawa is one of the world's top five sites for R&D
- Major research centres (government, university, industry)
 - Communications Research Centre, NRC (<http://www.crc.ca/>)
 - Carleton University (<http://www.carleton.ca/>)
 - University of Ottawa (<http://www.uottawa.ca/>) -- School of Information Technology & Engineering (SITE)
 - Algonquin College: (<http://www.algonquincollege.com/>)

Canadian nanotechnology activities (2000-2002)

National Research Council

- US \$78 M/ Y 9.2 B for NINT: Alberta
- NRC: 7 nanotech research sites, 10 nano incubators being built

Natural Sciences & Engineering Research Council

- 219 awards US \$6.3 M/Y 716 M '00-'01
- 4 Industrial Research Chairs
- Nano Innovation Platform: national network of nano researchers
- 3 nano-related Networks of Centres of Excellence

Canadian Institutes of Health Research

- Regenerative medicine
- Nanoscience strategy in planning process

Canada Foundation for Innovation

- US \$45.5 M /Y 5.4 B capital equipment awards related to nano; matching funds Provincial Gov'ts and Universities

Canadian Institute for Advanced Research

- Network of leading nanoelectronics researchers

Nano Québec

- Consortium of Québec gov't. with US \$9.7M /Y 1.2 B provincial funding over 3 years

Canadian Space Agency

- part of international CANEUS micro/nano development

Almost all Canadian universities carry out nanotech research

Nanotechnology at NRC

National Institute for Nanotechnology

- programmable, adaptive nanostructures

Information Communications Technology Group

- MBE, quantum dots, quantum computing, molecular electronics

Institute for National Measurements Standards

- standards for nanotechnology

Steacie Institute for Molecular Sciences

- biochips, molecular electronics
- membranes, sensors, films, coatings, templates, porous materials
- molecular, metallic and semiconductor clusters

Manufacturing Technologies Group

- polymers, metals, coatings, plastic molds, magnetic particles in polymers, porous materials
- fuel cells, Li ion batteries, chemical sensors, materials modeling, surface science
- laser machining, rapid prototyping, laser consolidation, nanofluidics,

Biotechnologies Group

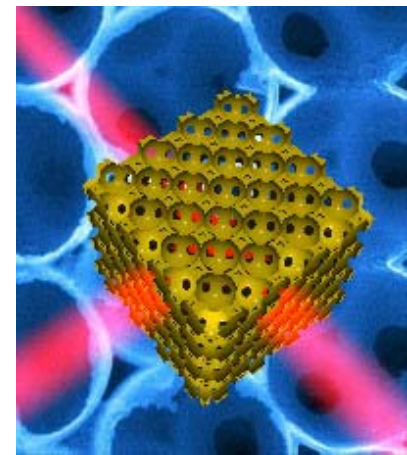
- biochips: DNA, proteins, microfluidics, biosensors
- implants, artificial joints, artificial skin
- membranes, membrane proteins, drug delivery

National Institute for Nanotechnology

- Collaborative venture between NRC, University of Alberta and Province of Alberta
- US \$78 million (Y 9.2 B) state-of-the art facility
- Designed to house 150 researchers, 300 scientists
- Business incubator
- Information resource center
- On-site industrial assistance to companies.

Focus areas of NINT

- Nanobiology
- Information technology
- Energy and materials nanoscience



3D Silicon Photonic Crystal
(G. Ozin, University of Toronto)

Canadian nanotechnology industry

- **Approximately 50 Canadian firms**

- **Mostly SMEs**
- **Concentrated along the Québec/Windsor corridor, Edmonton & Vancouver**

- **Nano powders**
- **Coatings**
- **Catalyst development**
- **Microfluidics**
- **Photonics/micro-electronics**
- **Diagnostics**
- **Fuel Cells**
- **Sensors**
- **Polymer nanocomposites**
- **DNA and protein engineering**
- **Lab-on-a-chip**



For More Information:

- Investment Partnerships Canada:
www.investincanada.gc.ca
- Canada's Innovation Strategy:
www.innovationstrategy.gc.ca
- Innovation in Canada Site:
www.innovation.gc.ca
- National Research Council Atlantic Clusters Initiative:
www.nrc.ca/atlantic/english/index.html
- Links to NRC Institutes:
www.nrc.ca/corporate/english/media/reg_e.html
- Innovation Systems Research Network Clusters Initiative:
www.utoronto.ca/isrn/clusters.htm

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