Canada Foundation for Innovation
Fondation canadienne pour l'innovation

BRIEF TO THE

HOUSE OF COMMONS

STANDING COMMITTEE ON FINANCE

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PRESIDENT AND CEO

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Highlights

Since 1997, the Canada Foundation for Innovation (CFI) has provided support for:

- **over 3,600** research infrastructure investments across Canada; at
- **118** universities, colleges, research hospitals and non-profit research institutions.

The federal government has invested $3.65B in CFI of which $2.7B has been committed. Because the CFI invests 40 percent of project costs, this $2.7B has levered additional commitment to a total of close to $7B.

The state-of-the art infrastructure provided by the CFI is helping institutions to recruit and retain skilled researchers and students. In 2003-04:

- nearly 3,200 new faculty were recruited; over 1,200 from abroad,
- 3,800 postdoctoral fellows were attracted, 2,000 from abroad; and
- 29,000 trainees made use of the CFI infrastructure projects at their institutions.

Canada's future as a knowledge economy depends on highly trained scientific personnel, who carry their advanced training into private and public sector careers.

Complex problems in science and technology require the integration of different disciplines and sectors for their solution. Through its investments in infrastructure, the CFI is helping to transform the way research is done in Canada, encouraging multidisciplinary, multisectoral approaches to problem-solving. In CFI projects:

- 90 percent of project leaders are involved in multidisciplinary endeavors; and
- over 15,000 researchers can pursue research that would not have been possible otherwise.

CFI-funded infrastructure projects are located in **59** municipalities across Canada. In many cases, this state-of-the-art infrastructure serves as a magnet for the attraction of investment and talent, and helps to forge linkages between research institutions and other agents of innovation at the local level. Technology clusters, large and small, are developing, centered on domains such as biotechnology, information and communications technology, fuel cells, pharmaceuticals and more. Social and economic benefits are becoming apparent. Research and development is proceeding in Canada to:

- generate improvements in engineering design to protect hydroelectric installations from ice storms;
- produce medical devices to alleviate chronic pain;
- preserve biodiversity through the integration of aboriginal and scientific knowledge and practice; and
- assist policy makers in the mitigation of global warming on the Canadian Arctic and its inhabitants.

And these are just a few of the hundreds of examples.

Canadian research and development projects marshalled around new infrastructure installations are becoming "the envy of the world," encouraging the involvement of world-class researchers from abroad due to the leading-edge quality of the work. A significant measure of its global significance is the amount of foreign financial support. In 2003-04, more than 40 percent of project leaders obtained research funds from international sources.

The CFI at Seven Years: Impacts and Results

Introduction

Canada's economic growth and quality of life must increasingly be based on expansions of knowledge and its application by skilled people at local, regional and national levels. Research and development (R&D) is the critical investment that results in the generation of this knowledge, including how to use it. Innovative private and public organizations are engaged in the translation of this R&D into new products, processes and services that meet many needs, result in cost-savings, spare the environment and create jobs.

In 1997 the federal government created the Canada Foundation for Innovation (CFI) to boost the contribution of the Canadian higher education and non-profit research sector to Canada's knowledge-based growth. The CFI assists with the building of R&D capacity through investments in infrastructure. These investments complement those of other agencies and organizations—federal, provincial and local—to create the conditions for innovation by the higher education and research hospital sectors across Canada, in large and small municipalities, for the short-, medium- and long-term.

CASE IN POINT

At the Telerobotics Laboratory in Sudbury, Ontario, R&D is being conducted on remote-controlled robots that can undertake dangerous tasks. Researchers at ***Laurentian University*** *and* ***Cambrian College*** *are using state-of-the-art technology linked to virtual reality mining control stations to study machine design, mining methods and mineral economics. Their results will have implications for telerobotics in mining, manufacturing, environmental clean-up, space, underwater work and elsewhere.*

The result? Established, world-class and promising young researchers are being attracted to the facilities at Canadian institutions, the training of young researchers is leading-edge, the research itself is being transformed by networking and collaboration, and technology clusters are emerging. The Canadian capacity for R&D is being dramatically enhanced. The CFI is proud to be a contributor to this economic and social transition.

About the CFI

The 1997 Act of Parliament that launched the CFI provided it with a mandate to strengthen the ability of Canadian universities, colleges, research hospitals, and non-profit research institutions to carry out world-class research and technology development that benefits Canadians. It is an independent, non-governmental organization with a Board of Directors numbering 15 who, in turn, report to 15 Members—a higher governing body similar to a company's shareholders, but representing the Canadian public. Members and Directors bring a wide range of expertise and perspective to their positions, representing government, industry, higher education and non-profit research sectors.

CASE IN POINT

At ***Mount Saint Vincent University's*** *Maritime Data Centre for Aging Research and Policy Analysis in Halifax, researchers are addressing the issue of an aging population of baby boomers and the level of care that family and friends may be willing and able to provide for them in the future. They have developed an assessment tool that will help home care agencies to determine what support caregivers require in this role. Research into home care and continuing care policy will help policymakers across Canada and around the world.*

At its regular meetings, the Board of Directors makes final decisions on infrastructure projects to be funded based on a rigorous merit review process. It also determines strategic objectives of the CFI in the context of the funding agreement with the federal government. It approves annual

plans and sets the overall compensation policy for CFI's managers and officers. It is responsible for formal evaluations of its programs whose results are posted on the CFI website.

Since 1997 the federal government has invested $3.65B in the CFI that, with compounded interest, is expected to grow to approximately $4.5B by 2010.

Overview of CFI investments

The CFI focuses its investments on *infrastructure* to enhance the capacity of institutions to undertake research. Research infrastructure includes facilities, laboratories, equipment, computing capability and networking. Why target infrastructure? State-of-the-art infrastructure empowers institutions and their researchers to dramatically raise productivity at a time of critical importance, and to be competitive internationally. Technological advances are making research tools more powerful, versatile, and accessible. With the appropriate infrastructure, new information is being shared on a larger scale, enabling innovative approaches and solutions across regions, countries and world-wide.

To date, the CFI's Board of Directors has approved:

- **over 3,600** research infrastructure investments;
- **infrastructure projects at 118** Canadian universities, colleges, research hospitals and non-profit research institutions in **59** municipalities; and
- a total investment of $2.7B.

CASE IN POINT

The establishment of 4D LABS at **Simon Fraser University** *in Burnaby, British Columbia has helped more than 100 researchers around the world to collaborate in building working devices on the nano-scale, that is, at the level of molecules and atoms. One project will focus on how to wire molecules, for example, in a bid to develop computer memory small enough to fit on the head of a pin. Molecular computers, and "smart" biosensors for use in artificial limbs are among the many applications for this technology.*

Funded projects are selected using a merit-based, competitive process that assesses proposals on the basis of three criteria:

- Quality of the research and need for the infrastructure;
- Contribution to strengthening the capacity for innovation; and
- Potential benefits of the research to Canada.

Each infrastructure proposal must compete against all others submitted and be assessed by external experts. A review by a multidisciplinary assessment committee makes recommendations as to which infrastructure projects represent the most effective investments of public funds.

Partnerships and leverage

Collaboration around critical infrastructure was an important consideration in the design of the CFI programs from the outset, and positive results from this approach are evident today. Through a unique funding partnership, the **CFI funds up to 40 percent** of a project's infrastructure costs. The funded institution works with its partners—primarily the provincial governments and the private sector, including not-for-profit organizations and business to generate the remaining 60 percent required to complete these projects. Resources are also dedicated by the institutions themselves.

Hence the $2.7B that has been invested to date by the CFI has triggered additional commitments of close to $7B. By 2010, it is anticipated that the CFI investments of $3.65B will lever an overall investment exceeding $10B.

CASE IN POINT

Tracking livestock, traffic, goods, people and other moving objects is the goal of Global Positioning Systems (GPS). At the ***University of Calgary****, algorithms and technology are being developed to improve the effectiveness of GPS which has widespread applications in safety and security, health and agriculture resource exploration. The University of Calgary is fast becoming a global centre of excellence in positioning and wireless navigation systems, contributing to Canada's success as the 2nd largest exporter of GPS technologies in the world.*

Another aspect of the CFI's programming that encourages collaboration is the requirement that proposals for infrastructure funding be based on **strategic research plans** that are submitted by universities, colleges, research hospitals and non-profit research institutions. It remains for the prospective host institution to develop the opportunity and assume the responsibility to develop appropriate partnerships for a given infrastructure application. A number of regional- and national-scale proposals, tapping into a range of collaborative research institutions, have emerged.

The investments in infrastructure are complemented by research support from the federal granting agencies (Natural Sciences and Engineering Research Council, Canadian Institutes of Health Research, Social Sciences and Humanities Research Council), Canada Research Chairs Program, Genome Canada, industry and the private non-profit sector. Provincial governments, for their part, have not only contributed to infrastructure projects directly, but have also in many cases developed new programs and strategies around research and training.

CASE IN POINT

The January 1998 ice storm that left hundreds of thousands of people in western Quebec and southeastern Ontario without power formed at least part of the inspiration for a program of research at the ***Université de Québec à Chicoutimi (UQAC)****. The design of outdoor insulators, new methods for de-icing and prevention of ice formation on electrical power grids, and 3D models are all helping in the design of future network equipment that will withstand ice storms. An international network has been established around UQAC in the Saguenay-Lac-Saint-Jean region, which has attracted prestigious researchers from abroad and more than 100 graduate and post-graduate students for training.*

Attracting, training and retaining the best

Not so long ago the media was full of stories describing the difficulties our research institutions had in attracting and retaining top quality research personnel. Examples of 'brain drain' abounded. Without the right people, our capacity to innovate for the present and to train young Canadians for the future was seriously undermined.

It is a fact that the global market for good researchers is highly competitive and will only intensify. Features that attract researchers include:

- the availability of state-of-the-art research equipment;
- the existence of a critical mass of excellent colleagues and students with whom to interact and collaborate; and
- availability of research funding opportunities.

Now, however, Canada has become a very attractive country for R&D.

CASE IN POINT

At the new Bonne Bay Marine Station, scientists at ***Memorial University of Newfoundland*** *can now undertake year-round studies of the impact of climate change on Bonne Bay fjord, an impossible feat until recently. Ice build-up and an extreme climate have prevented such work in the past. Now sub-sea cameras, optical fibres, state-of-the-art data collection and processing technology transmit data over the Internet. Insights into the most unique marine environment on the eastern seaboard are now at hand.*

Specific initiatives such as the Canada Research Chairs Program, CFI's accompanying Canada Research Chairs Infrastructure Fund and CFI's New Opportunities Fund directly address "brain drain." The CFI investments provide infrastructure for the new Chairs and newly-recruited faculty members, enabling institutions to package competitive offers for prospective recruits. Together, these two funds have helped advance the career of over 3,300 researchers.

More generally, CFI investment across all of its infrastructure programs acts as a magnet in concert with other Canadian funding agency programs to attract reputable researchers from all over the world. For example, the annual progress reports submitted by institutions and project leaders for 2003-04 indicate that:

- nearly 3,200 new faculty were recruited;
- of the new recruits, over 700 were from the U.S. and close to 550 were from other countries.

It is estimated that for each Innovation Fund project, nine researchers are involved. In sum, CFI investments have over the years served as a powerful incentive for the recruitment and retention of several thousand researchers, with about 40 percent of those recruited coming from abroad.

The positive turn at Canadian research and training institutions has been a strong attractant for undergraduate and graduate students, and likewise for postdoctoral fellows (PDFs) who are critical to a laboratory's success. CFI infrastructure has been instrumental in attracting about 3,800 PDFs over the year, 2,000 of these from other countries. An even greater number of trainees at all levels, almost 29,000, made use of the infrastructure available at their institutions, to enhance their training through research. All of this points to better-trained students, who, familiar with the latest technology, are more attractive to employers in the private and public sectors.

CASE IN POINT

At the ***University College of Cape Breton*** *in Nova Scotia, First Nations students draw on Aboriginal "ways of knowing" and Western scientific knowledge to research and comprehend ecology and the environment. Called "Integrative Science," the course of study synthesizes information from existing literature, living knowledge within Aboriginal communities and field observations and research. The preservation of biodiversity and understanding wildlife parasitology are just two of the downstream applications.*

Quality gains in research

Complex problems in science and technology require the integration of different disciplines and sectors for their solution. Research frontiers are being driven by teams of researchers working collaboratively and in a multidisciplinary manner. The mapping of the human genome, for example, required a global effort that combined the resources of many laboratories and involved public and private sector effort. Confronting today's scientific challenges requires a concerted approach so as to amass a critical intellectual capacity, as well as significant material resources.

By all accounts, Canada's research landscape has been transformed in recent years by the combined investments and funding provided by the federal government, provincial governments and the private sector. The CFI's infrastructure investments have enabled researchers and their trainees to undertake groundbreaking research that is making a noticeable impression worldwide and is demonstrating Canada's key research strengths.

CASE IN POINT

*Operating out of the **Université de Montréal**, the Canadian Network for Vaccines and Immunotherapeutics (CANVAC) and its Institute of Research in Immunovirology and Cancer are learning about how the immune system defends itself. These studies are contributing to a Canadian AIDS vaccine trial, and could lead to vaccines for cancer, SARS and Hepatitis C. Vaccines could be a promising alternative to the current regime of drug cocktails and other therapies, which often have serious side-effects and furthermore, are not affordable by most people around the world.*

For example, Canada increased its output of biomedical publications by 25 percent over the years 1999-2003, compared to an overall global increase in biomedical publications of 4.4 percent. This productivity can be attributed to the joint investments and research funding support provided by the CFI, the Canada Research Chairs Program, the Canadian Institutes of Health Research and Genome Canada.[1]

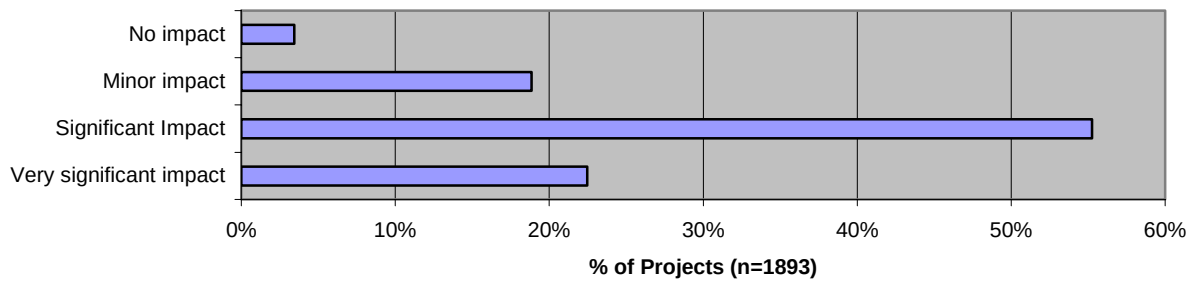
Through its investments in infrastructure, the CFI is helping to transform the way research is done in Canada, encouraging multidisciplinary, multisectoral approaches to problem-solving. Progress reports submitted to CFI for 2003-04 show that:

- 90 percent of project leaders are involved in multidisciplinary endeavors; and
- 90 percent of project leaders are collaborating with researchers across their institutions or in other institutions

Researchers within the institution, those at other institutions and researchers at private and public sector research organizations are frequently involved. Collaboration between universities and hospitals is intensifying.

It is estimated that presently, due to CFI infrastructure projects, over 15,000 researchers are able to pursue research that would not have been possible otherwise, and allowing them to be more productive, more multidisciplinary, and more competitive internationally.

Figure 1: Impact of the Infrastructure on Enhancing Opportunities for Multidisciplinary Research



[1] John J.M. Bergeron and Sean C. Taylor, "A national effort: Recent developments in Canadian biomedical and health research support," *EMBO reports*, Vol 5, No.8, 2004, p. 745.

Benefits to Canada

Achieving benefits for Canada is one of the main objectives of CFI infrastructure projects, and it is evident that researchers, institutions and their partners are making significant strides in this area. Progress reports indicate that CFI funding has set the conditions for the translation of innovative research into tangible economic and social benefits for Canadians. The availability of high quality infrastructure and the research it supports are important enablers of innovation, but ultimately the research must be transferred to, and exploited by others to create social and economic benefits. Collaborative partnerships with the private and public sectors are key to the transfer of research results, as these companies and agencies are most likely to deliver the economic and societal improvements.

CASE IN POINT

*The Canadian Light Source synchrotron at the **University of Saskatchewan** accelerates electrons to nearly the speed of light in a huge, ring-shaped vacuum chamber. It acts as a giant microscope with an intense beam that illuminates the structure of molecules. This advanced knowledge will speed the design of new medicines, improve the detection of environmental pollutants, raise the nutritional quality of food, and assist in the development of advanced materials for electronic, automotive and aerospace applications.*

Direct economic benefits result from commercialization activity. Along with the federal granting agencies, the CFI has a role in supporting such activity across the Canadian higher education sector. CFI reports on commercialization activity at Canada's universities and research hospitals are very encouraging.

Generally speaking, the increased investment and funding of the higher education sector in the last few years, including its university liaison and technology transfer offices, has resulted in more commercialization activity in Canada. For example, there was a 166 percent increase in licensing income received at Canadian universities between 1999 and 2002. The increase for the same period for the U.S. was 100 percent.

CASE IN POINT

*Lead contamination is a major public health risk, especially for children. At **Mount Allison University** in New Brunswick, researchers are using X-ray fluorescence to measure lead accumulation in bone. This technique is a non-invasive procedure using gamma and X-rays, and will determine a patient's long-term exposure. Mount Allison is one of only two locations in the world with this capability. The research team will be working with hospitals in the near future to initiate investigations within populations and determine sources of lead exposure.*

Canadian universities have also been more active than their U.S. counterparts in forming spin-off companies around R&D. An exploration of preliminary data for nine research-intensive universities across the country shows that of the 301 such companies created since 1995, 219 (or 73 percent) have survived. These companies are a significant factor in the development of Canada's knowledge economy, forming approximately 15 percent of R&D-based start-up companies[2].

Useful as they are, the performance indicators of commercialization efforts—patents awarded, licensing revenue and spin-off companies—are not the ultimate measure of the economic and social benefits of CFI investments. Like other public sector organizations that invest in R&D, the CFI is engaged in efforts to explore and expand possible measures of social and economic

[2] These companies are defined as spending more than 50 percent of revenue on R&D, and whose operations are being financed by lenders or investors rather than re-invested customer revenue.

activity that result from its investments. These efforts indicate to date that 27 percent of CFI projects have produced measurable economic benefits, including new or improved products, cost savings, private sector job creation and the creation of spin-off firms. In addition, 20 percent of the CFI progress reports note that research enabled by the infrastructure has translated into environmental, social and health improvements, as well as in improved public policies.

CASE IN POINT

More than 20 percent of Canadians suffer from severe chronic pain. Researchers at the ***Lawson Health Research Institute*** *in London, Ontario have designed a portable, hand-held device to treat different types of chronic pain, including arthritis and fibromyalgia. The inventors are specialized in bioelectromagnetics, a domain that investigates how weak-pulsed magnetic fields can "talk" to areas of the brain that process brain signals. Patients from St. Joseph's Health Care London Outpatient Clinics report significant pain reduction. Fralex Inc.—owned by Lawson, the University of Western Ontario and the inventors—has already begun to license the technology.*

Canadian cities in knowledge-based growth

It is widely perceived that economic growth takes place on the basis of "technology clusters" that comprise a geographical concentration of R&D-based firms, service companies, research organizations and intermediaries whose collaborative and competitive action gives rise to economic and social development of the region. Canada's technology clusters, large and small, are developing across the country, centered on domains such as biotechnology, information and communications technology, fuel cells, pharmaceuticals and more. Cities such as Lethbridge, Chicoutimi, Saskatoon and Truro have become global centres of scientific expertise—in areas such as neuroscience, power transmission in northern climates, synchrotron technology and agriculture. Vancouver, Winnipeg and Waterloo are renowned for research into sustainable power generation, HIV/AIDS in Africa and water quality.

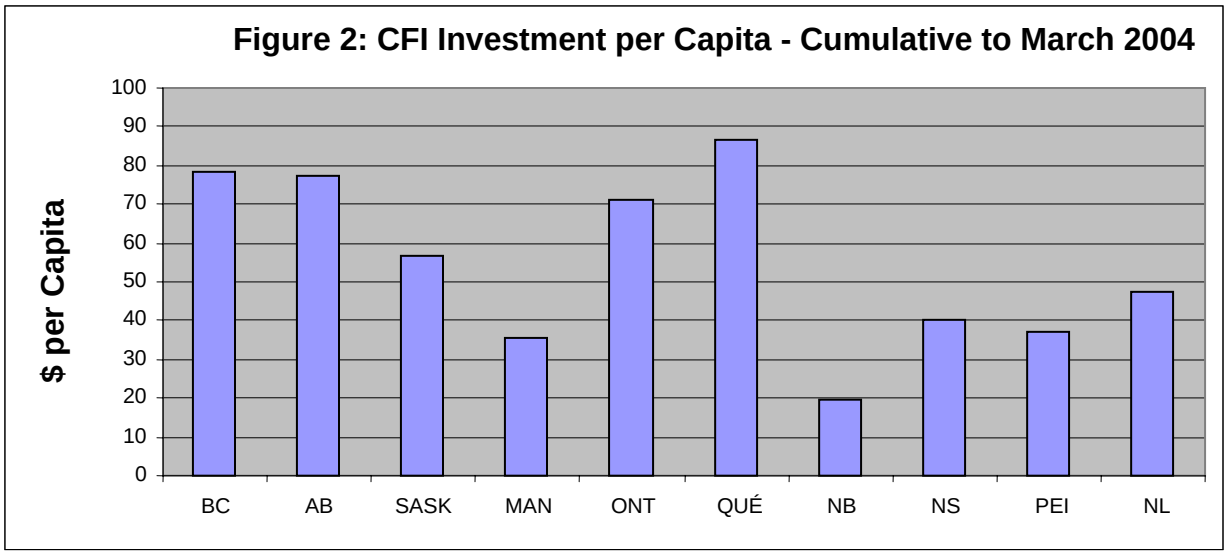
CASE IN POINT

Chemists and their research students at the ***King's University College*** *Centre for Molecular Structure in Edmonton are teaming up with Environment Canada to study the environmental effects of large fires. They are analyzing particulate matter from planned burns to determine if carcinogenic compounds are present at levels that would impair health. The results will be used to inform air-quality forecasts of communities affected by forest fires and smoke.*

State-of-the-art infrastructure serves as a magnet for the attraction of investment, and helps to forge linkages between research institutions and other agents of innovation at the local level. Currently, CFI-funded infrastructure projects are located in **59** municipalities across Canada. A total of **118** Canadian universities, colleges, research hospitals and not-for-profit research organizations house CFI-funded research infrastructure.

CASE IN POINT

Every year, 65,000 Canadians die from heart attacks, and 14,000 die from strokes. At the ***St. Boniface General Hospital*** *in Winnipeg, the newly-established I.H.Asper Clinical Research Institute is poised to launch a program of "translational research" that will link challenging problems at patient bedsides with rapidly advancing research and clinical trials. A world-class multidisciplinary team has been assembled in Winnipeg whose work will result in the development of new technologies and novel drugs.*



Raising Canada's global attractiveness for R&D

The issue of international S&T linkages for prosperity and quality of life is critical in the case of Canada, a trading nation with a limited domestic market. Canada accounts for 1.9 percent of the global economy, and 0.5 percent of the global population, according to the International Monetary Fund. Despite its small size, Canada has been producing proportionately more scientific knowledge, generating approximately 4 percent of the world's pool. However, this edge is being eroded. Challenges are coming from different directions, such as newly industrialized and emergent economies, for example Korea and China. Canada's economic future depends on being nimble, strategic and knowledge-based. It must deftly position its S&T strengths in a manner that assures linkages with the world R&D leaders and help key R&D alliances to flourish.

As a responsible, industrialized country with a role in multilateral organizations, and influenced by global phenomena, Canada must maintain a world-class scientific capability to enable it to participate in global S&T problem-solving. Examples include climate change, new energy sources, infectious disease, food safety and biodiversity. Projects of this nature demand the ability to:

- share data from interlinked sub-projects that form a thematic whole,
- access world-level, large-scale scientific facilities, and
- cooperate in research across geographic boundaries.

The CFI has broken new ground in international S&T for Canada. Following a 2000 report by the Advisory Council on S&T, which stated that "Canada [was] not develop[ing] critical mass in international S&T networks", the CFI was provided with $200M by the federal government to begin to address this situation. One year later, the CFI launched a Call for Proposals for two funds.

Under the *International Joint Ventures Fund,* infrastructure funding was awarded to three world-class projects with facilities in Canada:

- a research icebreaker;
- a 5-beam advanced laser; and

- an underground science facility to augment and enhance the Sudbury Neutrino Observatory.

Under its *International Access Fund*, the CFI funded projects that permitted Canadian researchers access to world facilities, giving a dramatic boost to Canadian partnerships in global research endeavours.

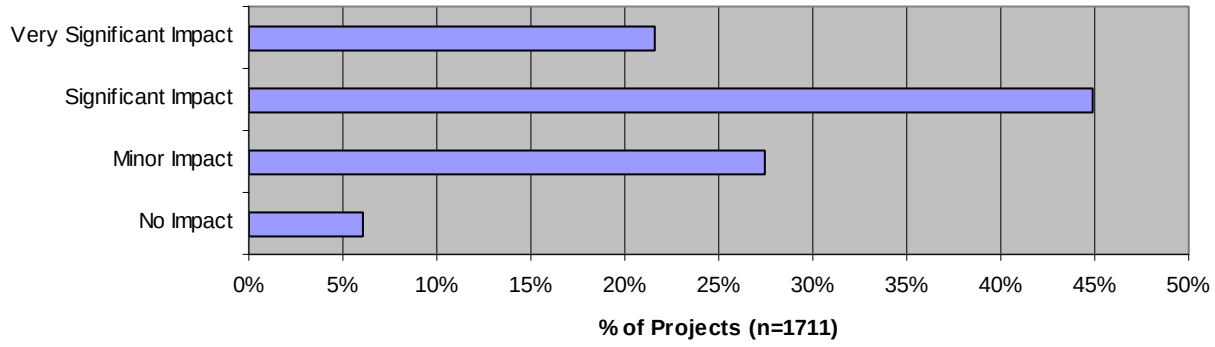
CASE IN POINT

The meltdown of the Arctic has already begun under the pressure of global warming, and is having a noticeable effect on habitat and ecology. This impact is expected to be very significant over time, affecting the lives and livelihoods of human inhabitants and wildlife, including migration patterns of mammals and birds, northern vegetation, roads and buildings, international shipping choices…the list is long. The ***Amundsen*** *is the name of a new* ***Canadian arctic research vessel*** *and icebreaker funded by the CFI as an International Joint Venture project. The retrofitted Coast Guard vessel launched its first, year-long expedition as a research platform in September 2003, to the Beaufort Sea in the Arctic Ocean. The Amundsen is central to the work of ArcticNet, a new Networks of Centres of Excellence that coordinates research projects of arctic science specialists across different domains—environment, health and social science. The research being undertaken with the sophisticated equipment on board will help to assess the impact of climate change and assist with the development of policies of mitigation and adaptation. The direct involvement of Northerners in the scientific process is a primary goal of the research, ensuring stewardship of the Canadian north far into the future. ArcticNet and the Amundsen are helping Canada to maintain its global edge in arctic science, presenting a beacon of attraction for the best teams from all over the world, including the U.S., Japan, Denmark, Sweden, Norway, Poland, the U.K., Spain and Belgium.*

More generally, CFI infrastructure has helped to make Canada a preferred country for undertaking R&D. According to 2003-04 progress reports, infrastructure projects have:

- fostered international collaborations in 80 percent of cases; and
- attracted new funding from international sources in 40 percent of cases.

Figure 3: Impact of the Infrastructure on International Collaboration



Communication with Canadians

Keeping Canadians informed about the impact and return on investment of research infrastructure continues to be a top CFI priority. Activities include:

- A supplement in a special edition Maclean's magazine devoted to innovation, released in October 2004. The 24-page supplement describes 55 success stories at Canada's universities, colleges, research hospitals and non-profit research institutes, running the gamut from economic development tools, waste recycling through bioprocessing, locating novel energy sources, and more. The CFI spearheaded the production of this

contribution, collaborating with federal granting agencies, private and voluntary sector partners and the research institutions themselves.

- For a new CanWest Global television series called Canada Communicates, the CFI produced a 27-minute video featuring researchers who had received infrastructure funding. It aired across Canada in June 2004, and interest by the producers has been expressed for another airing in the near future.
- The CFI's electronic magazine, *InnovationCanada.ca*, has a growing audience who are clicking into the website to discover more stories of Canadian innovation, at the rate of approximately 350,000 hits per month.
- In late 2002, the CFI launched a book and Web-based interactive essays by leading Canadian researchers, called *inno´va-tion* and *inno´v@-tion*^{2}. General dissemination has already been achieved in Canada through bookstores and via the CFI Website, and attention is now focussed on youth and educators. This year, the products were distributed at the Euroscience Conference in Stockholm, Sweden, at the Aventis Biotech Challenge for youth and teachers, the Youth Science Foundation of Canada and the Federation of Canadian Municipalities.
- The 2004 Annual Public Meeting was held in Regina, Saskatchewan in October. The event was widely publicized and the Canadian public was encouraged to attend. CBC Radio's host of *Quirks and Quarks* Bob MacDonald gave a fascinating presentation about innovative Canadian science projects and topics—from dark matter at the edge of the universe to clean fuels in the tanks of our cars—and everything in between.
- Each year the CFI produces an Annual Report that is tabled in Parliament by the Minister of Industry. The Annual Report includes information on all CFI programs and investments to date, and includes the financial statements prepared by external auditors.

The Way Forward

Midway through the mandate: taking stock

Since 1997, the CFI has invested in over 3,600 projects across Canada, with most of the activity occurring in the 2002-2004 period. On average, $400M/year will have been committed during the 1997-2005 period. The remaining resources ($750M) would permit investment in the 2006-2010 period at a rate of about half of what it has been, or $200M/year.

It is evident from the analysis of institutional and project progress reports on the CFI awards that these investments have had a significant impact on strengthening the country's capacity for innovation and laying the foundations of the country's future prosperity and well-being. The research landscape in Canada has changed dramatically since the mid-1990's, now that the highly qualified people, tools and research funding are flowing within and to Canada from domestic and international sources. World-class research centres are emerging at Canadian institutions that are helping Canada to maintain and build on its areas of R&D strengths, and are critical for its economic future. Community linkages and technology clusters large and small are springing up in Canadian cities that, in the long term, lead to training in technology, jobs and economic growth.

A recent survey[3] indicates that the great majority of Canadians (87 percent) have a favourable attitude to science, research and development, and believe that it is beneficial for Canada. Canadians are interested in science and technology, with 93 percent stating that they would be interested in learning more about new scientific discoveries. Canadians are very supportive of university-based research, with 89 percent stating that Canada needs to invest more in these institutions, and 86 percent considering that university research brings long-term benefits to Canadians and Canadian society. Clearly, science and research have become very important and top of mind for Canadians, who see the promise that R&D offers for the future.

Nevertheless, the air of optimism is tinged with a certain anxiety and questions at the level of the research institutions. Can this activity be sustained? Without proper signals of commitment, there is a high risk that the best researchers will be attracted to other jurisdictions. How should the investments already made be protected? How should the remaining resources be allocated?

It is an appropriate time to take stock. Over the past year, the CFI Board has been reflecting on future directions. While retaining its focus on investment in research infrastructure as a constant, the Board has agreed on an approach of continuous strategic planning. This will permit it to adapt to evolving Canadian needs for infrastructure in a changing research environment, domestically and globally. A new President and CEO, Dr. Eliot A. Phillipson, joined the CFI in July 2004. Consultation has been undertaken with research institutions and researchers, as well as various funding partners, and this continues in the context of a series of institutional visits by the new President in the fall of 2004.

Challenges and opportunities

It is clear from analyses of progress reports, and consultations to date that it is critical that research infrastructure investments be maintained and operated on the basis of adequate funding, and that infrastructure be updated or replaced as it nears the end of its useful life. Research infrastructure is rapidly evolving worldwide, and the availability of the latest infrastructure can determine the ability of a country's researchers to maintain their edge in competitive research domains, and to participate in leading world consortia. Retaining the highly skilled personnel who operate these often highly complex facilities is also vital, given the investment in time, money and effort dedicated to setting up the infrastructure. The momentum that has been achieved must be maintained to protect the existing investments by the CFI and other partners, and to continue to support Canadian research efforts in the future.

Research infrastructure has been shown to be one of several essential features for technology clusters, which, on the basis of need and initiative of companies, often form around academic research institutions, government research laboratories and other non-profit research organizations. Across Canada, the CFI, provincial governments and private sector partners have invested in infrastructure that has the potential to lend itself to local economic growth in the long term, and these investments should be protected and enhanced.

Attracting academic staff of high calibre, and providing up-to-date training to young researchers, is dependent on appropriate, leading-edge tools to do the job, including research infrastructure.

[3] EKOS Research Associates Inc., "Rethinking Science and Society: Public Survey Findings," September 2004.

Canadian universities will continue to confront a significant challenge in attracting quality faculty, as the demand is and will continue to be intense around the world. Indeed, there are indications that various countries are intent on designing programs for the attraction of staff not unlike the Canada Research Chairs Program, and the accompanying Canada Research Chairs Infrastructure Fund. The faculty renewal effort required in the next few years in Canada is expected to be enormous—some estimates suggest 60 percent—in addition to the need for the hiring of new faculty for expanding areas of research and teaching.

Until now, the CFI has pursued a strategy designed to empower institutions, either individually or collectively, to propose infrastructure projects in their priority areas of development. This strategy has evolved progressively to a point where the CFI is inviting projects that centre on platform technologies capable of serving the needs of groups or communities of researchers. However, certain facilities and equipment are demanding of a national-level strategy to mount them and ensure access, such as high performance computing. To respond to pan-Canadian infrastructure facilities, the CFI's programs and financial resources will have to be adapted and augmented appropriately.

Conclusion

The CFI is successfully meeting its mandate to strengthen the ability of Canadian universities, colleges, research hospitals and other not-for-profit institutions to carry out world-class research and technology development for the benefit of Canadians. Its infrastructure investments have clearly had a dramatic impact on the R&D landscape in Canada, paving the way for the transformation to a knowledge-based economy. Maintaining S&T capability to prosper in the face of global issues and competitive pressures is vital for present and future generations of Canadians.

Appendix 1: Projects Approved by the CFI

(Cumulative to June 29, 2004)

Institution	Maximum CFI contribution	# of projects
B.C. Cancer Agency	$27,800,000	1
British Columbia Institute of Technology	$639,990	3
Emily Carr Institute of Art and Design	$1,518,032	1
Forintek Canada Corp.	$1,362,000	2
Malaspina University-College	$4,275,744	6
Okanagan University College	$2,002,271	10
Open Learning Agency	$514,000	1
Paprican - BC	$2,500,000	1
Royal Roads University	$250,000	2
Selkirk College	$543,756	1
Simon Fraser University	$24,680,668	64
University College of the Cariboo	$365,241	2
University of British Columbia	$197,675,746	239
University of Northern British Columbia	$3,569,650	15
University of Victoria	$55,264,678	64
Vancouver Aquarium Marine Science Centre	$617,859	1
Total - British Columbia	$323,579,635	413
Athabasca University	$704,566	5
King's University Collge (The)	$298,708	2
Lethbridge Community College	$716,740	1
Olds College	$1,807,727	4
Southern Alberta Institute of Technology	$406,400	1
TRLabs	$3,727,387	1
University of Alberta	$148,906,759	201
University of Calgary	$78,290,167	134
University of Lethbridge	$3,476,528	12
Total - Alberta	$238,334,982	361
First Nations University of Canada	$351,924	1
University of Regina	$6,927,003	26
University of Saskatchewan	$50,544,718	85
Total - Saskatchewan	$57,823,645	112
Brandon University	$888,196	5
Red River College of Applied Arts, Science and Tech.	$550,788	1
St. Boniface General Hospital	$1,050,809	2
University of Manitoba	$37,221,204	106
University of Winnipeg	$1,400,176	7
Total - Manitoba	$41,111,173	121
Algonquin College of Applied Arts and Technology	$781,244	1
Baycrest Centre for Geriatric Care	$10,712,000	1
Brock University	$8,598,310	27
Carleton University	$66,622,773	58
Fanshawe College	$369,473	2
Lakehead University	$5,712,230	29
Laurentian University	$3,639,524	22
London Health Sciences Centre	$3,196,857	1
London Regional Cancer Center	$211,500	1

McMaster University	$77,205,387	149
Mount Sinai Hospital	$37,127,237	6
Niagara College	$797,110	1
Nipissing University	$241,753	2
Perimeter Institute for Theoretical Physics	$5,624,892	1
Queen's University	$54,593,141	107
Robarts Research Institute	$4,890,982	3
Royal Military College of Canada	$2,230,009	6
Ryerson University	$3,323,402	27
Sault College	$1,532,535	3
Seneca College	$676,035	2
Sheridan College Institute of Technology & Advanced Learning	$1,584,492	3
Sir Sandford Fleming College	$1,060,487	2
St. Joseph's Health Centre of London	$2,864,000	1
St. Joseph's Hospital (Hamilton)	$11,262,736	2
St. Michael's Hospital	$3,520,595	2
Sunnybrook and Women's College Hlth Sc. Centre	$16,597,506	4
The Hospital for Sick Children	$11,976,959	5
Trent University	$8,557,416	23
University Health Network	$28,193,890	6
University of Guelph	$59,317,546	102
University of Ottawa	$66,468,894	114
University of Toronto	$170,135,148	288
University of Waterloo	$63,789,803	105
University of Western Ontario	$91,772,408	123
University of Windsor	$9,054,375	47
Wilfrid Laurier University	$6,942,095	31
York University	$16,618,432	55
Total - Ontario	$857,803,176	1362
Bishop's University	$164,595	2
CÉGEP de Chicoutimi	$152,119	1
CÉGEP de La Pocatière	$957,360	2
CÉGEP de l'Abitibi-Témiscamingue	$594,000	1
CÉGEP de Lévis-Lauzon	$1,017,104	2
CÉGEP de Rimouski	$204,000	1
CÉGEP de Saint-Jérôme	$2,103,143	1
CÉGEP de St-Hyacinthe	$1,286,360	3
CÉGEP de Trois-Rivières	$1,936,951	4
CÉGEP Vanier College	$140,170	1
Collège de Maisonneuve	$558,840	3
Collège Shawinigan	$683,000	2
Concordia University	$21,691,361	36
École Polytechnique de Montréal	$46,063,904	33
HEC Montréal	$1,987,328	5
Institut de tech. agroalimentaire, Campus de La Pocatière	$52,700	1
Institut de tech. agroalimentaire, Campus de Saint-Hyacinthe	$879,597	1
McGill University	$164,772,807	209
Université de Montréal	$135,855,675	201
Université de Sherbrooke	$27,701,594	70
Université du QC École de technologie supérieure	$10,853,764	16
Université du QC INRS	$51,560,776	37
Université du Québec à Chicoutimi	$5,615,775	17
Université du Québec en Outaouais	$2,019,533	9

Université du Québec à Montréal	$9,122,334	37
Université du Québec à Rimouski	$9,064,895	14
Université du Québec à Trois-Rivières	$7,381,280	18
Université du Québec en Abitibi-Témiscamingue	$2,877,261	9
Université du Québec Télé-université	$3,479,044	6
Université Laval	$142,570,845	156
Total - Québec	$653,348,115	898
Collège communautaire du Nouveau-Brunswick	$187,338	1
Mount Allison University	$1,598,316	7
St. Thomas University	$249,975	1
Université de Moncton	$2,107,284	14
University of New Brunswick	$11,146,074	53
Total - New Brunswick	$15,288,987	76
Acadia University	$1,803,632	9
Dalhousie University	$26,759,376	97
GPI Atlantic	$126,000	1
Mount Saint Vincent University	$345,591	4
Nova Scotia Agricultural College	$4,512,151	14
Nova Scotia Community College	$1,905,000	3
Saint Mary's University	$1,588,486	11
St. Francis Xavier University	$1,512,216	11
University College of Cape Breton	$393,833	4
Total - Nova Scotia	$38,946,285	154
University of Prince Edward Island	$5,105,576	15
Total - Prince Edward Island	$5,105,576	15
College of the North Atlantic	$670,060	1
Marine Institute	$350,000	1
Memorial University of Newfoundland	$24,674,332	53
Total - Newfoundland and Labrador	$25,694,392	55
Total - Province	$2,257,035,966	3567
A National Ultrahigh-Resolution Electron Microscopy Facility for Nanoscale Materials Research	$7,083,799	1
Canadian Light Source	$56,400,000	1
Canadian Molecular Cytogenetics Platform	$4,512,925	1
High Throughput Macromolecular Crystallography Beamline at the Canadian Light Source	$4,174,285	1
National "System-on-Chip" Research Network	$15,892,932	1
National Core Facility to Monitor Immune Responses in Humans to Vaccines Against Infectious Diseases and Cancer	$5,292,839	1
National Microelectronics and Photonics Testing Collaboratory	$9,310,238	1
National Neutron Reflectometer Facility	$985,782	1
National Site Licensing Project	$20,000,000	1
National Solid State Ultrahigh Field NMR Facility	$4,440,300	1
Research Data Centres	$5,380,089	1
Resonant Elastic and Inelastic Soft X-ray Scattering Beamline at the Canadian Light Source	$3,334,065	1
Soft X-ray Beamline for Microcharacterization of Materials at the Canadian Light Source	$1,681,324	1
Text Analysis Portal for Research (TAPoR)	$2,629,223	1
The BioMedical Imaging and Therapy (BMIT) Beamline at the Canadian Light Source	$6,817,376	1

VESPERS (VEry Sensitive Elemental and Structural Probe Employing Radiation from a Synchrotron) at the Canadian Light Souce	$1,801,639	1
Total - Canada National Projects	$149,736,816	16
Total - Infrastructure projects	$2,406,772,782	3583
Infrastructure Operating Fund – Maximum Allocation *	$362,484,461	-
Grand Total	$2,769,257,243	3583

* This allocation represents 30 percent of the maximum CFI contribution for projects approved starting July 2001 under the Innovation Fund and the New Opportunities Fund.

Appendix 2: CFI Investments by Area of Application

Area of Application	# of projects	Maximum CFI contribution *
Exploration and Exploitation of the Earth	162	$139,166,784
Infrastructure and General Planning of Land-Use	216	$110,987,603
Pollution and Protection of the Environment	353	$160,352,728
Health	1395	$1,030,547,268
Production, Distribution and Rational Utilization of Energy	65	$70,300,914
Renewable Resource Production and Technology	231	$111,022,751
Industrial Production and Technology	686	$430,275,423
Social Structures and Relationships	213	$67,552,295
Exploration and Exploitation of Space	41	$31,056,742
Other Research	221	$255,510,274
	3583	**$2,406,772,782**

* Does not include the Infrastructure Operating Fund (IOF)

Appendix 3: CFI Investments in Canadian Municipalities

Municipality	# of projects	Maximum CFI contribution *
Antigonish	11	$1,512,216
Athabasca	5	$704,566
Bathurst	1	$187,338
Brandon	5	$888,196
Burnaby	68	$25,834,658
Calgary	135	$78,696,567
Cape Breton Region	5	$570,883
Castlegar	1	$543,756
Charlottetown	15	$5,105,576
Edmonton	204	$152,932,854
Fredericton	54	$11,396,049
Gatineau	9	$2,019,533
Glenhaven	1	$126,000
Guelph	102	$59,317,546
Halifax	114	$30,421,403
Hamilton	153	$98,181,145
Kamloops	2	$365,241
Kelowna	10	$2,002,271
Kingston	115	$82,026,320
La Pocatière	3	$1,010,060
Lethbridge	13	$4,193,268
London	135	$107,849,141
Lévis	2	$1,017,104
Moncton	14	$2,107,284
Montréal	543	$401,719,111
Nanaimo	6	$4,275,744
North Bay	2	$241,753
Oakville	3	$1,584,492
Olds	4	$1,807,727
Ottawa	175	$158,313,211
Peterborough	25	$9,617,903
Prince George	15	$3,569,650
Québec	199	$197,610,665
Regina	27	$7,278,927
Rimouski	15	$9,268,895
Rouyn-Noranda	10	$3,471,261
Sackville	7	$1,598,316
Saguenay	18	$5,767,894
Saint-Jérôme	1	$2,103,143
Sainte-Hyacinthe	4	$2,165,957
Saskatoon	87	$113,762,094
Sault Ste. Marie	3	$1,532,535
Shawinigan	2	$683,000

Sherbrooke	72	$27,866,189
St-Catherines	27	$8,598,310
St. John's	54	$25,024,332
Stephenville	1	$670,060
Sudbury	22	$3,639,524
Thunder Bay	29	$5,712,230
Toronto	396	$298,881,204
Trois-Rivières	22	$9,318,231
Truro	14	$4,512,151
Vancouver	248	$243,494,912
Victoria	66	$55,514,678
Waterloo	137	$76,356,790
Welland	1	$797,110
Windsor	46	$8,979,199
Winnipeg	116	$40,222,977
Wolfville	9	$1,803,632
	3583	**$2,406,772,782**

* Does not include the Infrastructure Operating Fund (IOF)

Appendix 4: CFI Governance and Accountability