Canada Foundation for Innovation
Fondation canadienne pour l'innovation

2007 Report on Results:

An Analysis of Investments in Research Infrastructure

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Executive Summary

Introduction

The Canada Foundation for Innovation (CFI) is an independent corporation created by the Government of Canada to fund research infrastructure. The CFI's mandate is to strengthen the capacity of Canadian universities, colleges, research hospitals, and non-profit research institutions to carry out world-class research and technology development that benefits Canadians. As of September 15, 2007, the CFI has committed more than $3.75 billion in support of 5,400 projects at 128 research institutions in 64 municipalities across Canada.[1]

The CFI has committed more than $3.75 billion in support of 5,400 projects.

Purpose

The purpose of this report is to document the outputs and outcomes of CFI-funded infrastructure as they relate to the overall objectives of the CFI and its programs. The aggregation and analysis of project progress report data serves to provide data which informs issues of relevance for planning and policy by examining:

- societal and economic benefits to Canada;
- levels of attraction and retention of researchers and other knowledge workers;
- progress related to international competitiveness and reputation;
- productive networks and research collaborations.

Aggregation of project data informs planning and policy.

In addition, the data presented in this report are used for communicating results to stakeholders as well as informing future program evaluations and other special studies.

Methodology and Sample

By June 15 of each year, institutions funded by the CFI are required to submit project progress reports for each funded project. Project reports are required to be submitted for every project for five years following the finalization of the award. As of July 24, 2007, the CFI had received 3,020 reports of the 3,169 required, representing a submission rate of more than 95%.

The submission rate for the 2007 Report on Results is more than 95%.

[1] Canada Foundation for Innovation. CFI Overview <http://www.innovation.ca/about/index.cfm?websiteid=5>

The data included in the project progress reports represent a heterogeneous aggregate sample of projects. Although this data can be practical for measuring the CFI's progress towards achieving its objectives, there are limitations to take into account when interpreting the data including self-reporting, size and complexity of projects, diversity of projects, timing of project funding, the potential for double counting, and attribution.

Highlights

Research infrastructure leads to social and economic benefits

For projects funded since 2002, the availability of the infrastructure led to the:

- creation of more than 4,000 public/private sector jobs;
- generation of 1,750 intellectual property rights;
- development of 760 new or improved products, processes or services;
- development of 613 new or improved public policies or programs;
- creation of 198 spin-off companies.

The availability of the infrastructure has led to the creation of 198 spin-off companies.

Fueling Brain Gain

In the past year:

- 35% of project leaders report that the availability of the infrastructure was an important factor in their decision to join the institution;
- almost 20,000 internal researchers (including the researcher, other principal researchers, and other faculty at the institution) advanced their research by using CFI-supported infrastructure;
- overall, 2,343 new researchers were recruited. Of this number, approximately half (46%) were recruited internationally.

20,000 internal researchers advanced their research.

Meeting Canada's need for knowledge workers

- In the past year, more than 16,000 Post-Doctoral Fellows/Graduate Students were attracted to the institutions, in part due to the availability of the infrastructure.
- For projects funded since 2002, more than 37,000 Post-Doctoral Fellows/Graduate Students have used the infrastructure as a key resource in their research project. Of this group, 58% have stayed at the institution as trainees, 11% have joined another Canadian academic institution, college or research hospital, and 9% have joined the Canadian private sector.
- For projects funded since 2002, almost 11,000 technical personnel have been trained on the use and maintenance of the research infrastructure. Of this group, 69% have stayed at the institution, 11% have joined another Canadian academic institution, college or research hospital, and 9% have joined the Canadian private business sector.

More than 37,000 students have used the research infrastructure as a key resource in their research project.

Enhancing Canada's international reputation

- In the past year, more than 16,000 visiting researchers from around the world made use of state-of-the-art infrastructure at Canadian universities, colleges, and research hospitals.

An additional 16,000 visiting researchers made use of CFI-funded infrastructure.

Fostering collaboration

For projects funded since 2002:

- 53% of the project leaders report that the infrastructure has contributed to fostering international collaboration in a significant/critical manner, while 40% reported that the infrastructure fostered local or regional collaboration;
- more than 9,000 internal/external research collaborations have occurred. More specifically:
  - 1,556 with an institution outside of Canada;
  - 1,109 with the private sector within Canada;
  - 1,941 with an institution within Canada;
  - 2,513 within the institution.

More than 9,000 internal and external research collaborations.

Conclusion

The results of this analysis indicate that the research enabled by the CFI is increasing research capacity and having a profound effect on the research environment in Canada. Benefits of CFI investments however, go beyond increased research capacity. Institutions continue to report that the research enabled by CFI investments support the development of new products, processes, and services that support improvements to public policy, health, science, engineering, and the environment.

The CFI's objectives, practices, and results demonstrate its commitment to the principles outlined in the Government of Canada's S&T strategy.

The CFI's objectives, practices, and results demonstrate its commitment to the principles outlined in the Government of Canada's S&T Strategy, *Mobilizing Science and Technology to Canada's Advantage.* Through the provision of state-of-the-art infrastructure, the CFI will continue to play a major role in helping Canada's research community transform their ideas into innovations.

1.0 Introduction

The Canada Foundation for Innovation (CFI) is an independent corporation created by the Government of Canada to fund research infrastructure. As part of its funding agreement with the Government of Canada, the CFI has committed to supporting several national objectives.[2] They include:

1. To support economic growth and job creation; as well as health and environmental quality through innovation;
2. To increase Canada's capability to carry out important world-class scientific research and technology development;
3. To expand research and job opportunities for young Canadians; and
4. To promote productive networks and collaboration among Canadian post-secondary educational institutions, research hospitals and the private sector.

The CFI normally funds up to 40 percent of a project's infrastructure costs which are invested in partnership with eligible institutions and their funding partners from the public, private, and voluntary sectors who provide the remainder. Research infrastructure includes state-of-the-art equipment, buildings, laboratories, and databases required to conduct research.

The research enabled by CFI also supports the necessary conditions for sustainable, long-term economic growth, including the creation of spin-off ventures and the commercialization of discoveries, and supporting improvements to society, quality of life, health, the environment, and public policy. As of September 15, 2007, the CFI has committed more than $3.75 billion in support of approximately 5,400 projects at 128 research institutions in 64 municipalities across Canada.

[2] Funding Agreement between the Canada Foundation for Innovation and Her Majesty in Right of Canada. March 31, 2003, Page 1

2.0 Purpose and Scope

2.1 Purpose of the Report

The purpose of the Report on Results is to document the outputs and outcomes of CFI-funded infrastructure as they relate to the overall objectives of the CFI and its programs. The aggregation and analysis of project progress report data serves to provide data which informs issues of relevance for planning and policy by examining societal and economic benefits to Canada; levels of attraction and retention of researchers and other knowledge workers; progress related to international competitiveness and reputation; and productive networks and research collaborations.

In addition, the data presented in this report are used for communicating results to stakeholders as well as informing future program evaluations and other special studies.

2.2 Scope of this Analysis

Project progress reports (PPR) address key areas related to infrastructure and personnel, as well as the research activities enabled by the infrastructure and overall benefits to Canada. Institutions are asked to provide both quantitative and qualitative data describing activities and outcomes over the past year.[3] It should be noted that the report presents the aggregate results of project funding for the identified sample and does not attempt to develop national or international comparisons of results.

The focus of the 2007 Report on Results is on projects funded since 2002 and submitted for the 2006-07 fiscal year (April 1, 2006 to March 31, 2007).

[3] There are also instances where data is requested since the beginning of the project which encompasses projects funded since 2002.

Table 1 shows an overview of the funds included in the 2007 analysis.

Table 1. Overview of CFI Funds Reporting in 2007 Sample

Fund	Number of Projects Reporting by Year					
	2002-03	2003-04	2004-05	2005-06	2006-07	Total
New Opportunities	238	383	352	339	141	**1,453**
CRC Infrastructure	212	236	241	200	122	**1,011**
Innovation	127	66	66	58	11	**328**
Leaders' Opportunity*	0	0	0	0	176	**176**
CFI Career Awards	1	7	9	7	1	**25**
Research Development	6	3	0	0	0	**9**
Research Hospital	0	0	0	1	7	**8**
International Access	3	3	0	0	0	**6**
International Joint Ventures	0	3	0	0	0	**3**
Exceptional Opportunities	0	0	1	0	0	**1**

* *In 2005-06, the New Opportunities Fund, the CRC Infrastructure Fund, and the Career Awards Fund merged into the Leaders' Opportunity Fund.*

Additional information and fund descriptions may also be obtained from the CFI Policy and Program Guide at http://www.innovation.ca/programs/index.cfm?websiteid=253.

3.0 Methodology

3.1 Data Collection Procedures

By June 15 of each year, institutions are required to submit a PPR for each funded project. Progress reports are required to be submitted for every project for five years following the finalization of the award (i.e. award agreement put in place).

PPR forms and instructions are available on the CFI website by April 1 of each year. Individual PPR are prepared by project leaders and reviewed, assembled and submitted by their host institutions. A copy of the 2007 Project Report Form is available at http://www.innovation.ca/cfionline/index.cfm?websiteid=31

3.2 Known Data Limitations and Characteristics

The data included in the PPRs represent a heterogeneous, aggregate sample of projects. Progress report data can be practical for measuring CFI's progress towards achieving the objectives set out for the organization and its funds. Yet, there are several considerations to take into account when interpreting the data.

Self-Reporting

Project reports are prepared by project leaders and compiled by their host institutions. Although a copy of the progress report is printed and filed for information and reference, given the shear volume alone, the coordinators of institutional relations are not tasked with the responsibility to review individual reports since they are not intended for individual monitoring of specific projects. There is however, little to no incentive for institutions to provide false or misleading data due to the fact that the reports have no bearing on potential future funding at this time. Rather, inaccuracies might occur due to a lack of administrative capacity to fill out forms comprehensively and track all numbers, especially for large, complex projects.

Size and Complexity of Projects

There is a great variety in terms of the size and complexity of research infrastructure projects. Smaller infrastructure projects, especially those intended to attract and retain researchers, are reasonably easy to plan, purchase, and develop, whereas large complex awards such as those provided under the Innovation Fund may take well over a year, and sometimes more, to plan, contract, purchase, construct, assemble, and develop. In sum, the scope and sophistication of such projects affects the speed of implementation, and generation of outputs and outcomes.

Diversity of Research Projects

There is a diversity of scientific disciplines and sectors covered by the projects. CFI-funded projects span all disciplines and the full range of higher education institutions including universities, colleges, research hospitals and non-profit research organizations. In addition, some projects fall at the more fundamental end of the spectrum of R&D, and some at the more applied.

Timing of Project Funding and Reporting

The CFI's database for progress reports submitted for the 2006-07 fiscal year contains information on projects that commenced anytime from April 1, 2002 to March 31, 2007. As a result, projects vary in terms of relative maturity and therefore the results achieved.

Double Counting

There remains a possibility that there is double-counting in the responses to questions asked related to attraction and retention, as researchers and students may regard more than one infrastructure project as a significant incentive to join institutions and/or pursue research careers. This would cause an overestimate of results. Alternatively, some data could be omitted, where data may be difficult to track or obtain with certainty. This would cause an underestimation of results.

Attribution

Finally, there is the dilemma of attribution. The research infrastructure investment made by the CFI is only one contribution to a larger endeavour. There are also the co-funders of the infrastructure, non-infrastructure support of research and training, and many other contributing factors that affect the ability to precisely attribute impacts.

Despite the limitations noted above, progress reports constitute an important and unique source of Canadian R&D information. It is noteworthy, as indicated above, that this database includes projects that span all disciplines and represent the full range of higher education institutions.

3.3 Data Sample

The CFI established July 24, 2007 as the cut-off date for inclusion of data in the PPR analysis. By this date, 3,020 reports had been received, of the 3,169 required, representing a submission rate of more than 95%. Table 2 shows the number of reports submitted for the year April 2006 to March 2007 and the corresponding response rate.

Table 2. Summary of 2007 Data Sample

Category	No. of Funded Institutions	No. of Funded Projects	No. of Reports Submitted	Response Rate (%)
A. Large Universities, Hospitals, and Not-for-Profit	43 (39.4%)	2,633 (83.1%)	2,536 (84.0%)	96.3%
B. Small Universities	45 (41.3%)	512 (16.2%)	476 (15.8%)	93.0%
C. Colleges	21 (19.3%)	24 (0.7%)	8 (0.20%)	33.3%
TOTAL	**109 (100%)**	**3,169 (100%)**	**3,020 (100%)**	**95.3%**

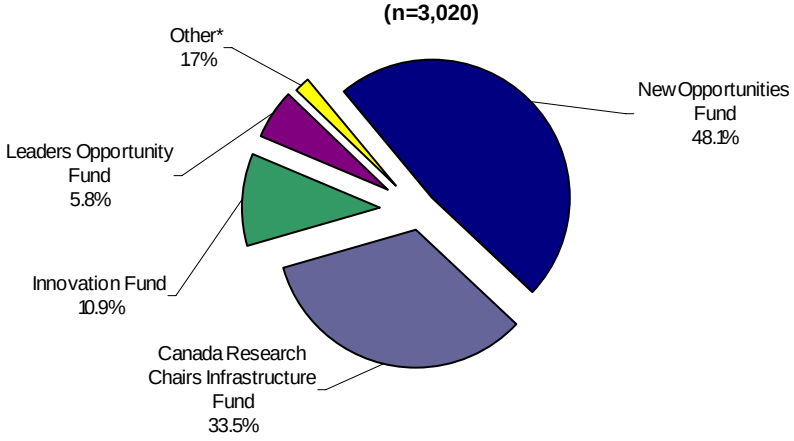
The CFI distinguishes between three broad categories of eligible institutions that may receive funding as revealed in Table 2. Universities are categorized based on whether they receive greater than or less than 1% of total federal funding agency awards. Category A institutions, therefore receive greater than 1% of total federal funding agency awards.

3.3.1 2007 Sample Profile

Composition of 2007 Sample by Fund

The 2007 sample consists of data distinguished by 10 fund categories. Projects classified as a New Opportunities Fund award represent over 48% of the sample. This is followed by the Canada Research Chairs Infrastructure Fund (34%) and the Innovation Fund (11%) as displayed in Exhibit 1.[4]

Exhibit 1 - Composition of the 2007 Sample by Fund
(n=3,020)



[4] Funds representing less than 1% of the total sample have been included in the 'other' category. They include CFI Career Awards (0.8%), the Research Development Fund (0.3%), the Research Hospital Fund (0.3%), the International Access Fund (0.2%), the International Joint Ventures Fund (0.1%) and the Exceptional Opportunities Fund (0.03%).

Composition of 2007 Sample by Fund and Total Dollar Value

Further to Exhibit 1, Table 3 shows the number of PPRs submitted for the 2007 sample and the associated size of the CFI award.

Table 3. Number of Reports Submitted by Award and Total Dollar Value, 2007 Sample

Fund	<$200k	$200K -$1M	$1M-$4M	$4M-$10M	$10M-$20M	>$20M	TOTAL (#/%)	TOTAL ($million)
New Opportunities Fund	1,087	363	3	0	0	0	**1,453 (48.1%)**	**$225 (13.0%)**
Canada Research Chairs Infrastructure Fund	833	178	0	0	0	0	**1,011 (33.5%)**	**$150 (8.7%)**
Innovation Fund	12	86	123	80	23	4	**328 (10.9%)**	**$1,101 (63.5%)**
Leaders Opportunity Fund	138	38	0	0	0	0	**176 (5.8%)**	**$26 (1.5%)**
CFI Career Awards	10	15	0	0	0	0	**25 (0.8%)**	**$6 (0.4%)**
Research Development Fund	4	5	0	0	0	0	**9 (0.3%)**	**$3 (0.2%)**
Research Hospital Fund	0	1	2	5	0	0	**8 (0.3%)**	**$43 (2.5%)**
International Access Fund	0	0	0	2	2	2	**6 (0.2%)**	**$80 (4.6%)**
International Joint Ventures Fund	0	0	0	0	0	3	**3 (0.1%)**	**$93 (5.4%)**
Exceptional Opportunities	0	0	0	1	0	0	**1 (0.03%)**	**$7 (0.4%)**
TOTAL	**2,084**	**686**	**128**	**88**	**25**	**9**	**3,020 (100%)**	**$1,734 (100%)**

The Innovation Fund (IF) represents the largest overall proportion of funding for the 2007 sample at $1.1 billion and 328 project reports. Whereas the New Opportunities Fund (NOF) represents 1,453 project report submissions and a total dollar value of $225 million. In contrast to Exhibit 1, the IF represents approximately 11% of the total project report forms submitted yet corresponds to over 63% of the overall dollar value of commitments for the 2007 data sample.

Table 3 also reveals that the majority (69%) of awards range in value of less than $200,000 and consist primarily of two funds; the NOF and the Canada Research Chairs Infrastructure Fund. In contrast, about 1% of the awards range in value of more than $10 million. This segment primarily consists of Innovation Fund awards ranging from $10 to $20 million.

Project by Sector

Table 4 shows the 2007 sample segmented by sector. It should be noted that project leaders self select the sector. Selections are not validated by CFI. The Government of Canada's S&T Strategy, *Mobilizing Science and Technology to Canada's Advantage*, identifies four target research priority areas. They include: Environment, Natural Resources, Health, and Information and Communications Technology. Moreover, a recent study[5] completed by the Council of Canadian Academies (CCA) reveals that Canada possesses four clusters of S&T strength:

1. Natural Resources;
2. Information and Communications Technologies;
3. Health and Related Life Science and Technologies;
4. Environmental S&T.

The data provided in Table 4 reveals that CFI project funding is generally aligned with the Government's priority areas and the four clusters of S&T strength as identified by the CCA.

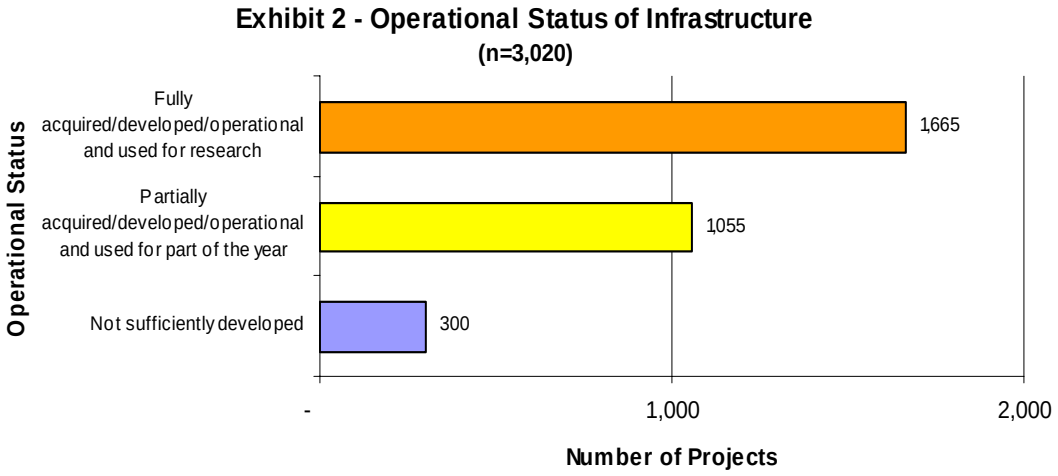
Table 4. Project by Sector, 2007 Sample

Sector	No.	%
Health	1,197	39.6%
Science	884	29.3%
Engineering	641	21.2%
Environment	298	9.9%
TOTAL	**3,020**	**100%**

Implementation Status and Project Maturity

A key consideration with respect to the 2007 sample is the implementation status of the infrastructure and the relative maturity of the individual projects. These issues have a direct impact on project results. Exhibit 2 reveals the operational status of the infrastructure. These data show that over 90% of the projects included in the 2007 sample were either partially or fully developed and were utilized for research for at least part of the year.

[5] Council of Canadian Academies, *The State of Science and Technology in Canada* (2006). Summary and Main Findings, page 5



Further to Exhibit 2, Table 5 shows the number of projects by year included in the 2007 sample and presents the level of operational status as identified by the institution.

Table 5. Project Maturity by Fiscal Year, *for projects funded since 2002*

Fiscal Year	Number of Years Since Award Finalization	Number of Projects	Fully Operational	Partially Operational	Not Sufficiently Developed
April 2006 to March 2007	1	458	35 (8%)	228 (50%)	195 (43%)
April 2005 to March 2006	2	605	187 (31%)	371 (61%)	47 (8%)
April 2004 to March 2005	3	672	369 (55%)	270 (40%)	33 (5%)
April 2003 to March 2004	4	701	555 (79%)	129 (18%)	17 (2%)
April 2002 to March 2003	5	584	519 (89%)	57 (10%)	8 (1%)

These data are important to consider because, typically in research and innovation, projects require a certain period of time to demonstrate results. For example, projects less than two years old typically generate fewer, if any, measurable outcomes because they are typically acquiring infrastructure, building or renovating research facilities, etc. To account for this time lag, the following section reports on those projects that were fully or partially operational (n=2,720) and used for research during the past year, unless otherwise noted.

4.0 Results

The Federal Government's S&T Strategy aims to build an S&T advantage for Canada based on three priority areas which include an Entrepreneurial Advantage, a Knowledge Advantage, and a People Advantage. The CFI plays a significant role in supporting the national strategy as support is intended to:

- strengthen Canada's capacity for innovation;
- attract and retain highly skilled research personnel in Canada;
- stimulate the training of Highly Qualified Personnel through research;
- promote networking, collaboration, and multidisciplinarity among researchers, institutions, and sectors;
- ensure the optimal use of research infrastructure within and among Canadian institutions.

Section 4.0 of this report addresses the key outputs and outcomes, as reported by institutions, of the CFI supported infrastructure by summarizing the information obtained from the 2007 PPRs.

4.1 Benefits to Canada

The CFI defines innovation as a process that begins with the creation of knowledge in research and continues through its applications, for the benefit of Canadian society. While the availability and quality of research infrastructure are important enablers of innovation, ultimately, it is the transfer of knowledge that leads to societal benefits.

Key Findings – Benefits to Canada

- ✓ A wide range of benefits have been realized as a result of CFI investments in infrastructure.
- ✓ Institutions continue to report that the research enabled by CFI investments support the development of new products, processes, and services that support improvements to public policy, health, science, engineering, and the environment.
- ✓ The CFI's objectives, practices, and results demonstrate its commitment to the principles outlined in the Government of Canada's S&T Strategy.

Table 6 is an overview of how CFI investments in infrastructure have helped to generate social and/or economic benefits for Canada for projects funded since 2002. Benefits may be generated directly by activities of researchers and trainees or by other users of the research infrastructure.

Table 6. Overview of Benefits to Canada *

	Number Responding Yes	% 'Yes'	If yes, how many #
Private/Public Sector Jobs	390	14%	4,388
Spin-off Companies	120	4%	198
New or Improved Public Policies and Programs	613	23%	N/A
New or Improved Products, Processes, or Services	760	28%	N/A
Patents	359	13%	1,882
Intellectual Property Rights	144	5%	1,794
Licensing Agreements	125	5%	377
Other Benefits	879	33%	N/A

n=2,691
** for projects funded since 2002*
N/A denotes that respondents are not asked to quantify their response

For projects funded since 2002:

Private/Public Sector Jobs

390 project leaders reported instances of their infrastructure facilitating the creation of over 4,000 public/private sector jobs. The types of jobs identified include: analysts, engineers, facility managers, programmers, research associates, and technicians.

Spin-off Companies

120 project leaders reported that the infrastructure has permitted the development of almost 200 spin-off companies. These include companies operating in the following sectors: Biotechnology, Engineering (All types), Manufacturing, Pharmaceutical, and Robotics.

> **A Materials Laboratory for the Evaluation and Characterization of New Molecular Switches and Molecular wires, Canada Research Chairs Infrastructure Fund, Simon Fraser University**
>
> **"**The infrastructure has helped establish the Branda Group as one of the leading groups in organic materials and molecular switching. The contribution of the infrastructure to the success of the Branda Group is also demonstrated by the group's role in manufacturing a tremendous number of compounds to supply to various IT companies in North America the success.**"**

Patents

359 project leaders reported that the infrastructure played a role in the ability to obtain a patent. For those who reported that a patent was obtained, project leaders reported a combined total of over 1,800 patents.

Intellectual Property (IP) Rights

144 project leaders reported that the infrastructure played a role in the ability to secure IP rights. For those who reported that IP rights were secured, project leaders reported a combined total of over 1,700 instances. These include: copyrights, disclosures, industrial designs, patent applications, publications, and various trade secrets.

Products, Processes, or Services

760 project leaders reported instances of their infrastructure enabling them to develop new or improved products, processes, or services.

> **Bringing Health Home: Web-based software to deliver psychosocial treatment to children and families, Canada Research Chairs Infrastructure Fund, Dalhousie University**
>
> "Our innovative treatments for child mental health, maternal mental health and for child chronic illness have been developed and evaluation is ongoing. The first set of randomized trials have been completed and the child mental health treatments have been adopted in Nova Scotia. Commercialization is about to begin."

> **Scientific Modeling and Simulation Laboratory, Canada Research Chairs Infrastructure Fund, Memorial University of Newfoundland**
>
> "The new ADMA software and modeling methods developed have lead to new details of hemoglobin function and to the establishment of the viability of two new families of materials for nanotechnology and biotechnology: spiral graphite, nano-coils for molecular size electronic devices and nanosprings, as well as for nano-needles, for structural elements of nano-construction."

Licensing Agreements

125 project leaders reported that the infrastructure played a role in the ability to secure licensing agreements. For those who reported that agreements were secured, project leaders reported a combined total of almost 400 instances.

Other Benefits

The final question of the report form allows project leaders to identify 'other' benefits that result from the infrastructure. Over 800 responses were recorded. In general, 6 themes were identified and/or reiterated:

- Advancing Knowledge or Research and Academic Contribution;
- Collaboration (both international and regional);
- Increased Research Capacity;
- Education, Training, and employment;
- Attraction of HQP;
- Research Publications.

4.2 Strengthening Canada's Capacity for Innovation

In the past, economic growth stemmed from increases in the supply of capital, labour, or natural resources. Today, growth stems from increases in knowledge and innovation and its widespread adoption.[6] Strengthening a country's capacity for innovation, however, is dependant upon numerous factors including the quality of infrastructure, as well as the availability and access to research funding and highly qualified personnel, not only to conduct research, but also to assist in the operation and maintenance of the infrastructure.

Key Findings – Strengthening Canada's Capacity for Innovation

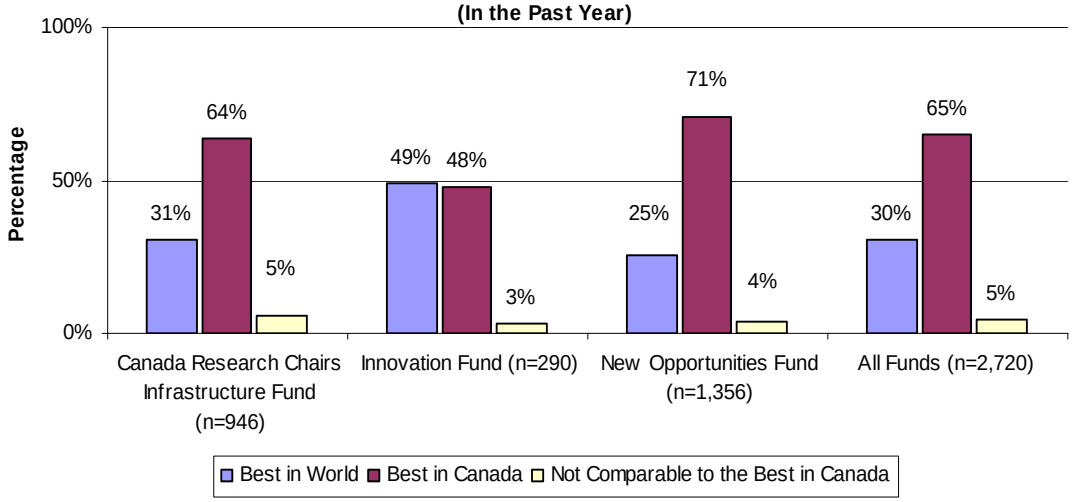
- ✓ Overall, 30% of institutions compare their infrastructure to the best in the world while 65% report that their infrastructure compares to the best in Canada.
- ✓ On average, the useful remaining life across all infrastructure types is 8 years for the 2007 sample data. This ranges from a low of 3 years (computing equipment, software, etc.) to a high of 12 years for buildings and research facility space.
- ✓ For those projects classified as fully or partially operational and used for research during the past year, approximately 15% of the institutions categorized as large universities, hospitals, and not-for-profit organizations report that the research enabled by the infrastructure has been leading edge internationally. This is a key finding given that this category represents over 83% of the projects funded in the 2007 sample.

[6] Kenan Patrick Jarboe and Robert D. Atkinson, "The Case for Technology in the Knowledge Economy: R&D, Economic Growth, and the Role of Government" (Washington: Progressive Policy Institute, 1998). http://www.ppionline.org

Comparative Quality of CFI-Supported Infrastructure

Exhibit 3 shows the comparative quality of CFI-funded infrastructure that was operational during the past year as assessed by project leaders.

Exhibit 3 - Comparative Quality of Operational Infrastructure (In the Past Year)



Note: The three individual funds shown in Exhibit 3 account for 92% of PPR responses.

Overall 65% of project leaders compare their infrastructure to the best in Canada. An examination of the funds independently reveals that:

- *Canada Research Chairs Infrastructure Fund* - 64% of project leaders report that their infrastructure compares to the best in Canada compared to 31% for the best in the world;
- *Innovation Fund* - 48% of project leaders report that their infrastructure compares to the best in Canada compared to 49% for the best in the world; and
- *New Opportunities Fund* - 71% of project leaders report that their infrastructure compares to the best in Canada compared to 25% for the best in the world.

A recent study completed on behalf of the Natural Sciences and Engineering Research Council of Canada (NSERC) in August 2007[7] demonstrated that under the Research Tools and Instruments Grants (RTI) program, the CFI and NSERC have made, 'significant contributions to improving the state of university research equipment over the past decade.' Further to this point however, three key messages were identified:

[7] Circum Network Inc/R.A. Malatest and Associates Inc. *Joint Evaluation of Research Tools and Instruments (RTI) and Major Facilities Access Grants (MFA)*, August 7, 2007

1. A large proportion (i.e. approximately 25% to 33%, or $1.5 billion) of existing infrastructure will require replacement over the next five years;
2. Approximately 20% of existing infrastructure will require major maintenance over the next five years;
3. It is difficult for researchers to find funding for small equipment.

> **The Centre for Shellfish Research: Phase III of the Institute for Coastal Research, Innovation Fund, Malaspina University-College**
>
> "The Centre for Shellfish Research (CSR) facility has become recognized as the premier facility of its kind on the west coast of Canada. While a comparable facility exists on Canada's east coast, where the shellfish aquaculture industry is significantly larger and has been long established, the CSR's research capabilities have accelerated and expanded British Columbia's research potential in this field. The research infrastructure has enabled the CSR to address key issues, related to ecologically sustainable shellfish aquaculture, in a timely fashion and the CSR is now ideally positioned to continue to meet the medium-term research needs of BC's shellfish industry, regulatory agencies and academic researchers."

In the fall of 2006, KPMG completed a study[8], on behalf of CFI, to measure the future investment required to maintain state-of-the-art quality at existing research installations. The findings, based primarily on a survey of IF and NOF project leaders, maintains that the investment required to, 'sustain the investments already made in IF and NOF projects combined will be about $225 million per year, or $560 million per year in costs to all parties.' It should be noted that the sample size for this study was relatively small (i.e. a response rate of 11% (33/300) for the NOF and 13% (40/300) for the IF). This study also examined the average lifetime for state-of-the-art equipment.

Useful Remaining Life of CFI-Supported Infrastructure

Useful life can be defined as the length of time that a depreciable asset is expected to be usable. Table 7 shows that the average remaining useful life across all types of infrastructure is eight years. The life of the asset however, is directly dependent on the application. Computer servers, software, and databases possess the lowest average useful life of approximately three years. At the other end of the spectrum, building(s) and research facility space have an average useful life of more than 12 years.

[8] KPMG. *Future Investment Required in Canadian Research Infrastructure*, September 26, 2006

Table 7. Useful Remaining Life of Infrastructure, 2007 Sample

Infrastructure Types	Average Years of Useful Life Remaining
Building(s) and research facility space	12.36
Other - specify (see below)	8.00
Non-specialized or standard research equipment	7.35
Highly-specialized research equipment, as appropriate to your field	6.88
Computing workstations, servers, software, databases, etc.	3.41
Average across all infrastructure types	**8.00**

In the table above, the category 'other' was in line with the overall average useful life at eight years. Examples of 'other' types of infrastructure include:

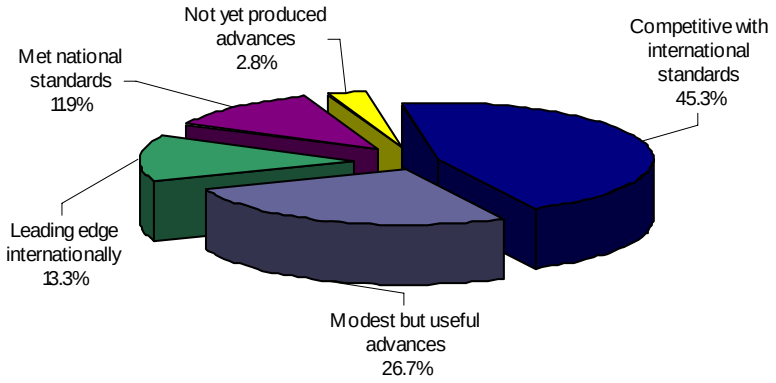
1. Animal care facilities;
2. Data (including databases, archives, data acquisition cards, etc.);
3. Research vehicles (including cars, trucks, trailers, and boats).

The KPMG study identified earlier also found similar 'lifetime' data. For NOF and IF projects, physical buildings, etc had an average 'lifetime' of 13 years while computers and servers had an average 'lifetime' of four years. These studies provide additional context for the comparative quality and useful remaining life data obtained through the PPRs in that although 30% of project leaders report that their infrastructure compares to the best in the world, ongoing investment is required to maintain world-class levels.

Research Enabled by the Infrastructure

For those projects funded since 2002 and classified as fully or partially acquired and used for research during the past year (i.e. n=2,720), 13% of the institutions indicated that the research enabled by the infrastructure has been leading edge internationally (Exhibit 4).

Exhibit 4 - Research Enabled by the Infrastructure
(n=2,720)



Overall, for the 2007 reporting period, 59% (45.3% + 13.3%) of institutions indicated that the research had met international standards to some degree. Table 8 examines this issue further by analyzing the research enabled by the infrastructure by category of institution.

Table 8. Research Enabled by the Infrastructure by Category of Institution, 2007 Sample

Category of Institution	Has Been Leading Edge Internationally	Competitive with International Standards	Met National Standards	Produced Modest Advances	Not Yet Produced Advances
A. Large Universities, Hospitals, and Not-for-Profit	334 (14.6%)	1,067 (46.7%)	245 (10.7%)	577 (25.3%)	62 (2.7%)
B. Small Universities	28 (6.5%)	165 (38.6%)	76 (17.8%)	146 (34.1%)	13 (3.0%)
C. Colleges	1 (14.3%)	1 (14.3%)	3 (42.9%)	2 (28.6%)	0 (0.0%)

Almost 15% of the large universities, hospitals, and not-for-profit institutions report that the research has been leading edge internationally and has been transformative, while approximately half (47%) of this same group report that the research has been competitive with international standards. This is a key finding given that large universities, hospitals, and not-for-profit institutions represent over 83% of the projects funded in the 2007 sample.

4.3 Attraction, Retention, and Training of Research Personnel

Attraction and retention of high quality researchers is an ongoing challenge for institutions. Competition for highly skilled research personnel is intensifying around the world. Within Canada, state-of-the-art infrastructure is a significant incentive that institutions rely on to recruit and retain faculty'

Key Findings – Attraction, Retention, and Training of Research Personnel

✓ **Researchers:**
- For the current reporting year, 35% of project leaders report that the availability of the infrastructure was an important factor in the decision to join an institution.
- Overall, 2,343 new researchers were recruited in the past year. Of these, 23% were recruited from the U.S. and 23% were recruited from elsewhere. The top five countries identified include Germany, France, the U.K., Australia, and China.
- Of the 2,343 researches recruited, over 90% were recruited from the academic/ hospital sector.

✓ **Post-Doctoral Fellows (PDF) and Graduate Students (GS):**
- Overall, 16,087 PDF/GS were attracted to the institutions due to the availability of the infrastructure. Further analysis reveals that CFI projects attracted, on average, 1 PDF and 4 GS per project.
  - For projects reporting since 2002, project leaders report that over 37,000 PDFs and GSs have used the infrastructure as a key resource in their research project. Of this group, 58% have stayed at the institution as trainees while an additional 11% have joined another Canadian academic institution, college, or research hospital.

✓ **Technical Personnel:**
- For projects reporting since 2002, project leaders report that almost 11,000 technical personnel have been trained on the use and maintenance of the infrastructure. Of this group, 69% have stayed at the institution while an additional 11% have joined another Canadian academic institution, college, or research hospital.

4.3.1 Researchers

Number and Origin of Researchers Attracted to the Institutions

The PPRs provide ample evidence that CFI's investments in infrastructure are playing a significant role in the recruitment of researchers to Canadian institutions. Thirty-five percent or 1,060 project leaders reported that the infrastructure was an important factor in the decision of a researcher to join an institution.

Overall, 2,343 researchers were recruited in the past year, of these:

- 1,255 (53.6%) were recruited from within Canada,
- 539 (23.0%) were recruited from the U.S.;
- 549 (23.4%) were recruited from elsewhere.

Table 9 shows that on average, CFI projects attracted 0.8 researchers per project. In some cases, as many as 5 researchers per project were recruited (i.e. International Joint Ventures Fund and the Exceptional Opportunities Fund). These data also show that almost half (46%) of the researchers recruited in the past year came from the U.S. or elsewhere. Of those researchers recruited from elsewhere (excluding Canada and the U.S.), 75 'other' countries of origin were identified. The top five countries identified by project leaders include Germany (61)[9], France (49), the United Kingdom (45), Australia (24), and China (22).

Table 9. Number of Researchers Recruited by Fund and Origin, 2007 Sample

Fund	Number of Projects (#)	No. of Researchers Recruited	Avg. No. Recruited/ Project	No. Recruited from Canada	No. Recruited from U.S.	No. Recruited from Other Countries
New Opportunities Fund	1,453	757	0.5	403	168	186
Canada Research Chairs Infrastructure Fund	1,011	893	0.9	450	193	250
Innovation Fund	328	554	1.7	332	141	81
Leaders Opportunity Fund	176	75	0.4	33	22	20
CFI Career Awards	25	13	0.5	5	4	4
Research Development Fund	9	6	0.7	4	2	0
Research Hospital Fund	8	22	2.8	17	3	2
International Access Fund	6	3	0.5	1	1	1
International Joint Ventures Fund	3	15	5.0	8	3	4
Exceptional Opportunities	1	5	5.0	2	2	1
TOTAL	**3,020**	**2,343**	**0.8**	**1,255**	**539**	**549**

[9] The number identified in the parenthesis denotes the number of times a country was identified by the institution

For projects funded since 2002[10], project leaders report that the availability of infrastructure has been an important factor in the decision to join an institution for over 7,500 researchers. Of these:

- 4,510 (59.5%) were recruited from within Canada,
- 1,604 (21.2%) were recruited from the U.S.;
- 1,467 (19.4%) were recruited from elsewhere.

These trends have remained relatively constant over the past four years. The data reveal that the majority of researchers are being recruited from within Canada (60%); however, Canadian institutions continue to attract international researchers from the U.S. and abroad (40%).

> **Infrastructure for Computational Biology & Bioinformatics, Canada Research Chairs Infrastructure Fund, University of Toronto**
>
> **"**The High Performance Computer cluster purchased with the funds provided by CFI had a major positive impact on the recruitment and retention of highly qualified personnel, as well as for training Post Doctoral fellows and graduate students.
>
> The research involves the handling of very large datasets, and the development and application of sophisticated machine learning techniques, optimization algorithms, and sampling methods. All of these must be performed as a function of a very large number of parameters, and are therefore extremely computationally demanding. Our research could not be carried out without the High Performance Equipment purchased with the CFI funds.**"**

Sector of Origin

Data shows that researchers are recruited from a variety of sources. In the past year, project leaders report that of the 2,343 researchers recruited, over 90% were recruited from the academic/hospital sector. Based on prior data, this trend has remained relatively constant for the past four reporting periods. In fact, of the 7,581 researchers recruited since 2002*:*

- 6,857 (90.4%) were recruited from the academic/hospital sector,
- 422 (5.6%) were recruited from the private sector;
- 302 (4.0%) were recruited from the public/not-for-public sectors.

[10] The 2007 sample includes project reports for projects that may be between 0 and 5 years along in development. Questions in the progress report forms address two timeframes. Some questions examine key outputs and outcomes during the past year while others examine project results since the beginning of the project.

Infrastructure for the Development of Robust Water Treatment Strategies and Tools for the Protection of Public Health, New Opportunities Fund, University of Waterloo

"The research enabled by the CFI has been competitive and innovative from an international standpoint. This is evidenced by the fact that the work investigating engineered media filtration, impacts of vegetation change on water quality, bioremediation, and cutting edge direct plasma technologies for pathogen inactivation in drinking water have been presented at several international conferences (e.g., American Water Works Association Water Quality Technology Conferences and Annual Conferences, Advanced Plasma Technologies Conference in Japan and China, Batelle International Conference on the Treatment of Chlorinated and Recalcitrant Organic Compounds in the U.S., as well as the International Gothenburg Symposium on the Use of Chemicals in Water and Wastewater Treatment). Work associated with these projects has been and continues to be published in international refereed journals. In the case of the direct plasma technology, Hitachi Inc. from Japan has decided to commercialize the technology.**"**

4.3.2 Post-Doctoral Fellows (PDF) and Graduate Students (GS)

Number and Origin of PDFs and Graduate Students

Research infrastructure also plays an important role in attracting PDFs and GSs to Canadian institutions. The project reports submitted for the 2006-07 fiscal year provide significant evidence that CFI's investments in infrastructure are playing a crucial role in stimulating the training of young Canadians through research. Overall, 16,087 PDF/GSs were attracted to the institutions due to the availability of the infrastructure.

Nerve Regeneration Laboratory, New Opportunities Fund, McGill University

"The CFI project represents a New Opportunities Award, and as such was used to set up a new laboratory, which studies neural regeneration. The award was directly responsible for enabling the setup of a competitive laboratory, including the recruitment of new staff and trainees (presently 2 technicians, 5 students, two of whom have graduated this year, and 1 PDF). My recruitment by McGill University from the United States was made possible directly by the availability of CFI funding to equip a world class new laboratory. Furthermore, CFI funding allowed me to utilize my start-up and operating funding to recruit two research technicians during the set up period. These technicians have now been trained on, and are currently using, the CFI infrastructure on a daily basis. We have recruited six new trainees (one PDF and five students), all of whom are leaders in their fields as evidenced by their having obtained their own external funding: all six trainees have secured their own external salary grants from CIHR (3), NSERC (1), and FRSQ (1), as a direct result of the CFI infrastructure which makes their projects possible. In addition, other graduate students and PDFs from our own and adjacent departments have made use of our CFI-funded equipment to pursue their projects in ways that would be impossible with the existing equipment in their own laboratories.**"**

Table 10 shows that the 3,020 funded projects attracted over 16,000 PDFs and GSs. The table also reveals that, on average, CFI projects attracted 1.4 PDFs and 4 GSs per project.

Table 10. Number of Post-doctoral Fellows (PDF) and Graduate Students (GS) Attracted to Institution Due to Availability of Infrastructure by Fund (past year)

Fund	No. of Projects	Total No. Attracted	Total PDFs	PDF/ Project	Total GSs	GS/ Project
New Opportunities Fund	1,453	5,164	1101	0.8	4063	3
Canada Research Chairs Infrastructure Fund	1,011	4,317	1257	1.2	3060	3
Innovation Fund	328	5,775	1624	5.0	4151	13
Leaders Opportunity Fund	176	454	90	0.5	364	2
CFI Career Awards	25	146	57	2.3	89	4
Research Development Fund	9	32	4	0.4	28	3
Research Hospital Fund	8	96	25	3.1	71	9
International Access Fund	6	17	5	0.8	12	2
International Joint Ventures Fund	3	77	30	10.0	47	16
Exceptional Opportunities	1	9	9	9.0	0	0
TOTAL	**3,020**	**16,087**	**4,202**	**1.4**	**11,885**	**4**

Canadian universities must be able to attract highly skilled PDFs and GS to remain competitive internationally. Data show that PDFs and GS are attracted from several sources. Of note are the following points (for the past year):

Post-doctoral Fellows

- 2,188 (52.0%) of PDFs are attracted from within or from other Canadian institutions;
- 1,574 (37.5%) of PDFs are attracted from other foreign institutions;
- 440 (10.5%) of PDFs are attracted from the U.S.

Graduate Students

- 8,893 (74.8%) of GSs are attracted from within or from other Canadian institutions;
- 2,614 (22.0%) of GSs are attracted from other foreign institutions;
- 378 (3.2%) of GSs are attracted from the U.S.

Development of a Cosmogenic Nuclide Extraction Laboratory and Surface Processes Facility for Landscape Evolution Studies, Canada Research Chairs Infrastructure Fund, Dalhousie University

"This facility provides access to geological dating methods involving rare isotopes produced in rocks exposed to cosmic rays. In addition to serving an international community of geoscientists and archeologists through collaborative efforts, the facility has trained dozens of students in isotope geochemistry, geochronology, and quantitative geomorphology, resulting in honours, M.Sc., or Ph.D. theses and associated publications. Research faculty have completed sabbaticals here, and others have visited to learn about the application and limitations of the technique. We have attracted international award-winning graduate students and a post-doc who would not have come if the facility was not available and successful."

The Association of Universities and Colleges of Canada (AUCC)[11], reports that Canadian universities attract students from over 200 countries. Based on 2004 data, China accounted for 23% of the total or almost 15,000 students. This was followed by the U.S. (7,000 students); France (5,000 students); and India (2,500 students). Conversely, the top five destinations for Canadians studying abroad at the post-secondary level includes the United States; the United Kingdom; Australia; France; and Germany.

Career Paths of PDFs and Graduate Students

Many project leaders track the career paths of the students that have worked in their labs. For projects reporting since 2002, project leaders report that 37,573 PDFs and GS have used the infrastructure as a key resource in their research project. It should also be noted that of these:

- 3,250 (8.6%) have joined the Canadian private business sector;
- 967 (2.6%) have joined the Canadian public sector;
- 239 (0.7%) have joined the Canadian not-for-profit sector.
- 21,825 (58.1%) have stayed at the institution as trainees;
- 4,015 (10.7%) have joined another Canadian academic institution, college, or research hospital;
- 2,932 (7.8%) have moved abroad;
- 2,757 (7.3%) have been classified as other[12];
- 1,588 (4.2%) have stayed at the institution as an employee or contractor.

It is clear from the data above, that the availability of state-of-the-art infrastructure has contributed to the attraction, retention and training of numerous PDFs and GSs, including a large number of international trainees.

[11] Association of Universities and Colleges of Canada. *Trends in Higher Education, Volume 1. Enrolment, 2007*

[12] The responses classified as 'other' above vary and are too broad to quantify. Responses range from currently seeking employment, to entered a new/different discipline, to not known.

4.3.3 Technical Personnel

Training

Different types of trained technical personnel are also being produced as a result of investments in infrastructure. Since the *beginning of the project*, project leaders report that 10,914 technical personnel have been trained on the use and maintenance of research infrastructure. Of these:

- 1,014 (9.3%) have joined the Canadian private business sector;
- 338 (3.1%) have joined the Canadian public sector;
- 79 (0.7%) have joined the Canadian not-for-profit sector;
- 7,542 (69.1%) have stayed at the institution;
- 1,227 (11.2%) have joined another Canadian academic institution, college, or research hospital;
- 449 (4.2%) have moved abroad;
- 265 (2.4%) have been classified as other.[13]

Attraction and Retention

Increasingly sophisticated research facilities, databases, and equipment require highly qualified individuals for their successful operation. The ability to attract, train, and retain technical personnel is a critical component in the operation and maintenance of research infrastructure. For those projects that were sufficiently developed in 2007, 78% of project leaders report that it was easy or reasonable to attract and retain skilled personnel. This compares to 22% who report that it was difficult or very difficult to attract and retain skilled personnel for operations and maintenance of the infrastructure. Of note is the fact that this finding has been consistent for the past three reporting periods (2004 to 2006).

[13] Again, the responses classified as 'other' above vary and are too broad to quantify. Responses range from returned to school, to on maternity leave, to retired although they represent a small proportion of the overall number reported.

4.4 Promoting Networking, Collaboration, and Multidisciplinarity among Researchers

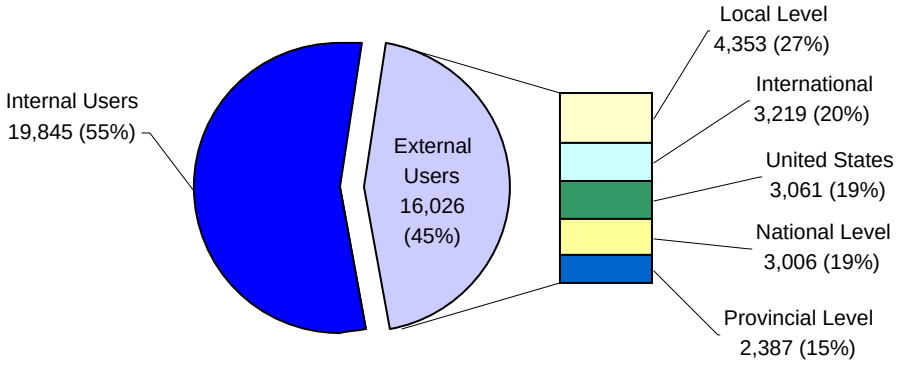
The demands of modern research means that investigators can no longer work in isolation. Partnerships, networking and collaborations across disciplines are increasingly necessary to achieve innovative results.

Key Findings – Networking, Collaboration, and Multidisciplinarity among Researchers

- ✓ In the past year alone, more than 35,000 researchers advanced their research by using infrastructure supported by the CFI.
- ✓ Overall, 71% of the project leaders indicated that the research benefited from a multidisciplinary approach and that it had been enabled by the CFI-supported infrastructure.
- ✓ A high proportion (92%) of researchers collaborate within the institution(s) and approximately 71% collaborate with other institutions within Canada.
- ✓ Over half (53% in 2007) of the project leaders report that the infrastructure has contributed to fostering international collaboration in a significant/critical manner while a smaller proportion (40%) reported that the infrastructure fostered local or regional collaboration.
- ✓ For the most recent year, 73% of project leaders indicated that the infrastructure had some influence in fostering local or regional collaboration in the formation of R&D clusters or regional R&D-based initiatives in Canada.

In the past year, project leaders report that more than 35,000 internal and external researchers advanced their research by using the infrastructure supported by the CFI (Exhibit 5). This number is based on 2,720 projects that were fully or partially operational and used for research during the past year.

Exhibit 5 - Users of the Research Infrastructure in the Past Year (n=2,720)



Based on the 16,000 external users of the research infrastructure during the past year, approximately 40% represent international users (i.e. International and U.S.). Local level use represents the highest proportion however at 27% (4,353).

Data also reveals that more than 20% of the users can be categorized as *international.* Of those users classified as international (i.e. excluding Canada and the U.S.), 76 'other countries' were identified. The top five countries identified by project leaders include France (87)[14], Australia (66), the United Kingdom (63), China (36), and Germany (31).

Further examination of the data by origin reveals that the majority (78%) of users represent the university, college, or hospital sector. This is followed by private sector users (9%), and public sector users (8%) at much lower rates. These findings are positive given the national objective to support productive networks and collaborations among Canadian post-secondary institutions, research hospitals, and the private sector.

Number of Researchers Advancing Research by Using CFI-Supported Infrastructure

For the 2007 sample, 19,845 researchers (including primary researchers, other principle researchers, and other faculty) advanced their research during the past year. This number represents approximately 7 researchers per respondent and remains relatively constant over the last reporting period (i.e. 2006 to 2007). Table 11 shows a breakdown of the number of researchers advancing their research broken down by fund and category of institution. Table 11 also reveals that the majority (88%) of researchers advancing their research (at the institution) on CFI projects do so at large universities, hospitals, and not-for-profits.

[14] Parenthesis denotes the number of times a country was identified by a project leader

Table 11. Number of Researchers Advancing Research by Fund and Category of Institution, 2007 Sample

Fund	Large Universities, Hospitals, and Not-for-Profit	No. per project	Small Universities	No. per project	Colleges[15]	No. per project	TOTAL	TOTAL /Project
Canada Research Chairs Infrastructure Fund	4,445	4.70	741	0.78	0	0	**5,186**	**5.48**
CFI Career Awards	132	6.00	4	0.18	0	0	**136**	**6.18**
Exceptional Opportunities	36	36.00	0	0	0	0	**36**	**36.00**
Innovation Fund	7,437	25.73	653	2.26	16	0.06	**8,106**	**28.05**
International Access Fund	6	6.00	0	0	0	0	**6**	**6.00**
International Joint Ventures Fund	45	15.00	0	0	0	0	**45**	**15.00**
Leaders Opportunity Fund	302	3.39	15	0.17	0	0	**317**	**3.56**
New Opportunities Fund	5,030	3.71	866	0.64	0	0	**5,896**	**4.35**
Research Development Fund	11	1.22	41	4.56	0	0	**52**	**5.78**
Research Hospital Fund	65	21.67	0	0	0	0	**65**	**21.67**
TOTAL	**17,509**	**6.44**	**2,320**	**0.85**	**16**	**0.01**	19,845	**7.30**

These data should be no surprise given that the three funds identified (i.e. the Innovation Fund, the New Opportunities Fund, and the Canada Research Chairs Infrastructure Fund) represent over 92% of the reports submitted and $1.476 billion in project funding.

Multidisciplinary Research

Responses show that the availability of the research infrastructure has enhanced opportunities for multidisciplinary research. Overall, for projects funded since 2002, 71% (1,928/2,720) of the project leaders indicated that the research benefited from a multidisciplinary approach and that it had been enabled by the CFI-supported infrastructure, while only 16% (435/2,720) reported that the research had not, to date, lent itself to a multidisciplinary approach, as shown in Table 12a. Project leaders who report that the research had benefited from a multidisciplinary approach (71% or 1,928, see table 12a), are asked to identify the extent to which the infrastructure aided in the process of drawing together disciplines.

[15] Eight colleges (16 projects) are included in the 2007 sample data and are classified as recipients of the IF.

Table 12a. Projects Benefited from a Multidisciplinary Approach by Fund and Type of Institution, *for projects funded since 2002*

	Total No. of Projects Fully/Partially Operational	No Opportunity (to Date)	Yes - But not due to the Infrastructure	Yes - The research has benefited from a multidisciplinary approach
By: TYPE OF FUND				
New Opportunities Fund	1,356	271 (20%)	175 (13%)	910 (67%)
Canada Research Chairs Infrastructure Fund	946	116 (12%)	138 (15%)	692 (73%)
Innovation Fund	290	20 (7%)	22 (8%)	248 (86%)
Leaders Opportunity Fund	89	24 (27%)	17 (19%)	48 (54%)
CFI Career Awards	22	2 (9%)	5 (23%)	15 (68%)
Research Development Fund	9	1 (11%)	0 (0%)	8 (89%)
Research Hospital Fund	3	1 (33%)	0 (0%)	2 (67%)
International Access Fund	1	0 (0%)	0 (0%)	1 (100%)
International Joint Ventures Fund	3	0 (0%)	0 (0%)	3 (100%)
Exceptional Opportunities	1	0 (0%)	0 (0%)	1 (100%)
TOTAL	**2,720**	**435 (16%)**	**357 (13%)**	**1,928 (71%)**
By: TYPE OF INSTITUTION				
A - Large Universities, Hospitals, and Not-for-Profit	2,285	358 (16%)	293 (13%)	1,634 (72%)
B - Small Universities	428	76 (18%)	62 (14%)	290 (68%)
C - Colleges	7	1 (14%)	2 (29%)	4 (57%)
TOTAL	**2,720**	**435 (16%)**	**357 (13%)**	**1,928 (71%)**

This data can also be examined further by the type of fund and the type of institution as shown in Table 12b. Overall, the infrastructure has been either significant (59%) or critical (30%) to enabling a multidisciplinary approach.

Table 12b. Impact of Multidisciplinary Approach

	Yes - The research has benefited from a multidisciplinary approach	*If yes, the role of the infrastructure has been*		
		Minor	Significant	Critical
By: TYPE OF FUND*				
New Opportunities Fund	910	95 (10.4%)	575 (63.2%)	240 (26.4%)
Canada Research Chairs Infrastructure Fund	692	84 (12.1%)	388 (56.1%)	220 (31.8%)
Innovation Fund	248	19 (7.7%)	127 (51.2%)	102 (41.1%)
TOTAL – 3 funds	**1,850**	**198 (10.7%)**	**1,090 (58.9%)**	**562 (30.4%)**
TOTAL – All Funds	**1,928**	**212 (11.0%)**	**1,132 (58.7%)**	**584 (30.3%)**
By: TYPE OF INSTITUTION				
A - Large Universities, Hospitals, and Not-for-Profit	1,634	175 (10.7%)	949 (58.1%)	510 (31.2%)
B - Small Universities	290	37 (12.8%)	179 (61.7%)	74 (25.5%)
C - Colleges	4	0 (0.0%)	4 (100.0%)	0 (0.0%)
TOTAL	**1,928**	**212 (11.0%)**	**1,132 (58.7%)**	**584 (30.3%)**

***** *The three funds identified above represent over 92% of the PPR responses*

Enhanced Opportunities for Collaborative Research

The data reveals that:

- 92% of researchers collaborate within the institution(s);
- 71% collaborate with other institutions within Canada.

The data also reveals enhanced opportunities for collaboration with other institutions outside of Canada at 57%. Another key finding, as shown in Table 13, is that almost one in five (18%) of the institutions have collaborated with not-for-profit institutions since the beginning of the project. It should be noted that institutions had the option to choose all that apply.

Table 13. Collaborative Research Arrangements

	Collaboration within Canada	Collaboration Outside of Canada	No Collaboration of this Type to Date
Collaboration within Institution(s)	92%	NA	8%
Collaboration with (an)other Institution(s)	71%	57%	14%
Collaboration with Government	34%	6%	65%
Collaboration with the Private Sector	41%	17%	54%
Collaboration with Not-for-Profit Organization(s)	18%	7%	79%

Note: project leaders have the option to choose all that apply.

Cellular Signaling Mechanisms in Growth Development and Disease, New Opportunities Fund, Memorial University

"The infrastructure has facilitated bridging of research and clinical disciplines. One example is the use of the cell biology and imaging equipment which was critical in a Canada-US collaboration..... This work has resulted in a new multidisciplinary publication on Tubedown in neuroblastoma."

International Collaboration

For the most recent year, 85% of institutions indicated that the infrastructure had some influence in fostering international collaboration in terms of joint research, the mobility of students and technical personnel, and participation in international networks.

Exhibit 6 - Influence of the Infrastructure Fostering International Collaboration

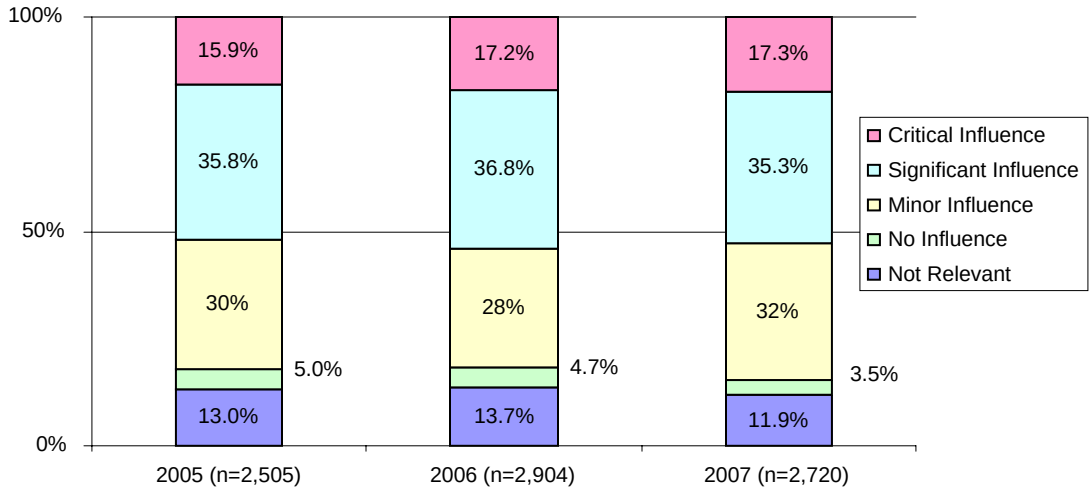


Exhibit 6 shows the response for the past three reporting periods and reveals a similar trend in previous years. Over half (52% in 2005; 54% in 2006; and 53% in 2007) of the institutions report that the infrastructure has contributed to fostering international collaboration in a significant/critical manner.

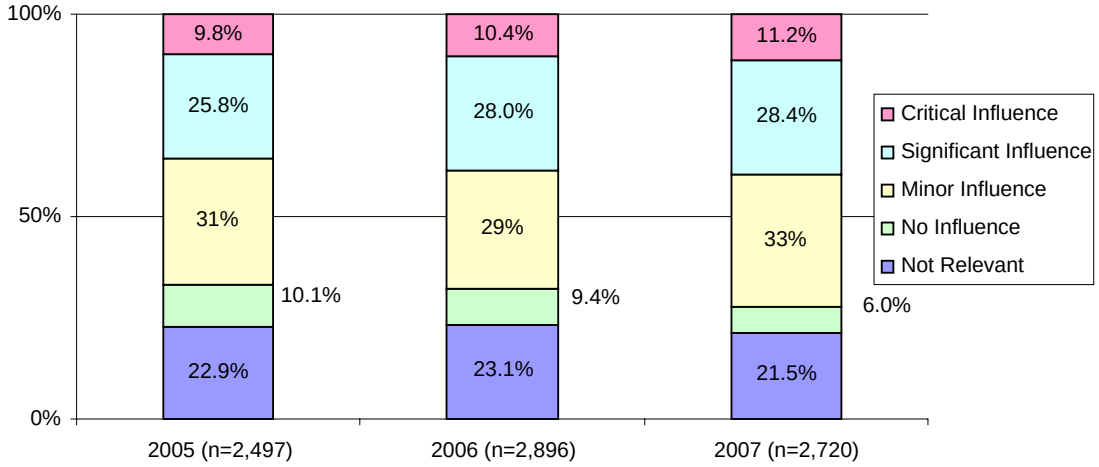
Laboratory for Research on the Innate Immune Response of Insects to Parasites and Pathogens Canada Research Chairs Infrastructure Fund, Simon Fraser University

"The nature of our research is multidisciplinary. We rely on collaborations with other researchers, institutions, and international collaborations that provide specific expertise that is complementary to our research interests. Therefore the infrastructure grant has allowed us to carry out aspects of research, define our hypotheses, and then test these in the field with leading researchers in Colombia, Guatemala, and Mexico where the parasites we study cause significant human disease. This would not have been possible without a sound infrastructure. Indeed, I would not have returned to Canada without such an infrastructure being available. Because of these capabilities we have hosted researchers from several countries where the diseases we study are endemic and will host researchers from Colombia and Guatemala for extended periods in our laboratory over the next year. "

Local/Regional Collaboration

International collaboration can be regarded as a key benchmark of success for research projects however, the ability to successfully collaborate at a local and regional level also creates value through the fostering of R&D clusters or through regional R&D-based initiatives.

Exhibit 7 - Influence of the Infrastructure Fostering Local or Regional Collaboration



For the most recent year, 73% of project leaders indicated that the infrastructure had some influence in fostering local and regional collaboration in the formation of R&D clusters or regional R&D-based initiatives in Canada. A similar response is shown for 2005 and 2006. The proportion

reporting that the infrastructure fostered local or regional collaboration (36% in 2005; 39% in 2006; and 40% in 2007) is smaller than the proportion reporting the same for international collaboration. Moreover, project leaders reporting that the type of collaboration was not relevant because the research has a different target was nearly double for local/regional collaboration as compared to international collaboration (see Exhibits 6 and 7).

> **Space Avionics and Instrumentation Laboratory (SAIL) New Opportunities Fund, Ryerson University**
>
> **"**Three types of collaboration have been enabled by this CFI funded infrastructure: collaboration with local industry, collaboration with government agencies, and collaboration with local universities: 1) In the past year, the presence of this infrastructure has enabled a productive collaboration with a local company. This company makes spacecraft navigation sensors and was a partner on a successful grant application with the Ontario Centres of Excellence. In the course of this project, work done in the CFI lab has produced technologies of appreciable commercial application. Licensing negotiations are currently underway; 2) The CFI infrastructure has also enabled collaboration with the University of Toronto Space Flight Lab. Using our facilities, researchers from U of T were able to calibrate sensors for the CanX nano-satellites. We have begun negotiations to flight-test some of our other technologies; and 3) Finally, our infrastructure has attracted interest from the Canadian Space Agency. The CSA funded a study at the SAIL facility to develop advanced processing software to run on spacecraft sensors that they were purchasing.**"**

4.5 Optimal Use of Research Infrastructure

The CFI promotes the optimal use of research infrastructure within and among Canadian institutions and creates the necessary conditions for sustainable, long-term economic growth.

Key Findings – Optimal Use of Research Infrastructure

- ✓ During the past year, 85% of institutions report that the infrastructure was fully utilized, of which, one in ten reported that it was over-subscribed.
- ✓ For those projects that were sufficiently developed in 2007, 77% of project leaders report that it was easy or reasonable to obtain sufficient funds for operations and maintenance though over time, there are some indications that this support may be becoming more difficult to source.
- ✓ Large/very large projects may require additional funding to support O&M.

Utilization of Infrastructure

Table 14 shows that 9% of project leaders report that the infrastructure was fully utilized to the point of being over-subscribed, while and additional 76% report that the infrastructure was fully utilized.

Table 14. Utilization of the Infrastructure

Fund	Fully Utilized & Over-subscribed	Fully Utilized
Canada Research Chairs Infrastructure Fund (n=946)	10%	76%
Innovation Fund (n=290)	11%	68%
New Opportunities Fund (n=1,356)	8%	77%
All Funds (n=2,720)	**9%**	**76%**

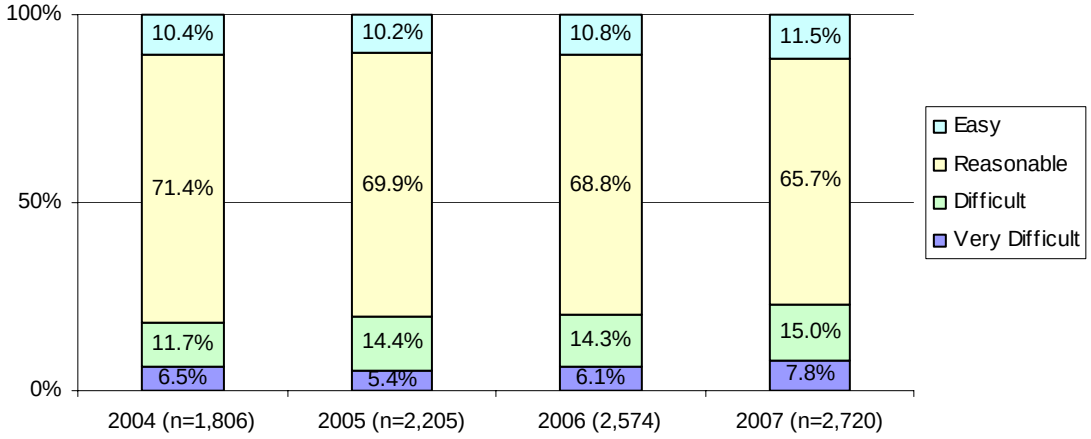
This pattern is similar across funds, however it is noted that 21% (15% for All Funds) of Innovation Fund project leaders report that the infrastructure was underutilized. Rationale cited by project leaders for the underutilization of CFI infrastructure under the Innovation Fund include incomplete installation of equipment (i.e. to be completed in the next year or two), projects are currently in the implementation/testing phase, and limited operating funds. Similar reasons for underutilization were recorded for all funds.

Funding for Operations and Maintenance

Obtaining state-of-the-art infrastructure is only one component of a successful research endeavour. Another key factor is the ability to obtain funding for the operation and maintenance of the infrastructure. Funding for operations and maintenance is not only critical for the attraction, training, and retention of highly-skilled personnel, but it is also used to cover other expenses such as supplies, minor upgrades, and maintenance contracts.

For those projects that were sufficiently developed in 2007, 77% of project leaders report that it was easy or reasonable to obtain sufficient funds for operations and maintenance. This compares to 23% who report that it was difficult or very difficult to obtain funds. Exhibit 8 shows that this finding has been somewhat consistent for the past three reporting periods (2004 to 2006).

Exhibit 8 - Funding for Operations and Maintenance
(In the Past Year)



An operations and maintenance costs study recently completed by CFI[16] produced the following findings[17]:

1. On average, total operations and maintenance costs will amount to 44% of total capital costs over a five year period or 9% per year;
2. Much of the increase in operations and maintenance costs is related to an increased proportion of operations and maintenance that is to be dedicated to personnel support, amounting to an average of 61% of the total;
3. An increased reliance on the institution for operations and maintenance is anticipated, due in part to a lack of success in securing funding from other sources; and
4. For large projects (i.e. capital costs greater than $4 million), additional O&M support will be required given that the state-of-the-art lifetime generally exceeds six years. Very large projects (i.e. International joint Ventures Fund projects) should be considered on a case-by-case basis given the unique requirements of each facility.

[16] Canada Foundation for Innovation, *Operations and Maintenance Costs of CFI-Supported Infrastructure*

[17] Based on 88 applications to the Leading Edge Fund that were recommended for funding by the CFI's Multidisciplinary Assessment Committees.

5.0 Conclusion

The results of this analysis indicate that the research enabled by the CFI is increasing research capacity and having a profound effect on the research environment in Canada. Benefits of CFI investments however, go beyond increased research capacity. Institutions continue to report that the research enabled by CFI investments support the development of new products, processes, and services that support improvements to public policy, health, science, engineering, and the environment.

Also of note, is the fact that 30% of institutions compare their infrastructure to the best in the world while 65% compare their infrastructure to the best in Canada. Moreover, the number of highly qualified research personnel attracted to and trained at Canadian institutions continues to demonstrate strong results, as well as the focus on networking, collaboration and multidisciplinarity among researchers.

It is evident from the PPRs that the research enabled by the CFI is supporting the necessary conditions for sustainable, long-term economic growth. A review of the 2007 sample data (April 1, 2002 to March 31, 2007) reveals the following key findings:

Benefits to Canada

- A wide range of benefits have been realized as a result of CFI investments in research infrastructure.
- Institutions continue to report that the research enabled by CFI investments support the development of new products, processes, and services that support improvements to public policy, health, science, engineering, and the environment.
- The CFI's objectives, practices, and results demonstrate its commitment to the principles outlined in the Government of Canada's S&T strategy.

Strengthening Canada's Capacity for Innovation

- Overall, 30% of institutions compare their infrastructure to the best in the world while 65% report that their infrastructure compares to the best in Canada.
- On average, the useful remaining life across all infrastructure types is eight years for the 2007 sample data.
- For those projects classified as fully or partially operational and used for research during the past year, approximately 15% of the institutions categorized as large hospitals, universities, and not-for-profit organizations report that the research enabled by the infrastructure has been leading edge internationally. This is a key finding given that this category represents over 83% of the projects funded in the 2007 sample.

Attraction, Retention, and Training of Research Personnel

- **Researchers:**
  - For the current reporting year, 35% of project leaders report that the availability of the infrastructure was an important factor in the decision to join an institution.
  - Overall, 2,343 new researchers were recruited in the past year. Of these, 23% were recruited from the U.S. and 23% were recruited from elsewhere. The top five countries identified include Germany, France, the U.K., Australia, and China.
  - Of the 2,343 researches recruited, over 90% were recruited from the academic/ hospital sector.
- **Post-Doctoral Fellows (PDF) and Graduate Students (GS):**
  - Overall, 16,087 PDF/GSs were attracted to the institutions due to the availability of the infrastructure. Further analysis reveals that CFI projects attracted, on average, one PDF and four GS per project.
    - For those projects reporting since 2002, project leaders report that over 37,000 PDFs and GSs have used the infrastructure as a key resource in their research project. Of this group, 58% have stayed at the institution as trainees while an additional 11% have joined another Canadian academic institution, college, or research hospital.
- **Technical Personnel:**
  - For projects reporting since 2002, project leaders report that almost 11,000 technical personnel have been trained on the use and maintenance of the infrastructure. Of this group, 69% have stayed at the institution while an additional 11% have joined another Canadian academic institution, college, or research hospital.

Networking, Collaboration, and Multidisciplinarity among Researchers

- During the past year, more than 35,000 researchers advanced their research by using infrastructure supported by the CFI.
- Overall, 71% of the project leaders indicated that the research benefited from a multidisciplinary approach and that it had been enabled by the CFI-supported infrastructure.
- A high proportion (92%) of researchers collaborate within the institution(s) and approximately 71% collaborate with other institutions within Canada.
- Over half (53% in 2007) of the project leaders report that the infrastructure has contributed to fostering international collaboration in a significant/critical manner while a smaller proportion (40%) reported that the infrastructure fostered local or regional collaboration.

- For the most recent year, 73% of project leaders indicated that the infrastructure had some influence in fostering local or regional collaboration in the formation of R&D clusters or regional R&D-based initiatives in Canada.

Optimal Use of Research Infrastructure

- During the past year, 85% of institutions report that the infrastructure was fully utilized, of which, one in ten reported that it was over-subscribed.
- For those projects that were sufficiently developed in 2007, 77% report that it was easy or reasonable to obtain sufficient funds for operations and maintenance though over time, there have been some indications that this support may be becoming more difficult to source.
- Large/very large projects may require additional funding to support operations and maintenance.