
**Impacts and outcomes of infrastructure projects funded by
the Canada Foundation for Innovation and other funding
partners**

Analysis of reports submitted by institutions and project leaders

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1. Executive Summary

The goal of the Canada Foundation for Innovation (CFI) is to strengthen the capability of Canadian universities, colleges, research hospitals, and other not-for-profit institutions to carry out world-class research and technology development. By investing in research infrastructure projects, the CFI supports research excellence, and helps strengthen research training at institutions across Canada.

In order to assess the impact of its investment, CFI requires that institutions and project leaders provide yearly reports. This 2002-2003 Impact Report covers the period April 2002 to March 2003 and analyzes and summarizes information provided by 83 institutions on the status of 1833 projects.

Given the diversity of projects in size, complexity and budget; the differences in their implementation status; and the different objectives of the three main programs (Innovation Fund [IF], Canada Research Chairs Infrastructure Fund [Chairs] and New Opportunities Fund [NOF]), the picture assembled through the project reports is complex. Nevertheless, the survey illustrates clearly that the investment in Canadian research infrastructure achieved by CFI and institutions as well as their partners is having a profound impact on the way research is being done in Canada and on the profile of Canadian research internationally.

The results of the analysis of the institutional and project reports are summarized below. They are organized under the headings of the CFI objectives.

Attracting and retaining highly skilled research personnel in Canada

The capacity of a country for innovation rests largely on the availability of highly qualified people (HQP). Since research is such an important component of innovation, it is essential to ensure that we are able to attract and retain the best.

Several thousand researchers were recruited or retained in the past year, as a result of the availability of state-of-the-art research infrastructure. The impact appeared independent of the state of readiness of the project. That is, the existence of the funding and the expectation that the project would be realized were important recruitment incentives. This speaks to the importance of the CFI program in promoting a dynamic image of the Canadian research enterprise in Canada and abroad.

Strengthening research training of young Canadians for the knowledge economy

One of the major mechanisms required for increasing the future pool of highly qualified people (HQP) and ensuring its quality is to give the Canadian research establishment the means to attract more and better trainees.

The data show that the CFI program has had an impact on the attraction of thousands of trainees such as postdoctoral fellows (PDF) and postgraduate (PG) students. PDFs were recruited mainly from abroad (53%, including 11% from the USA). In the case of PG students, 30% of those recruited were from abroad. This is significantly higher than the overall proportion of visa PG students at Canadian universities. This influx of trainees from abroad broadens the educational experience of young Canadians. Those who choose to remain in Canada following their training also contribute to the expansion of the pool of HQP in Canada. Furthermore, those who choose to return to their country of origin are likely to collaborate with Canadian researchers in the future.

In addition to those attracted, more than 20,000 PDFs, PG students and other trainees at various levels are reported to have substantially advanced their training and improved its quality because of the CFI program.

Promoting networking, collaboration among researchers and multidisciplinary

The demands of modern research mean that investigators can no longer work in isolation. Collaborations, networking and linkages of all types are increasingly necessary to achieve results in a timely manner.

The impact report demonstrates that, apart from the project leaders themselves, the research of more than 15,000 researchers has benefited from the CFI infrastructure program by being more productive, more multidisciplinary, more risky and/or more competitive internationally.

A large proportion of project leaders reported that their infrastructure had significantly enhanced the opportunities for multidisciplinary research and played a role in creating, maintaining or strengthening collaborations among sectors. As well, the availability of the infrastructure fostered international collaborations and helped in the creation of centres, networks and clusters. In fact, 70% report enhanced inter- and intra-institutional collaborations and 50% report significantly enhanced international collaborations. This shows that the infrastructure is shared among researchers across the country and even abroad.

Ensuring the optimal use of research infrastructure within and among Canadian institutions

The conservation of our limited research resources requires that research funding, including that for infrastructure, be used judiciously. Furthermore, it is important to ensure that research infrastructure be available as widely as possible.

Thanks to the institutions' efforts at coordination together with the commitment of project leaders, the infrastructure resources are already used to full capacity in the great majority of cases. Even projects that are only partially developed appear to be used extensively relative to their state of completion. Overall, 80% of respondents reported that their infrastructure was fully utilized.

Institutions and project leaders are concerned about the costs of maintaining and operating the infrastructure, particularly in the case of projects not eligible for support through the Infrastructure Operating Fund (IOF). There are also issues developing in relation to infrastructure renewal, particularly in certain areas, that will require the attention of CFI in the near future.

The infrastructure is viewed as being of high quality: 80% considered it to be above average and 34% believe that their infrastructure is among the best in the world. The respondents also judge that research undertaken with the infrastructure is of high quality: 75% say that research enabled by the infrastructure meets at least national standards and 60% say that it is competitive by international standards or is leading edge.

Strengthening Canada's capacity for innovation

A country's capacity for innovation is a function of many factors, not the least of which is its research capacity. This, in turn, is dependent on the quality and availability of research infrastructure and on the provision of funds to support the research enabled by the infrastructure.

The Canadian research community strongly believes that the CFI program has had a significant impact on the quality of the research that is performed not only by the project leaders, but also by their colleagues near and far. The number of instances of reports showing that the research enabled by the infrastructure in the past year meets international standards or is leading edge is impressive for a program that is relatively young.

Researchers who benefit from the infrastructure projects established as a result of the CFI program are also successful in attracting funds from various sources. The data, restricted as they are to the past year, actually underestimate the impact of the CFI program in this respect. Nevertheless, 75% report that the infrastructure has had at

least a minor impact on their ability to attract research funds from the federal granting agencies. 50% report at least a minor impact in their ability to leverage funds from their own institutions, Canadian industry, and provincial sources. An impressive 25% report an impact on their ability to attract funds from international sources.

The CFI program has already had a major impact in supporting research that is of benefit to Canada, with signs that there will be much greater rewards in the future. In the past year, research outcomes have been translated into a number of economic and social benefits. Project leaders reported that their infrastructure had enabled the following outcomes:

- more than 130 instances of disclosures of inventions, registrations of patents and copyrights;
- eighty instances of technology transfer to private sector partners in the form of improved products, processes and services;
- the creation of 20 spin-off companies.

Benefits were also reported in areas such as job creation, cost savings and contribution to social, economic, health and environmental policy. These benefits are difficult for investigators to document, as the end-users rather than the researchers are responsible for adopting the research that would lead to improvements. As a result, the data are qualitative. However, there are numerous examples of such benefits quoted by the project leaders in the narrative portion of their reports.

Conclusions

The data provided in this impact report leave no doubt about the positive impact that the CFI program is having on building capacity for innovation. In addition to providing statistical information, the annual project and institutional reports denote a sense of enthusiasm and optimism, despite some of the challenges encountered in the implementation of projects.

By giving Canadian researchers the tools necessary to undertake riskier and more innovative research, the CFI program has already enabled enhanced research productivity and transfer of technology and knowledge to end users. Given the length of time required for the translation of knowledge into applications, this bodes well for the future and puts the CFI program in the vanguard of the tools that Canada has given itself to meet its target to become one of the most innovative economies in the world by 2010.

Introduction

The Canada Foundation for Innovation (CFI) was established as an independent corporation by the Government of Canada in 1997. The Foundation's goal is to strengthen the capability of Canadian universities, colleges, research hospitals, and other not-for-profit institutions to carry out world-class research and technology development. By investing in research infrastructure projects, the CFI supports research excellence and helps strengthen research training at institutions across Canada.

The CFI's programs are designed to:

- strengthen Canada's capacity for innovation;
- attract and retain highly skilled research personnel in Canada;
- strengthen research training of young Canadians for the knowledge economy;
- promote networking, collaboration among researchers and multidisciplinary;
- ensure the optimal use of research infrastructure within and among Canadian institutions.¹

In turn, the research enabled by the infrastructure will generate benefits for Canadians through the creation of spin-off ventures, the commercialization of discoveries, as well as better health, environment, and public policy.

On average, the CFI contributes 40% of the cost of the infrastructure projects, the remainder must come from the institution itself or from its partners; typically provincial governments and businesses.

The CFI invests in projects through the following programs:

The **Innovation Fund** (IF) enables eligible institutions to strengthen their research infrastructure in the priority areas identified in their strategic research plan. The fund promotes multidisciplinary and inter-institutional approaches, and enables Canadian researchers to tackle groundbreaking projects.

Initially, the Innovation Fund was designed to respond to the needs of larger research institutions (Category A), that is, those having received the bulk of the sponsored research funding for the 1994-96 period. Separate funds were created for smaller institutions:

The **University Research Development Fund** (URDF) was a fund designed to strengthen the research infrastructure of eligible universities (Category B) that received, during the 1994-96 period, less than 1% of total sponsored research funding in Canadian universities. The CFI invested \$36 million under this fund.

¹ <http://www.innovation.ca/about/>

The **College Research Development Fund** (CRDF) was designed to help Canadian colleges, institutes, and their affiliated research centres (Category C) develop and strengthen their research infrastructure in areas identified in their strategic research plan. Colleges could submit proposals for projects totalling up to \$2 million in eligible costs with a maximum contribution of \$800,000 from the CFI. The CFI invested \$15.6 million under this fund.

Since 2001, all eligible institutions submit proposals to the Innovation Fund. For this reason, the three types of projects (IF, URDF and CRDF) are grouped under the IF heading in this impact report.

In addition to the Innovation Fund, which serves broad communities of researchers at institutional, regional or national levels, the CFI also supports the infrastructure needs of individual researchers and their research teams along institutionally-identified priorities. It does so through the following funds:

The **New Opportunities Fund** (NOF) provides infrastructure support to newly recruited academic staff. The fund helps universities attract world-class faculty members in areas that are essential to the institutions' research objectives.

The **Canada Research Chairs Infrastructure Fund** (Chairs) provides infrastructure support to the Canada Research Chairholders.

The CFI **Career Awards** (CA) were established through a partnership with federal granting agencies. These awards recognize and support outstanding researchers by providing institutions with the infrastructure that is essential for their research program. This category is included in the totals, but not treated separately in the current report, as only one report was received.

In addition to the above infrastructure programs the CFI has recently implemented the following program:

The **Infrastructure Operating Fund** (IOF) contributes to the incremental operating and maintenance costs associated with infrastructure projects partially funded by the CFI. Unlike other CFI awards, there are no requirements for matching funds. Each eligible institution receives an IOF allocation representing 30% of the finalized CFI contribution (representing approximately 12% of the total cost of the project) for projects approved between July 2001 and December 2005 under either the **Innovation Fund** or the **New Opportunities Fund**. The impacts of this fund are not analyzed in detail in this report.

As of March 31st, 2003, the CFI had contributed almost \$1.7 billion to 2543 research infrastructure projects in 108 institutions through its various funds.

2. Methodological notes

Report format and content

In order to assess the impact of its investment, the CFI requires that institutions and project leaders provide yearly reports. This 2002-2003 Impact Report summarizes information covering the period of April 2002 to March 2003 that was received by the reporting deadline. This information was provided by 83 institutions (77% of the 108 institutions for which a report was required) on the status of 1833 projects received within the reporting deadline (90% of the 2031 projects for which a report was required)².

For the fiscal year ending on March 31st, 2003, institutions were asked to submit a brief report (maximum of 5 pages) on the impact, in the past year, of all CFI investments (both infrastructure and operating funds), in accomplishing the objectives of their strategic research development plan. They were asked especially to consider the objectives of the CFI, as outlined in the Introduction.

Institutions were also asked to report on challenges they faced, such as delays in, or barriers to, the acquisition, development or implementation of infrastructure. As well, they were asked to note challenges in operation or maintenance of the infrastructure and how the IOF had helped to meet them.

Most institutions, particularly the larger ones with numerous projects, chose to highlight the impact of the CFI contribution by providing examples of outcomes for specific projects. Given that the CFI publishes institutional reports on its web site, this afforded institutions a means of showcasing their most successful projects. However, it made it difficult to analyze institutional reports as a group. Instead, the present report provides selected comments gleaned from institutional reports that illustrate the impact of CFI investments on institutions and their researchers. The reader is referred to the individual reports on the CFI website for more detailed information on individual institutions.

Currently, the CFI expects a status and impact report on each project (project report), each year for the first five years following finalization of the budget. The information expected in project reports was in three sections and the data were to be limited to results obtained within the past year.

Part A, to be completed for all projects, irrespective of their implementation status, consisted of information on the implementation of the infrastructure and on the impact of the project on the attraction and retention of researchers and on the attraction of trainees. 1833 project leaders responded to these questions.

² Several reports received after the reporting deadline could not be included in this analysis.

Part B was to be completed for projects that were fully or partly operational during the period covered by the report April 1, 2002 to March 31, 2003. It consisted of information on the status of the infrastructure and its impact on the research activities and collaborations, training, and the social and economic benefits to Canada that have ensued from the research supported by the infrastructure. 1691 project leaders responded to Part B.

The answers to parts A and B were computerized and the results analyzed under various headings, as indicated in the text.

Part C consisted of an optional narrative to provide fuller explanations on (1) project implementation and management challenges; (2) major benefits of the research to Canada; and (3) other significant benefits, over the past year. Most project leaders who completed part B of the questionnaire also provided additional comments in Part C.

Profile of projects included in the analysis

There is an enormous variety in terms of size, budgets, types and complexity of the projects that have been funded so far. This is illustrated in Table 1, which lists the number of project reports received by the deadline for inclusion in this analysis, together with the total, average and median CFI contribution and the smallest and largest CFI awards, by fund.

Table 1. Number of reports, total, average and median funding and smallest and largest awards, by fund.						
Fund	#	Total	Average	Median	Smallest	Largest
		In million dollars		In thousand dollars		
IF	552	779.2	1.412	1 204.0	28.0	56 400
Chairs	410	59.7	0.146	145.6	6.2	1 000
NOF	870	140.8	0.162	150.0	15.4	980
Total ³	1833	980.0	0.534	200.0		

In general, Canada Research Chair Infrastructure (Chairs) and NOF projects are smaller and less complex than IF projects (see averages and median contributions in Table 1). Projects supported through these two funds are intended to support the research program of individuals (e.g. for NOF projects, to accelerate the establishment of their research career in Canada).

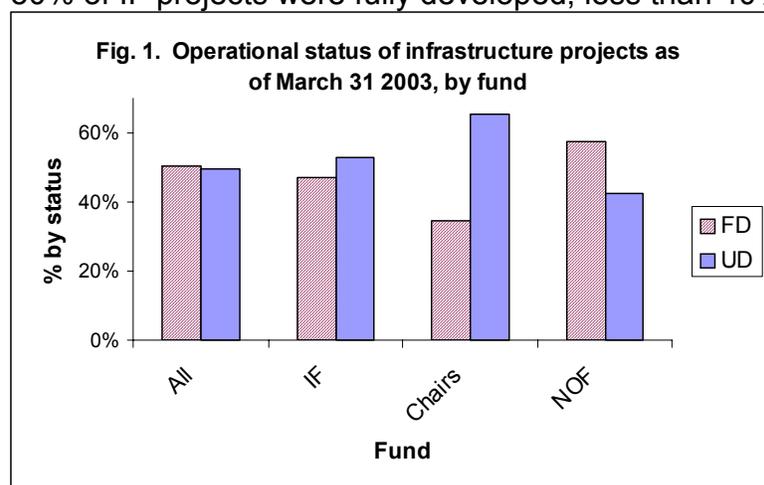
As a result of this diversity, the time required for approval and implementation of projects varies greatly. Since this analysis includes projects for which the budgets

³ Includes data on one Career Award.

were finalized in 1998, and some which were finalized in March 2003, the picture assembled through the projects reports is complex.

Implementation Status of projects

Fig. 1⁴ shows that, overall, 50% of projects were fully developed as of March 31, 2003. However, the implementation status varied with the fund. While approximately 50% of IF projects were fully developed, less than 40% of Chairs projects were in that



state. This is due to the fact that the fund is relatively new and a large number of awards were finalized in the last 6 months of the reporting period. By contrast, almost 60% of NOF projects were fully developed, reflecting the longer award history of this fund. The differences in implementation status of projects in each fund add to the complexity of the analysis.

Approximately 45% of project leaders reported some delay in the implementation of their project in the past year. The narrative comments indicate that, generally, in the case of Chairs and NOF projects, these delays were relatively short and due to such reasons as needed adjustments to equipment, back-ordering of certain components, the time needed to construct prototypes. In the case of IF projects, the delays were more pronounced in the case of large construction projects. Some of the reasons cited for such delays were the severity of the 2002-03 winter, which affected certain steps in construction, conflicting priorities in universities' construction projects due to the anticipated greater than usual influx of students in the fall of 2003, delays in provincial ministries' approval for construction projects in research hospitals and, in some cases, institutional inexperience with the management of large research projects. In some cases, the delays have necessitated amendments to the agreements between the CFI and the institutions.

Interpretation of numerical data

Another methodological issue relates to the numbers generated to illustrate the impact of the program on attraction and retention of researchers and on training. Since many of the infrastructure projects serve many users, the numbers generated by adding data from individual project reports are unlikely to always represent

⁴ Captions for Fig. 1 are as follows: FD: Fully developed; UD: under development.

different individuals, as the decision of a particular researcher or trainee might have been influenced by the array of infrastructure available, rather than by one specific infrastructure project. For this reason, the analysis uses approximations rather than absolute numbers to provide an assessment of the impact of the CFI program.

Diversity of institutions

Finally, the institutions eligible to apply for CFI funding (categories A, B and C, as described in the introduction) have vastly different missions and are at different stages in the development of their research activities. The nature of the research they carry out is also a function of their specific mission. This provides an additional area of complexity. In general, the project report questionnaire used in the past year is better adapted for projects in category A and B institutions than for those in category C institutions (colleges). The research done in colleges tends to be more applied and college researchers are not generally eligible to apply for grants from the federal granting agencies, to hold Canada Research Chairs and receive the related CFI Chairs fund, or to apply for CFI NOF awards. Furthermore, the recruitment of researchers has not been a priority for colleges and, since they do not have degree granting power, their impact on the attraction of post-doctoral fellows (PDFs) and graduate students is limited. As a result, these indicators do not apply to the projects funded in colleges.

Nevertheless, the survey illustrates clearly that the investment in Canadian research infrastructure made by the CFI and institutions as well as their partners is having a profound impact on the way research is being done in Canada and on the profile of Canadian research internationally.

3. Results

This portion of the impact report summarizes the information obtained from the institutional and project reports under the five objectives of the CFI program.

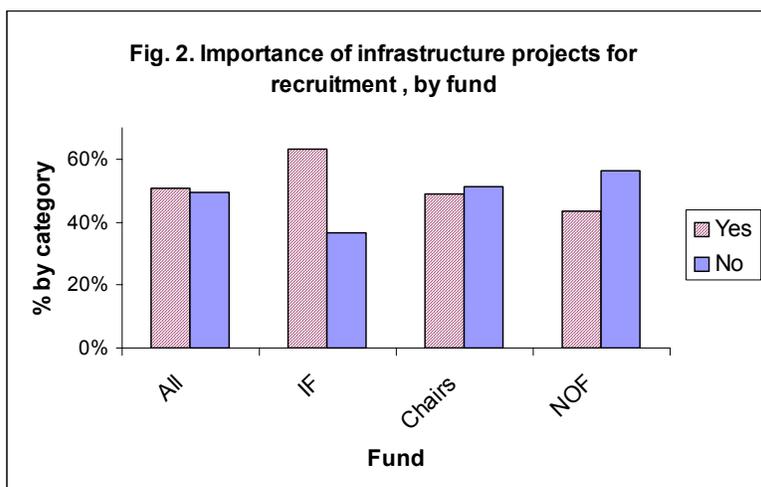
3.1. Attracting and retaining highly skilled research personnel in Canada

The capacity of a country for innovation rests largely on the availability of highly qualified people with an environment that allows them to be competitive. Since research is such an important component of innovation, it is essential to ensure that we are able to attract and retain the best people. Recognizing that research is necessary for innovation, most developed countries have the same ambitions. As a result, the competition for the best qualified researchers is fierce and international in scope. In the final analysis, the countries that succeed are those that are successful in creating the appropriate climate to allow creativity to flourish.

“CFI supported research infrastructure has had a significant positive impact on the recruitment and retention of faculty members and graduate students in a number of programs. Many of our [Canada Research Chairs] would not have considered [this] University without the availability of the state-of-the-art infrastructure. Faculty members and graduate students from Canadian, American and other international institutions as well as researchers from the private and public sector have been drawn [here] ... the availability of CFI funded infrastructure was an important factor for attracting 20 new faculty members and retaining 27 faculty members (in 2002).”

The combination of investments made by the federal and provincial governments in the past few years has had an immense impact on Canada’s ability to attract and retain highly qualified people. Without high quality infrastructure, however, other programs, such as the Canada Research Chairs and the increases in research funding through various federal and provincial agencies and programs, would not have had as great an impact. For example, institutions believe that the combination of Canada Research Chairs and CFI infrastructure has been (and continues to be) a powerful tool in this

critical period of renewal of the faculty complement at universities and affiliated hospitals, an effect that is not fully demonstrated in the present report due to the one-year limitation on the data collected.



The impact of the CFI program is substantiated by the project reports, which show that several thousand researchers were recruited or retained in the past year, as a result of the availability of the state-of-the-art research infrastructure.

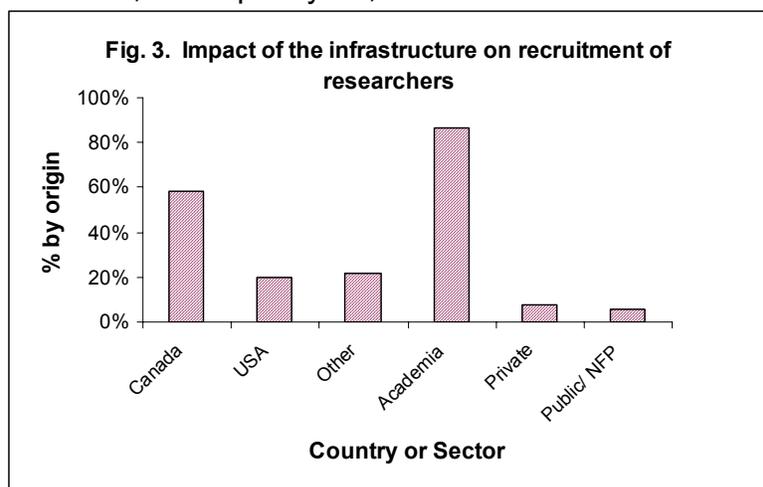
As shown in Fig. 2, more than half of the project leaders reported a positive impact of their infrastructure

on researcher recruitment of. Given its nature and its scope, it is normal that the IF fund influenced the recruitment of more people. However, both the Chairs and the NOF funds also contributed to attracting researchers to Canadian research institutions. It is important to remember that respondents were only to include recruitments that occurred in the past year; therefore, many of the Chairs and NOF recipients recruited prior to that period could not include themselves in these numbers.

Each IF project influenced the recruitment of an average of 3.5 researchers in the past year. The Chairs and NOF funds, geared as they are to meeting the infrastructure needs of individual researchers, could be expected to have a lesser impact on researcher recruitment; however, the number of recruits due to these funds (an average of 1 per project) was still important compared to the funds expended (see Table 1 in section 2). It is also important to remember that respondents were only to include recruitment that occurred in the past year; therefore, many of the Chairs and NOF recipients recruited prior to that period could not include themselves in these numbers.

For projects reporting a positive impact on recruitment (those shown as responding “yes” in Fig. 2), the impact appeared independent of the state of readiness of the project. That is, the existence of the funding and the expectation that the project would be realized appeared to be the important drawing card for recruitment, as approximately the same proportion of projects under development and fully developed was reported as having had an impact. This speaks to the importance of the CFI program in promoting a dynamic image of the Canadian research enterprise in Canada and abroad, as shown by the data quoted in the remainder of this report.

Given the need to quickly expand the pool of researchers available, it is important to note that, in the past year, 40% of researchers whose recruitment was influenced by



the availability of the infrastructure were from abroad (Fig. 3). They came from the USA and other countries in approximately equal proportions, helping to reverse the brain drain that had plagued the Canadian research establishment in the 1990s.

Overwhelmingly (86% overall) the recruits were from the academic sector

(including hospitals). Numerous researchers were also recruited from the private or the public/not-for-profit (NFP) sector, although the proportions may appear low in comparison with the totals (14% of the total). Traditionally, recruitment from these sectors tends to occur mostly in the engineering and environmental areas and indeed, in these areas 24% of new researchers whose recruitment was influenced by the existence of IF projects came from the public or private/NFP sectors.

The projects finalized between 1998 and 2001 reported the greatest impact on recruitment in the past year, versus those finalized in the following years. This is explained by the higher proportion of IF projects (which have the greatest impact on recruitment) which were finalized in those years.

As was the case for recruitment (Fig. 2 above), over 60 % of project leaders reported that the infrastructure had a positive impact on the retention of researchers. The proportion did not differ substantially among the funds. As was the case for recruitment, retention was not influenced by the implementation status of projects, merely by their existence.

The IF projects had a greater impact on retention compared to the funds intended to provide the infrastructure needs of individual researchers (Chairs, NOF). This makes sense given the IF fund's objectives and the generally larger scope of the projects and the fact that the NOF is focused entirely on recruitment.

Taken together, these findings clearly support the view that the CFI program is having a strong impact on recruitment and retention of researchers. The mere fact that a project is approved appears sufficient to attract or retain researchers. Furthermore, these projects have assisted the expansion of the Canadian research community by helping to attract researchers from abroad and from sectors outside academia.

Moreover, the CFI program is helping to increase the visibility of Canada as a competitive place to do advanced research.

3.2. Strengthening research training of young Canadians for the knowledge economy

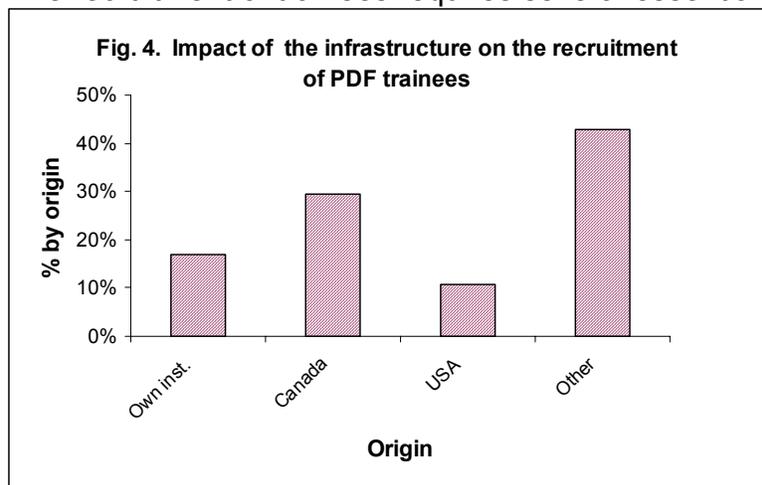
One of the major mechanisms required to increase the size and quality of the future pool of highly qualified people is to give the Canadian research establishment the means to attract more and better trainees. This requires that potential trainees in

“CFI investments have caught the attention and interest from scientists from around the world. New infrastructure and the many opportunities it has created, has generated much enthusiasm and excitement for students to pursue careers in research.”

Canada and abroad have confidence that Canadian research institutions can provide them with an educational experience that compares to the best in the world. It also requires that the research done in our country have a high profile internationally, since the decision of trainees to undertake their work in a given location is often influenced by the opinion of their previous mentors.

This section provides information on the impact of the CFI program on the attraction of several thousand trainees such as postdoctoral fellows (PDF)⁵ and postgraduate (PG) students.

The recruitment of trainees requires several essential elements, including the

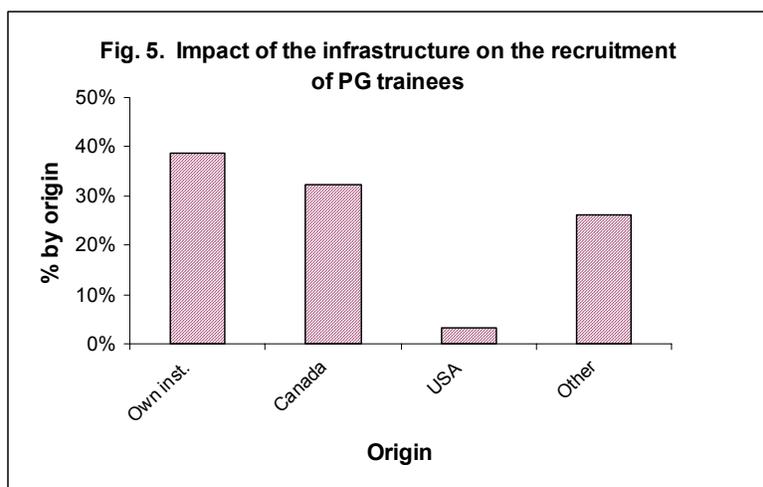


confidence that they will be able to work in modern facilities with state-of-the-art equipment. Such an environment influences the trainees' research productivity and, therefore, their competitiveness when it comes time to secure a faculty or other research position.

The data gleaned from the project reports demonstrate that the CFI program is contributing to such recruitment, not only from Canada but from abroad as well. As shown in Fig. 4, the largest proportion of PDFs whose recruitment was influenced by the infrastructure acquired through the CFI program was from abroad (almost 53% of the total, 11% of whom were from the USA).

The data gleaned from the project reports demonstrate

⁵ CFI did not define PDF. Therefore, it is not known whether project leaders included only individuals who fit the eligibility criteria of the federal granting agencies or whether more experienced individuals who are normally classified as research associates were included in this category.



(Fig. 5) demonstrates that approximately 70% of the PG trainees attracted by the infrastructure acquired through the CFI program originated from Canadian institutions, either the project leader's own or another. Few PG trainees were recruited from the USA, but 30% came from other countries. The small proportion recruited from the USA is not surprising since the majority

of PG trainees in the USA are themselves recruited from abroad. The proportion of PG students attracted from abroad (30% of total attracted in 2002-03) is considerably greater than the proportion of visa students studying in Canada (15%)⁶. This influx of trainees from abroad broadens the educational experience of young Canadians. Foreign trainees who choose to remain following their training also contribute to the expansion of the pool of HQP in Canada. Furthermore, those who choose to return to their country of origin are likely to collaborate with Canadian scientists in the future.

Taken together, these data show that the availability of modern infrastructure is important in attracting a large number of PDFs and of PG students to pursue research in Canadian institutions. They are also a further indicator that the CFI program has contributed to the enhanced visibility of Canadian research internationally.

⁶ Based on the latest statistics available from the Canadian Association for Graduate Studies http://www.cags.ca/publications/33rd_statistical_report.html

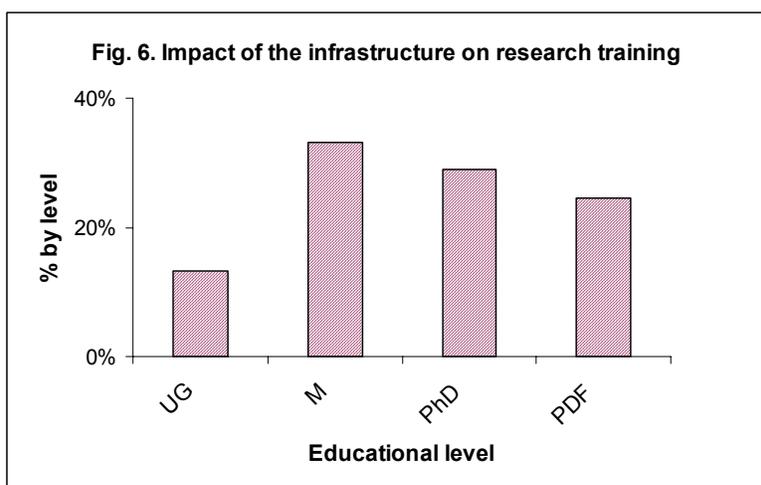
“... the infrastructure has greatly facilitated the training of postdoctoral researchers and graduate students in the areas of molecular characterization, and, as such, the general area of synthetic chemistry. These skills are vital for many areas of Canada’s economic development, including pharmaceutical research, polymers, new materials, and nanotechnology...”

“[The project] greatly increases the productivity of the trainees in two ways. Firstly, [it] removes the burden of routine experimentation by performing these activities in the core facilities. The PDF and graduate students’ time can be better spent analyzing and interpreting data. Secondly, [it] provides a teaching environment in which the trainees are welcome to spend time within the core facilities to either gain knowledge in a field that is not their primary discipline, or to utilize the resources and expertise within the facilities to further their research”.

While the CFI program has had a major impact on the recruitment of a large number of trainees to Canadian research institutions, as demonstrated above, even greater numbers have seen the quality of their training enhanced as a result of the program.

Thus, more than 20,000 PDFs, PG students and other trainees at various levels are reported to have substantially enhanced their training by making it more relevant, interdisciplinary, collaborative, cross-sectoral, or international because of the availability of the infrastructure.

To put things in perspective, in 1999, the latest year for which statistics are available, there were close to 100,000 PG students enrolled at Canadian universities, 36,000 of them in life, natural and applied sciences, which together account for more than 95% of the CFI investments. The information provided by project leaders suggests that a large proportion of these students benefited from the CFI program. The narrative comments also indicate that the quality of the training has improved as a result of the availability of the infrastructure.



The distribution of these trainees according to their educational level is given in Fig. 6. While PG students and PDFs accounted for more than 85% of the total, a substantial number of undergraduate (UG) students also benefited from these installations.

As might be expected from the distribution of the postgraduate student

population in Canada, master's students (M) being most numerous, also represented the highest proportion of trainees whose education was enhanced by the various infrastructure projects. The IF reported the highest average number of trainees per project (33) who benefited from the infrastructure versus 10 trainees per project for the other funds. The enhancement of training enabled by the infrastructure was reported by project leaders at all types of institutions.

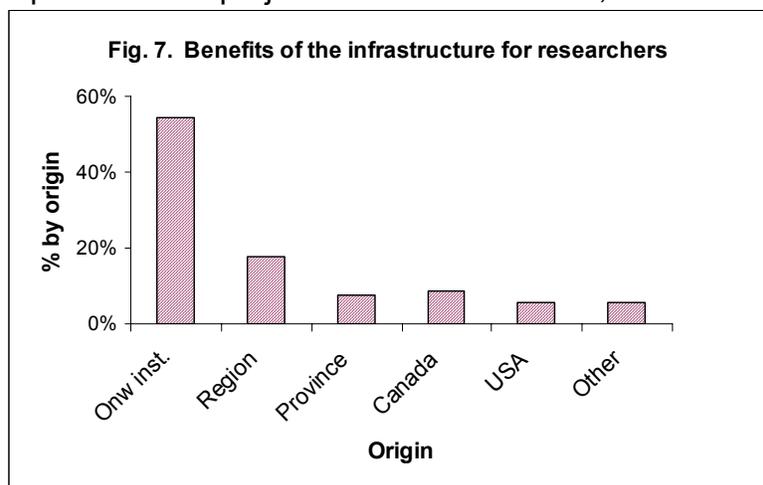
Therefore, a large number of future graduates and PDFs trained in Canadian institutions are deriving significant benefits from the opportunity to work with the state-of-the-art equipment and infrastructure afforded by the CFI program. This bodes well for their future careers and is already contributing to the development of a larger cadre of highly qualified people in Canada.

3.3. Promoting networking, collaboration among researchers and multidisciplinary

The demands of modern research mean that investigators can no longer work in isolation. Collaborations are increasingly necessary to achieve results in a timely manner. Networking across the country and indeed across the world has become essential and has been aided by the speed of modern communications. Many important research advances, such as the elucidation of the human genome could not have taken place in such a short time without a high degree of collaboration and networking among various groups. In such an environment, one of the major benefits of the CFI program has been to provide Canadian investigators with the tools that make them desirable collaborators.

“We have provided microarrays to over 250 research groups worldwide, including more than 100 in Canada. Evidence suggests the majority have made significant advances based on the interaction”.

Apart from the project leaders themselves, the research of more than 15,000



researchers is reported to have benefited from the CFI investments in infrastructure by being more productive, more multidisciplinary, more risky or more competitive internationally.

As might be expected, most of the beneficiaries were within the project leader's own institution; however, a substantial proportion came from other parts of the

country and even from abroad (Fig. 7).

All types of projects (IF, Chairs and NOF) had multiple beneficiaries. Not surprisingly, given its nature and objectives, the IF fund had the greatest average multiplier effect at 11.4. The average multiplier effect for projects for which budgets were finalized in 1998-99 was 9, compared to 3 for 2002-03, likely because the more mature projects are fully implemented or close to completion and are better known to the research community at large.

“In obtaining these funds for the development of this infrastructure, I also was committed in developing significant opportunities for other researchers to use these facilities. This approach led to numerous collaborations with other researchers who were not originally members of the CFI grant”.

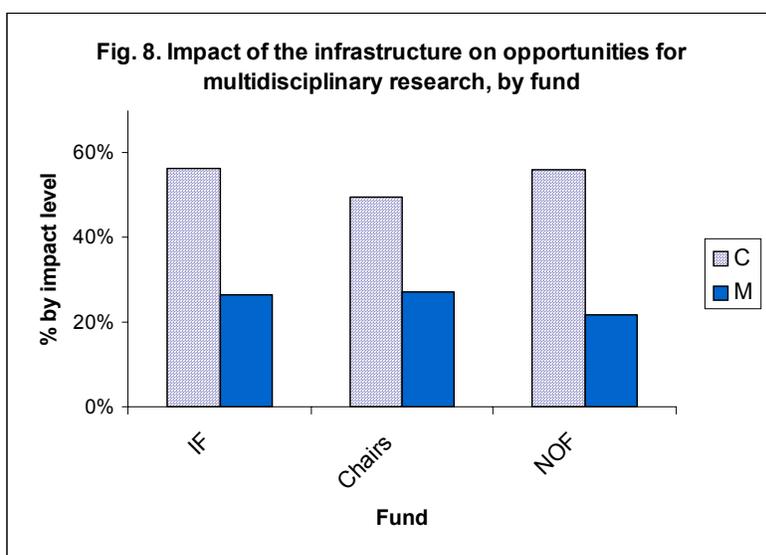
Predictably, the greatest impact for beneficiaries external to the project leader’s own institution has been on the work of researchers within Canada. Nevertheless, the impact of the infrastructure projects on international researchers is impressive, accounting for 25% of external beneficiaries. This demonstrates the broad impact of the CFI on the reputation and influence of the Canadian research enterprise and the links that it is helping to create among researchers.

The great majority of external beneficiaries were from the academic/hospital sector. However, in colleges-based projects almost half came from the private sector, reflecting the mission and style of research of colleges.

More and more, the exciting advances in research occur at the boundaries of disciplines. It is therefore essential for researchers to engage in multidisciplinary research. It is one of the objectives of CFI to foster such interactions.

“The Canada Foundation for Innovation support has intensified both formal and informal collaborations between faculty members on campus, internationally as well as on a regional and national level.”

Examples abound in the institutional reports of the way in which the CFI program has helped to transform research from a largely disciplinary base into collaborative and multidisciplinary endeavours, by enabling large projects that would have been difficult to achieve otherwise. These state-of-the-art facilities are also enabling Canadian researchers to participate in international collaborations as equal partners, enhancing the visibility of Canadian research.



More than 60% of project leaders believed that the infrastructure had had a significant (C) or major (M) impact on the ability of users to perform multidisciplinary research. This was true across the different funds (Fig. 8).

The proportion of those reporting a significant or major impact was greatest for projects with budgets finalized in 1998-99 (78%); however,

50% of the projects with budgets finalized in 2002-03 also reported at least a significant impact.

« L'impact de l'infrastructure sur les collaborations de recherche a aussi été considérable au cours de la dernière année. Ainsi, presque tous les chercheurs (> 85 %) estiment que des liens additionnels ont pu être tissés avec leurs collègues intra- et interinstitutionnels à leur infrastructure dans la création d'ententes de partenariat avec des établissements du secteur privé, du secteur public ou d'autres secteurs. Sur le plan des collaborations internationales, l'infrastructure a favorisé de telles interactions dans plus de la moitié des cas ».

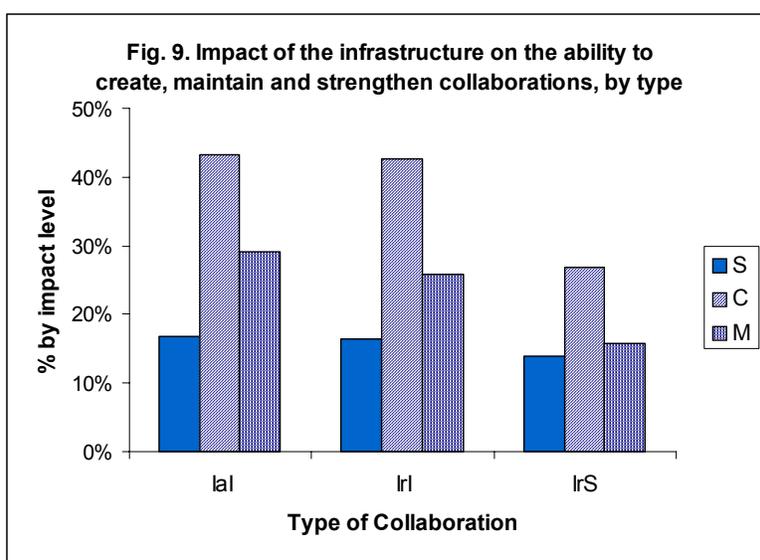
Partnerships of all kinds have been and are being established as a result of the various infrastructure projects. In many provinces, the creation of initiatives to enable institutions to take advantage of the CFI program has borne fruit. This provincial (or regional) support has now extended across Canada.

Partnerships have also developed between different types of institutions (e.g. colleges and universities), different sectors and across regions.

As shown in Fig. 9⁷, the great majority of respondents reported that their infrastructure

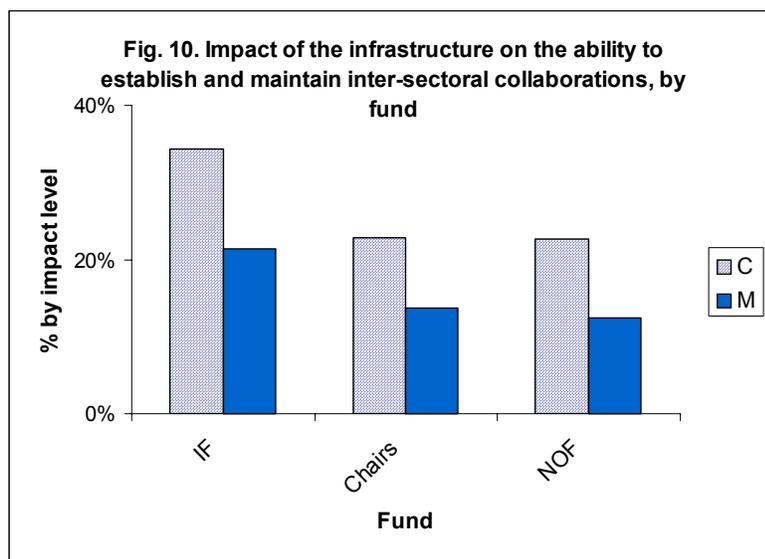
project is having a significant or major impact on intra-institutional (Ial) and inter-institutional (Irl) collaborations: respectively 72 and 69%.

Note that for ease of viewing, the data shown in Figs 9, and 10-12⁸ depict only a sub-set of the data. The bars, therefore, do not add up to 100%.



⁷ Captions for Fig. 9 are as follows: S: minor impact; C: significant impact; and M: major impact. Ial: intra-institutional; Irl: inter-institutional and IrS: inter-sectoral.

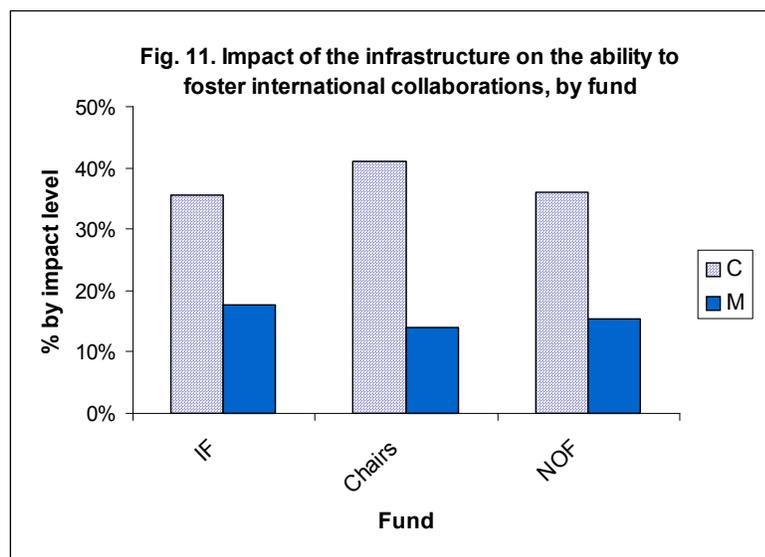
⁸ Captions for Fig. 10-12 are as follows: C = significant impact; M = very significant impact.



The impact of the CFI infrastructure projects on intra-sectoral (IrS) collaborations was somewhat less: overall 42% reported a significant or major impact (see Fig. 9). However, as shown in Fig. 10, there is a noticeable variation among the funds. More than 55% the IF projects leaders and 36% of the Chairs and NOF project leaders reported at least a significant impact in promoting inter-sectoral collaboration.

This difference among the funds may be explained in part by their nature, since the Chairs and NOF funds support the infrastructure needs of individuals. In addition, since 30% of the projects in these two categories had their budget finalized in the last six months of the reporting period, any impact will probably not be evident for some time.

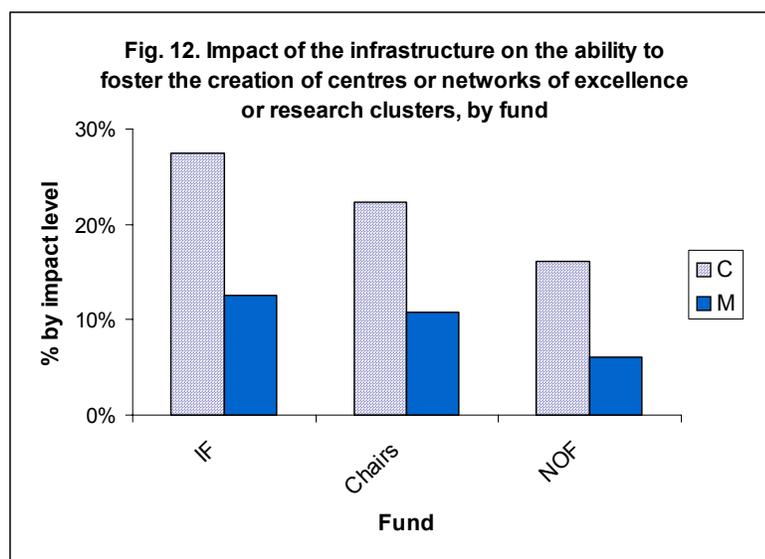
When projects were examined on the basis of their disciplinary area (called sector in the CFI database) those in the natural sciences, engineering and environmental areas, where there is a longer tradition of collaboration across sectors, were found to be more likely to have promoted inter-sectoral collaborations than those in health or social sciences and humanities.



Over 70% of project leaders reported that the availability of the infrastructure had fostered international collaboration to at least some degree (Fig. 11). For most of the funds, the impact was believed to be at least significant by more than 50% of the respondents.

As was the case for other indicators, the existence of the infrastructure project seemed as important as its implementation status in fostering international collaborations, signalling that the

prestige of Canadian researchers is enhanced by the CFI program, helping to make them desired collaborators.



As might be expected, the ability of the infrastructure to help in the creation of centres, networks or clusters varied somewhat, depending on the fund (Fig. 12). Since it supports the creation of many multiple user facilities, the IF was naturally more successful in this respect than funds geared to the recruitment of individual researchers (Chairs, NOF). However, this impact was seen across all funds.

These data as well as the narrative comments strongly

support the conclusion that Canadian researchers are keen to collaborate within and across institutions and sectors and are excited at the prospect of entering into multidisciplinary research projects with collaborators the world over.

3.4. Ensuring the optimal use of research infrastructure within and among Canadian institutions

“In addition to the benefits of research collaborations, the CFI program itself has provided an opportunity for the University to examine the provision and use of research infrastructure on the campus. ...we have moved to a system of major shared facilities, allowing for optimal acquisition and operation. We are now trying to build on research collaborations with outside institutions to explore equipment-sharing arrangements”.

The conservation of our limited research resources requires that research funding, including that for infrastructure, be used judiciously and that research infrastructure be available as widely as possible.

Institutions are using various strategies to ensure that the infrastructure is used optimally. Many are supporting the creation of multiuser facilities to provide for enhanced interactions among users and reductions in the cost of operations.

Nevertheless, in general, the institutions remain preoccupied by the long term maintenance costs

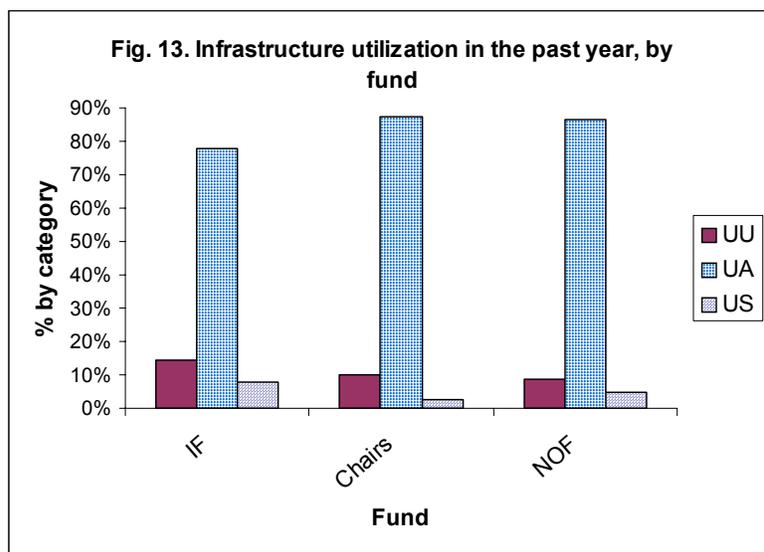
they will incur, once projects are fully implemented. They are grateful for the provision of the IOF funding, but are concerned about the viability of some of the projects that do not qualify for support under this fund. In some cases, the optimal utilization of the infrastructure was reported to be limited by the availability of funds for operation and maintenance.

Project leaders view this issue from the vantage point of their own project. Given that only about 50% of projects included in this analysis are fully operational, the project leaders' assessments are much more limited than those of the institutions. Nevertheless, approximately 20% of them expressed concern with their ability to sustain the costs of maintenance and operation in the long term.

The recruitment and retention of skilled personnel to operate and maintain the infrastructure was also a matter of concern. As one project leader noted, the recruitment could be relatively easy, since there are superbly qualified people; the difficulty resides in finding adequate salary support and suitable career paths for such people, particularly in competition with other sectors.

If Canadian research infrastructure is to remain state-of-the-art, infrastructure renewal, particularly in areas where technical developments are extremely rapid, is also viewed by institutions and project leaders as an issue that will need attention from the CFI in the near future.

Despite these preoccupations, the institutions' efforts at coordination together with the



commitment of project leaders are bearing fruit. As shown in Fig. 13⁹, more than 80% of respondents reported that the infrastructure was fully utilized in the past year and fewer than 10% reported that the infrastructure was unable to satisfy demand, suggesting an appropriate equilibrium. Patterns were similar across the different funds.

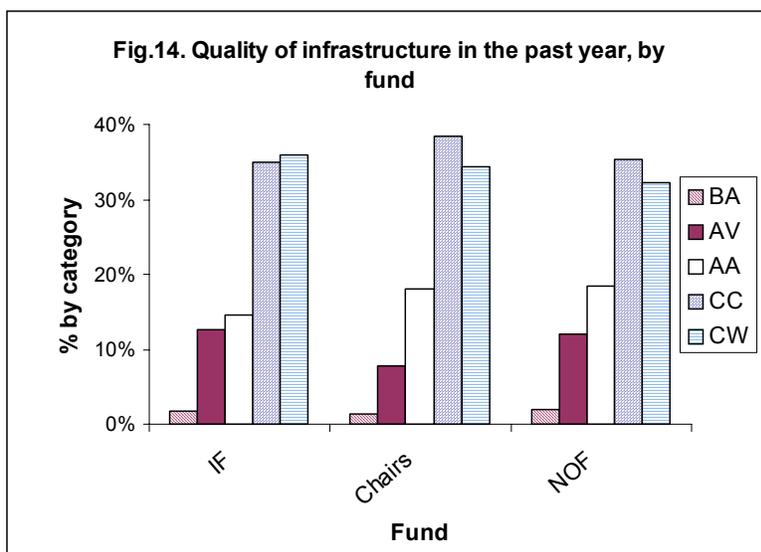
The main reasons given for infrastructure underutilization in addition to the difficulty of retaining trained personnel for operation and maintenance alluded to above, were the reluctance of researchers to pay user fees and, for some, the slower than expected take-up from private sector partners.

Not surprisingly, there was a high degree of correlation between the year when the project budget was finalized and the patterns of utilization: the earlier the project was finalized, the more likely the infrastructure was to be fully utilized. This correlates with the implementation status of the infrastructure (shown in Fig. 1) where 84% of those with a fully developed infrastructure reported that it was fully utilized. Of those reporting that their infrastructure was still under development, 54% reported full utilization (presumably of the portion already implemented).

The high level of utilization of the facilities and equipment provided through the CFI program is an indication of the need for infrastructure support; it also indicates the research community's perception of the high quality of the infrastructure.

⁹ Captions for Fig. 13 are as follows: UU: underutilized; UA: fully utilized; US: unable to satisfy demand

Indeed, researchers are enthusiastic about the quality of the infrastructure acquired with the assistance of the CFI program, As depicted in Fig. 14¹⁰ 85% of project leaders considered their infrastructure at least above average and more than 34% considered it to be comparable to the best in the world.



The maturity of the project did not appear to play a role in the evaluation of comparative quality, indicating that project leaders may have evaluated the potential quality of their project, rather than its status

in the past year. Nevertheless, this enthusiasm undoubtedly translates in increased research productivity and quality.

It follows from the foregoing that the infrastructure resources are used to full capacity in the great majority of cases. Even projects that are only partially developed appear to be used extensively relative to their state of completion. However, there are issues developing around operation, maintenance and renewal that may require the attention of CFI in the near future. The narrative comments indicate that the CFI program has significantly increased the quality and competitiveness of research in Canada.

¹⁰ Caption abbreviations for Fig. 14 are as follows: BA: barely average; AV: average; AA: above average; CC: comparable to others in Canada; CW: comparable to others in the world

3.5. Strengthening Canada's capacity for innovation

“In looking back at some of the key research areas that have been funded by the CFI, it is safe to say that this has been a significant component in building [this university's] research capacity”.

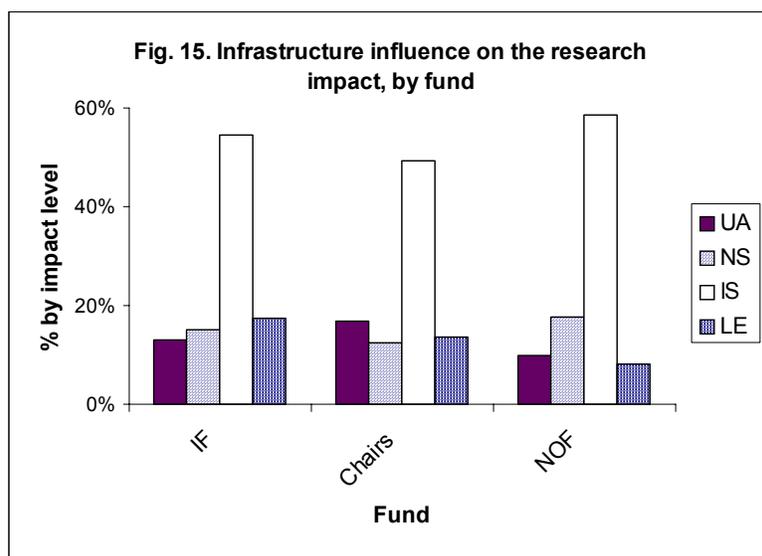
“The University ...continues to regard the Canada Foundation for Innovation as the federal program that has contributed most dramatically to Canada's Innovation Strategy for the 21st Century and to our ability to provide first-class research facilities on our campus”.

A country's capacity for innovation is a function of many factors not the least of which is its research capacity. This, in turn, is dependent on the quality and availability of research infrastructure and on the provision of funds to support the research enabled by the infrastructure.

The annual progress reports demonstrate that by contributing to the implementation of state-of-the-art infrastructure in Canadian research institutions, the CFI is helping to enhance Canada's capacity for innovation and is contributing to Canada's Innovation Strategy. This is increasing the quality and international competitiveness of the research conducted by Canadians and enabling research that is producing social and economic benefits for the country. Each of these aspects will be illustrated in the following pages.

Research quality

Not only is the CFI program benefiting numerous researchers both within and outside Canadian institutions by accelerating their research programs it is also contributing to enhancing the quality of the research that is being performed in Canada.



Overall, 75% of project leaders reported that research undertaken with the infrastructure met at least national standards (NS) and more than 60% reported that the research was competitive by international standards (IS) or leading edge (LE) (Fig. 15¹¹)

Not surprisingly, there was a correlation between the maturity of the infrastructure projects and their impact on

research quality. Projects for which budgets were finalized in 1998-99 were more likely to be classified as having enabled research competitive by international standards than those finalized in 2002-03. This seems entirely reasonable since it is unlikely that the research undertaken with infrastructure implemented in the past year has been completed and disseminated.

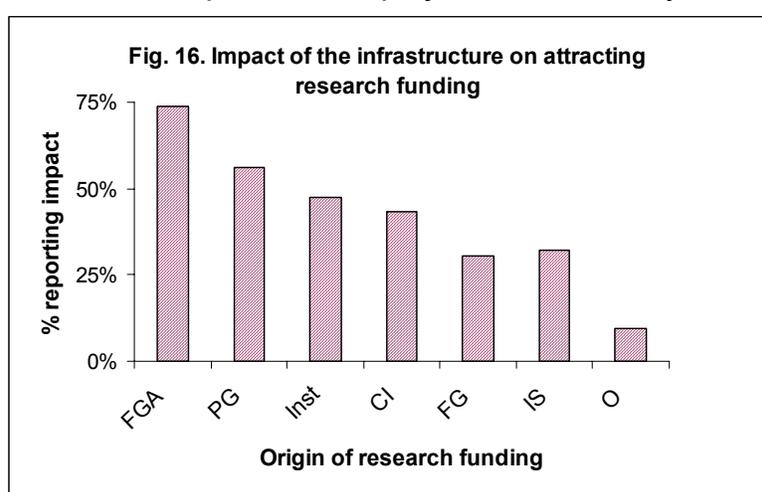
The foregoing shows that the Canadian research community strongly believes that the CFI infrastructure program has had a significant impact on the quality of the research performed by the project leaders as well as by their colleagues near and far. The number of instances of reports showing that the research enabled by the infrastructure meets international standards or is leading edge is impressive for a program that is relatively young.

¹¹ Caption abbreviations for Fig. 15 are as follows: UA: modest but useful advances; NS: national standards; IS: International standards; LE: leading edge

Leveraging resources

Research infrastructure is an important component of the type of resources that are required to strengthen innovation capacity. However, research support and other resources are also required to ensure that the research infrastructure is fully exploited.

As shown in Fig. 16¹², researchers who benefit from infrastructure projects are also successful in attracting funds from various sources. Overall, approximately 75% reported that the infrastructure had had at least some impact on their ability to attract funds from the federal granting agencies (FGAs). In addition, around 50% reported at least some impact of their project on their ability to leverage funding from provincial



government sources, their own institutions and/or Canadian industry. An impressive 25% reported that their infrastructure has had an impact on their ability to obtain funds from international sources. These figures are even more impressive when it is remembered that the data apply only to the past twelve months.

It is important to note that many users might not have had the opportunity to apply for funding since the infrastructure project has been in place. Federal granting agencies, for example, award funding for periods of 3-5 years. The beginning of an agency's award may, therefore, have preceded the implementation of a specific infrastructure project. In such cases, the existence of the infrastructure would have been deemed (correctly) to have had no impact on leveraging these funds.

The narrative comments of project leaders document that those who applied for FGA funding in the past year believe that they were more successful than they had been before the implementation of their project, because they were in a position to do more innovative research more quickly. However, only that sub-set of users could respond positively to the question. Despite these limitations, data gleaned from the progress

¹² Captions for Fig. 16 are as follows: project leader's own institution (Inst); the federal granting agencies (FGA); other federal government sources (FG); provincial government sources (PG); Canadian industries (CI); international sources (IS); and other sources (O).

reports nevertheless provide strong indications that the existence of CFI program confers a competitive advantage to its users in attracting research funds.

Social and economic benefits

While the availability and quality of research infrastructure are of paramount importance to enable innovation, ultimately, it is the exploitation of the research results that leads to the creation of social and economic benefits.

“A tangible outcome of the investment by the Canada Foundation for Innovation in universities is the transfer of new ideas to patents, licensed technologies, to spin-off companies, new industries and employment opportunities for Canadians. Many of the [project leaders’] reports document this kind of benefit to Canada. As the projects move forward, one can anticipate further benefits to Canada”.

While pointing out that the CFI program is relatively young, the first awards having been made in December 1998, institutions believe that it has already had a major impact in supporting research that will benefit Canada, with signs that there will be much greater rewards in the future. Already, research outcomes have been translated in the disclosure of inventions, the registration of patents and copyrights, the creation of spin-off companies and the transfer of technology and knowledge to the private and public sectors.

The outcomes of the CFI program described in the previous sections of this report represent major benefits to Canada, in terms of the attraction, retention and training of highly qualified people and the performance of high quality research. Similarly, the ability of Canadian researchers to perform and collaborate at national and international levels means that Canada is better able to share the benefits of international research. In one way or another, the majority of project leaders pointed out that the dissemination of their research through publications or other means is also essential to ensure that Canadian research is known and its results adopted in practice. Although they were not asked, project leaders were quick to point out that the research enabled by the infrastructure had enhanced their research productivity and translated into numerous publications in top quality journals.

“... the various scientific results obtained through this infrastructure had a significant impact on recognition and visibility. Many scientists from our group published the results of their studies in high impact journal”.

Both the institutional and the project reports document that the research enabled by the infrastructure permitted major advances of knowledge. Translating advances of knowledge into economic and social benefits is a much lengthier and circuitous process. Nevertheless and despite the relative youth of the CFI program, project leaders reported some remarkable results in the areas singled out by CFI in the project report questionnaire.

These areas can really be divided into two broad groups, which overlap to a certain degree:

- those in which researchers can take an active part in ensuring outcomes, such as the production and disclosure of intellectual property, the provision of new or improved products and services, and the creation of spin-off companies;
- those that depend on the improvements resulting from the research being adopted by the end users (e.g., industry, health professionals, policymakers), once they have been disseminated. Job creation, cost savings, public policy, health, social and environmental improvements fall mainly in that category.

The information provided below was gleaned from the narrative comments of project leaders who reported a significant impact of their projects in the various areas that signal social and economic benefits.

Intellectual property

Project leaders reported that, in the past year, they have produced research that lead to technology transfer, as evidenced by more than¹³ 130 instances of patents, patent applications, provisional patents, invention disclosures, licenses and copyrights. They credit the CFI program for playing a significant role in supporting the research that led to these successes.

“At least three small Canadian start-ups have been significantly assisted by their partnerships with [our project]. One patent has been awarded and licensed to a major manufacturer with an anticipated royalty stream”.

« ...la création de l'entreprise essaimée (“spin-off”) [...]. Cette entreprise a acquis une licence sur un brevet découlant de nos travaux antérieurs tout en octroyant un important contrat de recherche (3.9 M \$ sur 3 ans) pour améliorer la technologie existante et développer une nouvelle technologie plus performante. »

¹³ It is not possible to ascertain an exact number, since some respondents used several or many instead of exact numbers.

New or improved products, processes or services

Eighty project leaders reported instances of their infrastructure enabling them to carry out research that resulted in technology transfer to their private sector partners that translated into improved products, processes and services. These are best illustrated in the words of the project leaders themselves:

“Nortel Networks in Ottawa has, in collaboration with [us], launched its own development work for ... transistors. This should allow *Nortel* to remain competitive with other organizations...On a more fundamental level, the fact a Canadian university can develop a record breaking transistor technology serves our national image well insofar as high technology is concerned: we have clearly demonstrated there is more to Canada than natural resource exploitation”.

“... improved environmental services; namely, better weather and disaster forecasts. We have successfully achieved the goal of our CFI proposal to develop a real-time, daily ensemble of weather forecast models, the output of which is used as input to disaster forecast and research models”.

« Globalement, les résultats de ces recherches ont permis de rehausser la fiabilité du transport et de la distribution de l'énergie électrique, contribuant ainsi à rendre l'industrie canadienne d'électricité plus productive et à assurer une meilleure qualité de vie à la population canadienne. »

“The work has resulted in the development of non-invasive tests to assess vascular reactivity in humans and is currently being used to develop improved markers for the monitoring of early sight-threatening diabetic retinopathy. The work also has application for the investigation of [many diseases]”.

From these selected quotations, the reader can only begin to understand the breadth of activities supported by the CFI program and the immense benefits likely to accrue to the Canadian private sector as a greater proportion of the projects become fully functional and the research is more advanced.

Spin-off companies

Project leaders also credit their infrastructure project for having had a significant impact on supporting research that led to the launching of 20 new spin-off companies. The sampling of quotes below speaks to the activities enhanced by the CFI program.

“At least three small Canadian start-ups have been significantly assisted by their partnerships with [our project]. One patent has been awarded and licensed to a major manufacturer with an anticipated royalty stream”.

“...the presence of the [...] laboratory has had considerable impact on the region’s economy in 2002 with the development of two spin-off companies ... These companies have hired seven [of our] graduates...”

« ...la création de l’entreprise essaimée [...]. Cette entreprise a acquis une licence sur un brevet découlant de nos travaux antérieurs tout en octroyant un important contrat de recherche (3.9 M \$ sur 3 ans) pour améliorer la technologie existante et développer une nouvelle technologie plus performante. »

It is evident from the foregoing that Canadian researchers are intent in transferring the knowledge acquired through their research and putting it to work for Canadians.

Job creation and cost savings

As described above the following benefits are mainly accrued as a result of decisions external to the research community. Nonetheless, project leaders were able to provide anecdotal evidence of instances where the research enabled by their infrastructure led to benefits.

Some of the project leaders indicated that the outcome of the research supported by their infrastructure had led to job creation and cost savings in the private or public sectors.

“As a result of the [Canada Research] Chair and infrastructure, one company has relocated to Canada from the USA and we are negotiating with a second company for relocation. We have been able to generate venture funds to assist these companies to become viable entities in the biopharmaceutical arena. In addition to the jobs created by these companies (estimated to be 20 by the end of this year), we are also creating a unique training environment”.

Few respondents were able to be specific, saying that information about the number of jobs that might have been created outside their research laboratories simply was not available. However, 40% of the respondents believed that, because the CFI infrastructure program had had an effect on their research productivity and on their ability to leverage research funding, research jobs had been created within their research

laboratories or within the facility created as a result of the grant.

« Les logiciels associés aux cimenteries, couplés à des campagnes d'échantillonnage, ont facilité l'obtention de certificats d'autorisation pour l'utilisation de combustibles alternatifs. Les retombées représentent des économies en combustible fossiles estimables à plusieurs millions de dollars par année. »

“Our research has allowed the photographic industry to reduce the cost of photoprocessing by improving the cost-effectiveness of pollution controls”.

New products and services introduced as a result of the research enabled by the infrastructure often resulted in cost savings for private sector partners. While providing systematic information on this aspect was beyond the capabilities of project leaders, there are anecdotes in the narrative portion of the reports that illustrate this point.

As discussed above, the ultimate decision to adopt advances in knowledge rests mainly with the end user. Researchers produce the data and disseminate the information through publications or transfer the knowledge to

their sponsors. Had the two industries alluded to in the quotes above not adopted the research in their practice, the cost saving benefits would have been lost; however, the intrinsic quality of the research itself would not have been diminished.

A large number of respondents also pointed out that the new infrastructure was responsible for making their research more efficient and more cost-effective. This allowed them to provide research materials or analyses to their colleagues at lower costs, enabling increased research productivity.

Public policy, health, social and environmental improvements

Research can lead to improvements in all these areas; however, the active participation of the end-users and decision-makers is necessary for the translation of knowledge to occur and improvements to be implemented. That the research enhanced by the CFI program has already produced results in many areas is evident from the sampling of quotes below:

“...Inputs into Kyoto protocol and other policies”.

“The infrastructure has enabled [a] major provincial health research and programme implementation”.

“Experimental research findings in the [...] Laboratory have already been translated to the improvement of products being used in fracture fixation applications. Our work quantifying the biomechanical stability of high proximal tibial fracture fixation has lead to improvement of [a] tibial implant. The recommendations supported by our research findings are changing the product at the manufacturing level throughout North America”.

“The computers purchased have allowed us to mount, calibrate and validate a sophisticated hydrodynamic model for Lake Erie that is now being used by Environment Canada to evaluate future climate scenarios”.

“The research work has also resulted in a new protocol for rapid diagnostics using Real Time PCR of water pathogens, and the technology is being evaluated by the Ministry of Health”.

“... research enabled by the CFI infrastructure has provided key stock surveys and information for cod and capelin in Newfoundland and Labrador waters”.

These few quotes show the breadth of benefits attributable to the CFI program. Given the wealth of potential applications for the research enabled by this program, it will become increasingly important for Canada to find mechanisms to ensure that these and other research findings are translated into policies and practices. It will also become more important to ensure that mechanisms are available to document and capture this information to be able to assess the impact of our investments in research and, in particular, in the CFI program.

4. Conclusions

The data provided in this impact report leave no doubt about the positive impact that the CFI program is having on building capacity for innovation. In addition to providing statistical information, the annual project and institutional reports convey a sense of

enthusiasm and optimism, despite some of the challenges encountered in the implementation of projects.

By giving Canadian researchers the tools necessary to undertake riskier and more innovative research, the CFI program has already enabled enhanced research productivity and transfer of technology and knowledge to end users. Given the length of time required for the translation of knowledge into applications, this bodes well for the future and puts the CFI program in the vanguard of the tools that Canada has given itself to meet its target to become one of the most innovative economies in the world by 2010.

5. Appendix 1- Abbreviations

Abbreviations used in the text

CFI	Canada Foundation for Innovation
Chairs	Canada Research Chairs Infrastructure Fund
HQP	Highly qualified people
IF	Innovation Fund
IOF	Infrastructure Operating Fund
NOF	New Opportunities Fund
PDF	Postdoctoral Fellow
PG	Postgraduate

Abbreviations used in Figures are explained in the adjacent text or in footnotes to each Figure.

6. **Appendix 2** Copies of the Institutional and project report questionnaires

Institutional Report Form

Report for the Year April 2002 to March 2003

Background

Institution:

Date:

Name of Report Author:

Institution's progress in the past year in achieving the objectives of its strategic research plan (Maximum 5 pages. Will be published on the CFI website)

Using as headings the priority areas identified in your strategic research plan, please report on the impact, in the past year, of all CFI investments (both infrastructure and operating funds) at your institution, in accomplishing the objectives of your plan. While institutions may refer to individual projects, the detailed information contained in the individual Project Reports should not be repeated.

In reporting on **each priority area**, you may wish to keep in mind the following:

- Building capacity for innovation;
- Attracting and retaining high quality faculty, other researchers, and trainees;
- Promoting collaborative and multidisciplinary research;
- Promoting partnerships;
- Ensuring optimal use of infrastructure; and
- Generating social and economic benefits to Canada.

Challenges faced by the Institution over the past year

(Maximum 1 page. Will not be published)

Please explain any significant delays or barriers in the acquisition, development or implementation of infrastructure at your institution in the past year.

Please describe any operations or maintenance challenges in the past year, and how the CFI Infrastructure Operating Fund has helped the institution meet the challenge.

New Opportunities

In future annual Institutional Reports, we intend to request information on the number of eligible new faculty recruited by Canadian universities each year, in order to assist the CFI in

planning future directions for the New Opportunities Fund. Individual institutional information will not be published.

If you have this information available, it would be very helpful if you could tell us how many new faculty taking up their first full-time faculty appointment at a Canadian university you recruited in the past year. _____

Communications Activities

(Will not be published)

In future annual Institutional Reports, the CFI intends to ask you to provide information on your communications activities carried out over the past year, as these relate to your institution's Communication Plan. In this report, we would appreciate this information to better enable the CFI to work with you in supporting your activities.

If you have this information available, please indicate how many of the following communications activities your institution carried out over the past year to showcase research enabled by CFI investments.

1) News Release	None	3 or less	More than 3	Monthly
National Media				
Local/Regional Media				
Concurrent to CFI Announcements				

2) Publications (non academic)	None	3 or less	More than 3	Monthly
National Magazine				
Local/Regional Magazine				
Campus News				
Web site				

3) Events	None	3 or less	More than 3	Monthly
Receptions/Open House				
Groundbreaking/Launch event				
Funding Announcements				
Impact or Outcome Announcement				

4) Other	None	3 or less	More than 3	Monthly
(Specify):				

Comments (Optional. Maximum 30 lines)

Project Report Form

Report for the Year April 2002 to March 2003

Part A

(to be completed for all projects whether fully, partly, or not yet operational)

<p>6.1.1. Background</p> <p>Project Number:</p> <p>Project Leader:</p> <p>Date:</p> <p>Title of project:</p> <p>Institution:</p> <p>CFI Fund:</p> <p>CFI Contribution:</p> <p>Date of Approval:</p>
<p><i>Project Summary (Maximum 30 lines).</i></p> <p><i>This summary of the Project will be published on the CFI web site and should be written in language that can be understood by the public.</i></p> <p><i>If this section is blank, please fill it in. If there is information already in this section, please verify it and/or update it.</i></p> <p><i>Please provide a brief overview of the infrastructure, mentioning unique or significant individual items. Please describe the main themes of research supported by the infrastructure, and indicate the social or economic benefits of this research to Canada.</i></p>
<p>Infrastructure Implementation</p> <p>1) By March 31 2003, was the infrastructure fully acquired/developed and operational? Yes ____ No ____</p>

2) Please provide the date when the infrastructure became, or is expected to become, fully operational. Year: ____ Month: ____

3) This past year, were there delays with the acquisition, development and implementation of the infrastructure? (If so, please explain in Part C).

- Not applicable
 No delays
 Delays (Explain in Part C)

6.1.2. Researchers

4) Over the past year, was the availability of the infrastructure an important factor in the decision of any researchers (faculty members, and other researchers, including yourself if applicable), but not trainees (e.g. PDFs, graduate or undergraduate students) to **join** your institution? Yes _____ No _____

If any, for how many researchers was this an important factor: _____

a. Of these researchers, how many were recruited from:

- i. Canada: _____
 ii. the U.S.: _____
 iii. other countries: _____

b. Of these researchers, how many were recruited from the:

- i. academic/hospital sector: _____
 ii. private sector: _____
 iii. public/not-for-profit sector: _____

5) Over the past year, was the availability of the infrastructure an important factor in the decision of any researchers (faculty members, and other researchers, including yourself if applicable), but not trainees (e.g. PDFs, graduate or undergraduate students) to **stay** at your institution? Yes _____ No _____

If any, for how many researchers was this an important factor: _____

6) Over the past year, for how many **PDFs** and **graduate students** was the availability of the infrastructure an important factor in their decision to **come** to your institution to pursue their training? PDFs _____ Graduate students _____

a. Of these PDFs, how many came from:

- i. your own institution: _____
 ii. other Canadian institutions: _____
 iii. U.S. institutions: _____
 iv. other foreign institutions: _____

b. Of these graduate students, how many came from:

- i. your own institution: _____
- ii. other Canadian institutions: _____
- iii. U.S. institutions: _____
- iv. other foreign institutions: _____

- 7) Over the past year, for how many **other trainees** (undergraduate students, other trainees) was the availability of the infrastructure an important factor in their decision to come to your institution to pursue their studies? _____

Part B

(to be completed for all projects that are fully or partly operational)

Infrastructure Status During the Past Year

- 8) In the past year, how did the infrastructure compare to similar infrastructure in other research institutions in Canada and around the world? (Select which best applies).
- It was below average compared to other labs.
 - It was average compared to other labs.
 - It was above average compared to other labs.
 - It was comparable to the best in Canada.
 - It was comparable to the best in the world.
- 9) In the past year, which of the following best characterizes the utilization of the infrastructure?
- Not applicable this past year.
 - The infrastructure was under-utilized.
 - The infrastructure was fully utilized.
 - The infrastructure was unable to satisfy the demand of researchers wanting to use it.
- (In Part C, please explain if the infrastructure was underutilized or over-subscribed).
- 10) Over the past year, how easy or difficult has it been to obtain sufficient funds for Operations and Maintenance of your project?
- Not applicable this past year
 - Very difficult
 - Difficult
 - Reasonable
 - Easy

(If you indicated difficulties, please explain in part C)

11) Over the past year, how easy or difficult has it been to attract and retain skilled personnel (e.g. technicians) for Operations and Maintenance?

- Not applicable this past year
- Very difficult
- Difficult
- Reasonable
- Easy

(If you indicated difficulties, please explain in part C).

12) Over the past year, has your institution used funds from its allocation under the CFI Infrastructure Operating Fund to assist with the O&M for this project?

Yes _____ No _____

6.1.3. Research Activities During the Past Year

13) In the past year, how many researchers **at your institution**, including faculty, and other researchers but not including trainees (PDFs, students etc.), have substantively advanced their research (e.g. more productive, more multidisciplinary, more risky, more competitive internationally) because of the availability of the infrastructure? _____ (Put "0" if none yet).

14) In the past year, how many researchers **outside your institution** (not including trainees) have substantively advanced their research (e.g. more productive, more multidisciplinary, more risky, more competitive internationally) because of the availability of the infrastructure? _____ (Put "0" if none yet).

a) If any, how many of these researchers are at institutions/organizations:

- i. within your region: _____
- ii. elsewhere within your province: _____
- iii. elsewhere in Canada: _____
- iv. in the U.S.: _____
- v. in other countries: _____

b) If any, how many of these researchers are at:

- i. universities, colleges or hospitals: _____
- ii. the private sector: _____
- iii. the public sector: _____
- iv. the not-for-profit sector: _____

15) Over the past year, how has the availability of the infrastructure enhanced opportunities for multidisciplinary research?

- No multidisciplinary research this past year.
- No impact
- Minor impact
- Significant impact
- Very significant impact

16) Please select which one of the following statements best represents the research enabled by the infrastructure in the past year.

- no research undertaken with the infrastructure in the past year
- the research has not yet produced an advance
- the research has produced a modest but useful advance***
- the research has met national standards, or is the best in an undeveloped field, and contains some innovative aspects***
- the research was competitive at international standards and innovative***
- the research has been at the leading edge internationally, and has been transformative***

Training Activities in the Past Year

17) In the past year, how many trainees have substantively enhanced their training (e.g. more relevant, more multidisciplinary, more collaborative, more cross-sectoral, more international) because of the availability of the infrastructure? _____ (Put "0" if none yet).

If any, how many of these trainees are:

Undergraduate students or equivalent: _____

Masters students: _____

Doctoral students: _____

Post-doctoral Fellows: _____

Sources of funding over the Past Year

18) Over the past year, has the infrastructure had an impact on the ability of its users to attract funds from the following sources? (Check which best applies for each source from which funds were received this past year).

Funding Source	No Funds from this source this past year	No Impact	Minor Impact	Significant Impact	Very Significant Impact
Your/their institution					
Federal Granting agencies					
Other federal government sources					

Provincial government sources					
Canadian industry					
International sources					
Other (specify) _____					

Collaborations over the Past Year

19) Over the past year, has the availability of the infrastructure helped create/maintain/strengthen collaborations? (Check what best applies to each type of collaboration or partnership in the past year).

Collaborations	No such collaborations over the past year	No Impact	Minor Impact	Significant Impact	Very Significant Impact
Intra-institutional: Linkages/informal interactions among colleagues in same or different department/discipline					
Inter-institutional: Collaboration across institutions with researchers in same or different discipline/sector					
Inter-sectoral: Partnership agreements with institutions in private, public, or other sectors					

20) Over the past year, to what extent has the availability of the infrastructure fostered international collaboration?

- No international collaboration over the past year
 No impact

- Minor impact
- Significant impact
- Very significant impact

21) Over the past year, to what extent has the availability of the infrastructure helped in the creation of centres or networks of excellence, or clusters?

- No such centres etc. created over the past year
- No impact
- Minor impact
- Significant impact
- Very significant impact

Benefits of the Research to Canada in the Past Year

22) In the past year, to what extent has the research supported by the infrastructure led to benefits to Canada in the areas listed below? (Check what best applies to each area in the past year).

Area	No benefits in this area	Minor benefits in this area	Significant benefits in this area	Very significant benefits in this area
Intellectual property (e.g. patents, software copyrights) or other forms of technology transfer (e.g. licenses)				
New or improved products, processes or services				
Spin-off companies				
Jobs created as a result of research outcomes				
Cost savings as a result of research outcomes				

Public policy improvements				
Health improvements				
Social improvements				
Environmental improvements				
Other (specify) _____				

Part C

To be completed, as applicable, for all projects. This section is complementary to Parts A and B, and is for text explanations of:

- delays in acquiring or implementing the infrastructure project
- issues of over- or under-utilization of the infrastructure
- difficulties with operations and maintenance
- major benefits of the research to Canada, and
- other significant benefits of the project

Project implementation or management challenges over the past year (maximum 1 page)

23) If you indicated in Question 3 that there were delays in the acquisition, development and implementation of the infrastructure, please explain. If you indicated in Question 9 that the infrastructure was under-utilized, or over-subscribed, please explain. If you indicated in Questions 10-11 that there were difficulties in obtaining funds or personnel for operations and maintenance, please explain.

Major benefits of the research to Canada over the past year (maximum 2 pages)

24) Please illustrate your answers to Question 22 by briefly describing major benefits to Canada over the past year, of the research which was enabled by this infrastructure project.

Other significant benefits of the project over the past year (maximum 2 pages)

25) Please describe any significant benefits of the project over the past year in areas covered in Questions 4-8, 13-21, such as: recruitment/retention of researchers; access to world-class infrastructure; advancement of research; enrichment of training environment; employment of trainees; creation of collaborations, partnerships, or clusters; sharing of infrastructure; attraction of funding; recognition and visibility.

