



# Understanding the role of CFI-funded infrastructure in intersectoral linkages

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## INTRODUCTION

It is widely recognized that research and development contribute to long-term economic growth and quality of life. By helping solidify the critical mass of research capacity — both human and physical — and by improving the ability to understand and address issues from a variety of angles and perspectives, research linkages within (intrasectoral) and across (intersectoral) sectors have come to play a crucial role in creating a more effective research environment that can meet the challenges of a rapidly evolving and highly competitive global economy.

As a result, many governments have tailored their science policies to encourage research linkages, in particular those between universities and businesses, and Canada is no exception. Many policy decisions and budget announcements in recent years have specifically focussed on bringing together the various players in the research enterprise. Governments see those linkages as one way to: ensure greater economic and social value from large public investments in research; ensure results from university research get to the marketplace and get there faster; and create a learning environment that equips students with the skills and knowledge they need to succeed in the workforce.

The CFI has always played a role in this effort. “Promoting productive networks and collaboration among Canadian universities, colleges, research hospitals, non-profit research institutions and the private sector” has long been a national objective of the CFI. More recently, the CFI’s Board of Directors adopted six strategic directions the CFI will pursue in the coming years to achieve its mandate, including “forging productive partnerships to ensure that, where appropriate, CFI infrastructure investments achieve maximum impact through partnerships.”

Although data is limited, Canadian research publications offer insight on research linkages in Canada. Between 1980 and 2007, the number of Canadian papers written in collaboration with international partners has increased by 45 percent, indicating extensive collaboration with researchers from abroad. Similarly, a considerable portion of papers authored by Canadian researchers involve peers from their own or other provinces, which demonstrates a high level of collaboration within Canada’s research ecosystem.<sup>1</sup>

Additional metrics shed light on intersectoral research linkages involving Canadian universities — linkages with the private sector or the public/non-profit sector. Of the \$6 billion invested in university research in 2011 (external funding only), private and non-profit organizations account

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<sup>1</sup> According to a study conducted by the *Observatoire des sciences et des technologies (Research in Canada 2007: A Collaborative Affair, March 2010)*, almost a quarter of papers examined were written by researchers with collaborators from the same province, while the rate of papers written in collaboration with researchers from other provinces ranged from 16 to 43 percent.

for almost \$1 billion each.<sup>2</sup> The magnitude of these investments underlines the central role universities play in realizing the objectives of extra-academic clients and in developing innovation in Canada. Canada also ranks first among G7 countries for the extent to which the private sector directs its research expenditures to universities (6.7 percent of overall private-sector funding for research goes to universities).<sup>3</sup> In a recent opinion survey of executives, Canada ranked 11th of 142 countries for the question: “To what extent do businesses and universities collaborate on research and development in your country?”<sup>4</sup>

Given the emphasis on intersectoral research linkages, it is worthwhile gaining a better understanding of the role of CFI-funded infrastructure in those linkages.

## **INTERSECTORAL LINKAGES AND THE CFI**

Data from CFI’s project progress reports help highlight the contribution of CFI-funded infrastructure in the creation and development of linkages within and across sectors. More specifically, questions related to the utilization of the infrastructure and formal research agreements with partners from the academic, private and public/non-profit sectors offer some insight into the characteristics of collaborative projects.<sup>5</sup>

The sample used for analysis contained 1,419 CFI-funded projects that submitted progress reports in 2008-09, 2009-10 and 2010-11, and that declared being at least partially operational.<sup>6</sup> We looked at formal agreements and, more broadly, linkages — an aggregation of external users and formal agreements — through multiple lenses, crossing the data by sector, project size, field and reporting year. The data only speak to the presence or absence of agreements or linkages; they do not give information on the nature, importance or quality of those linkages, the type of collaboration that is occurring or the benefits deriving from those collaborations.<sup>7</sup>

The CFI’s contribution to projects in the sample ranges from about \$10,000 to more than \$30 million, with an average contribution of \$380,000 (or approximately \$950,000 when factoring in partner funding). Almost all projects in the sample (1,343) were funded under the Leaders Opportunity Fund (LOF) while the remaining (76) were funded under the Leading Edge Fund,

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<sup>2</sup> Statistics Canada, *Gross Domestic Expenditures on Research and Development in Canada (GERD), and the Provinces*, 2012.

<sup>3</sup> CFI calculations based on data from the OECD.

<sup>4</sup> World Economic Forum, *The Global Competitiveness Report 2011-12*, 2011.

<sup>5</sup> Question on the utilization of the infrastructure included in project progress reports: *In the past year, have any researchers from outside the institution (not including trainees) advanced their research using the CFI-funded infrastructure?* Question on formal agreements in project progress reports: *In the past year, have any formal collaborative research agreements related to CFI-funded infrastructure been signed or entered into?*

<sup>6</sup> There were no colleges in this sample.

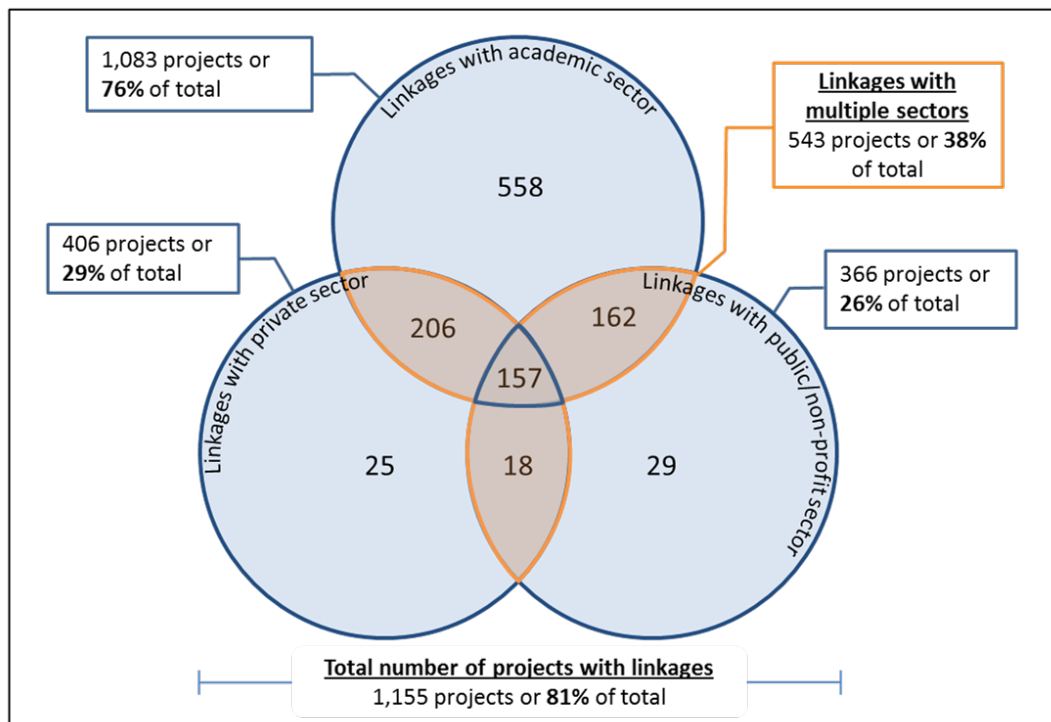
<sup>7</sup> The next phase of this study will specifically focus on further investigating some of these issues.

the New Initiatives Fund or other funds (all included under “non-LOF”). Most LOFs are small projects monetarily while non-LOFs typically involve larger investments.

**Infrastructure acts as a catalyst for linkages within and across sectors**

The OECD 2010 Innovation Strategy states that post-secondary institutions “act as essential bridges between players — business, governments and countries — in broader and more open systems of innovation.” Our sample demonstrates that projects funded by the CFI act as nodes and bridges in the Canadian research environment. External linkages were reported in 81 percent of the 1,419 projects in the sample (Figure 1) while three quarters of projects (1,083 of 1,419) had linkages with the academic sector. Linkages with the private sector and the public/non-profit sector respectively account for 29 and 26 percent of the 1,419 projects. Overall, 42 percent of projects (597 of 1,419) have intersectoral linkages; linkages with the private and/or the public/non-profit sectors. Most of those projects with intersectoral linkages also involve academic researchers from outside the institution where the project is based. This helps create bridges between researchers from a variety of sectors, creating a more integrated and efficient research environment. Almost 40 percent of projects (543 of 1,419 projects) had linkages with at least two sectors, while one project out of 10 (157 of 1,419 projects) had linkages with all three sectors.

**Figure 1: Number of CFI-funded projects with external linkages**



A preliminary analysis of project progress reports suggests that projects that have intersectoral linkages are more productive in a number of elements, including number of HQP attracted,

number of HQP trained, academic outputs and intellectual property. These projects are also more likely to report tangible benefits.

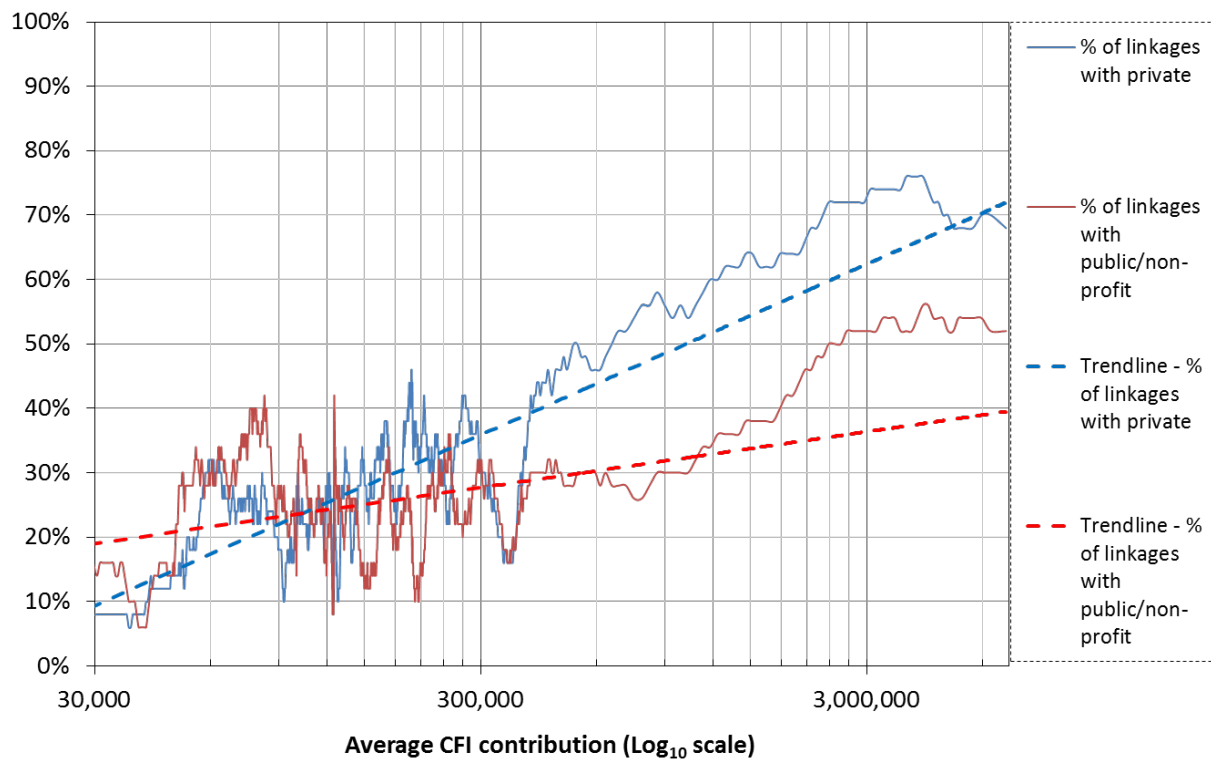
*Without the CFI investment it is hard to see how any of these partnerships would have developed. The infrastructure provided by CFI supports the intellectual capacity and enables the pursuit of the key strategic research questions. That capacity and the approach to applied problems attract the external partners.*

**Excerpt from an Outcome Measurement Study report**

***There is a close relationship between the size of a project and the frequency of intersectoral linkages***

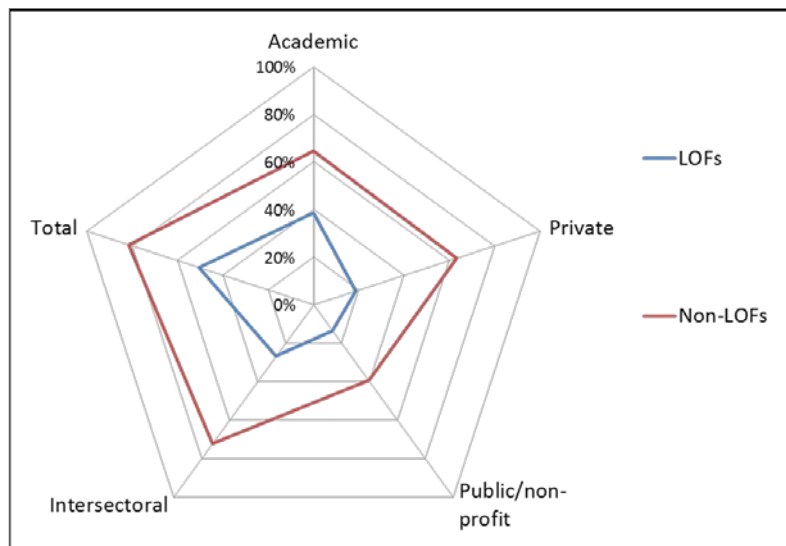
Using moving averages (with subsets of 50 projects), we see a close relationship between the size of projects and the frequency of linkages with both the private and the public/non-profit sectors (Figure 2). The relationship is stronger for linkages with the private sector than for those with the public/non-profit sector. Smaller projects are somewhat better able to forge linkages with the public/non-profit sector but this trend quickly reverses as projects move along the scale. Also, the trends show more stability in the level of linkages for both sectors as the value of projects increases.

**Figure 2: Relationship between project size and frequency of intersectoral linkages**



There is a clear difference between linkages of projects funded under the LOF compared with those funded under non-LOF (Figure 3). Non-LOFs have a much higher propensity for developing linkages of all types. While linkages with the private sector prevail for both groups of funds, there is a significant difference in the frequency of those linkages between LOFs and non-LOFs. Less than 20 percent of LOFs have linkages with the private sector compared to more than 60 percent for non-LOFs. Non-LOFs generally involve more principal investigators, have a higher monetary value and often include much more sophisticated and specialized equipment. This, combined with the rarity of the equipment, might explain why these projects more often attract outside users or collaborations. This type of information might be useful as the CFI thinks about ways to stimulate collaboration. The focus might have to be on non-LOFs since they most frequently engage in linkages within and outside academia. These projects are facilitating interactions and enhancing the exchange of ideas due to a high level of collaboration.

**Figure 3: Frequency of linkages by fund**



**As projects mature, they are more likely to involve collaborations**

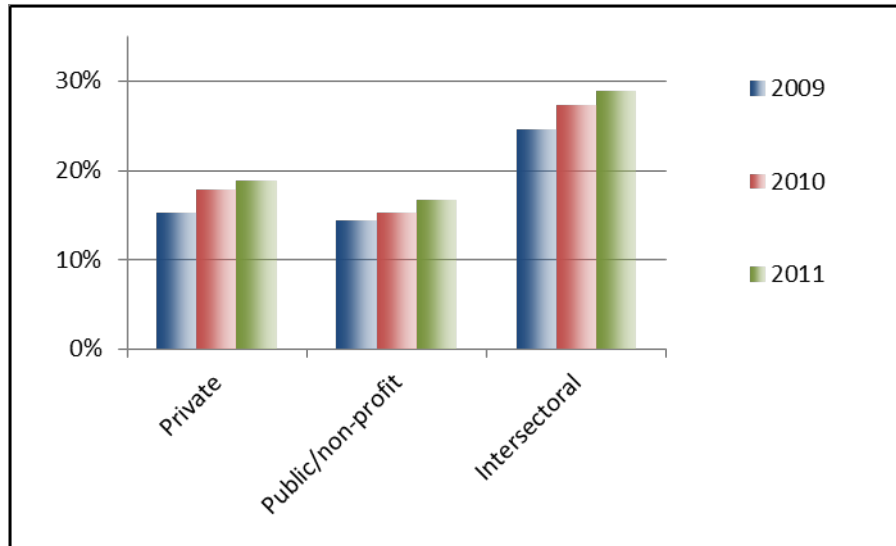
*La chronologie des avancées en matière de partenariats en fait foi, les financements de la FCI ont joué un rôle moteur dans la constitution et la mise à disposition de moyens et d'une expertise très qualifiée d'un grand intérêt pour l'industrie.*

**Excerpt from an Outcome Measurement Study report**

Time also appears to be a factor in the development of linkages. Figure 4 shows that by following the same projects over a period of three years, they are more likely to report intersectoral linkages as they mature. The trend is the same for linkages with both the private and public/non-profit sectors. As the CFI thinks about developing new funds or rethinking existing ones, it should take into account the fact that the frequency of linkages grows over time

for both sectors. If the objective is to promote greater intersectoral linkages, the CFI may want to focus on building on and enhancing existing facilities or supporting new facilities that build on pre-existing collaboration.

**Figure 4: Frequency of intersectoral linkages by reporting year**



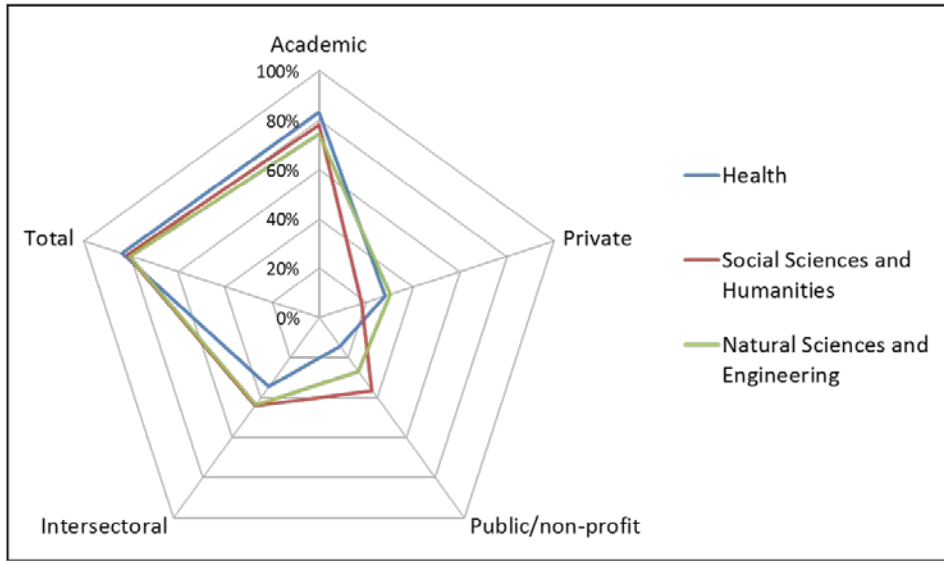
### *Intersectoral linkages vary by field*

The overall frequency of linkages is similar across fields of study despite differences in the frequency of linkages with specific sectors (Figure 5). The health sector most frequently forges linkages with the academic sector, but those projects are generally less likely to develop intersectoral linkages, particularly with public/non-profit organizations. Health projects, along with those in natural sciences and engineering, forge the most linkages with the private sector, and at a similar frequency. This is not surprising since many initiatives put in place in recent years by NSERC and CIHR specifically pushed for greater collaboration with private-sector organizations. Social Sciences and Humanities projects are more likely than any other field to collaborate with organizations from the public/non-profit sector since the very nature of research in those fields creates a natural fit for such linkages (e.g., demography, poverty, public health). However, these projects are far less likely to involve collaborations with the private sector, despite the fact that the frequency of those linkages reported here is higher than anticipated.

*The related CFI funding was essential to our basic research in the health sector and our collaborative research with a local biotech company with which we're developing novel therapeutics.*

**Excerpt from Tenth Year Evaluation of the Canada Research Chairs Program**

**Figure 5: Frequency of linkages by field**



## CONCLUSION

This analysis has shown that research in Canada is a collaborative endeavour. It has also shown that the large facilities funded by the CFI act as hubs of collaborative activities and hubs of intersectoral collaboration. Given the CFI's wish to strengthen intersectoral collaboration, the analysis indicates that a productive approach could consist of a two-pronged strategy that builds on existing facilities and supports new facilities that capitalize on pre-existing intersectoral collaborations. In many respects, this analysis has only scratched the surface. The next phase of the project will consist of a more in-depth and targeted analysis of collaborative projects through data analysis and interviews with researchers and end-users. This will allow us to better understand the nature, importance and success factors of intersectoral linkages.





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