CANADA FOUNDATION FOR INNOVATION



Strategic roadmap

2018–23

INNOVATION.CA

Cover image : Ryoji Iwata, Unsplash

1100-55 Metcalfe Street
Ottawa ON K1P 6L5

Telephone: 613.947.6496
Fax: 613.943.0923
Email: info@innovation.ca

INNOVATION.CA
CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION

1 Introduction

3 A new context for CFI

4 Who we are and how we work

7 Being accountable

9 Strategic directions for 2018–23

10 Support the full range of research infrastructures required by Canada's research institutions to achieve excellence

12 Spark innovation by strengthening linkages and encouraging collaboration among research institutions, the private sector and not-for-profit organizations

13 Supporting global research to find solutions to Canada's and the world's most pressing challenges

15 Strengthen Canada's global competitive advantage by supporting the institutions that are home to researchers throughout their careers

17 A final word

18 Appendix A

Introduction

The Canada Foundation for Innovation (CFI) is Canada's principal mechanism for funding the research infrastructure that our universities, colleges, research hospitals and non-profit research institutes require to conduct cutting-edge research and technology development.

Together, the CFI and its funding partners — provincial governments, research institutions and the private sector — invest nearly $1 billion per year in the tools, equipment and facilities researchers use to create new knowledge, develop groundbreaking technologies, help companies innovate, and train the next generation of creative, talented and entrepreneurial researchers. These investments have boosted Canada's capacity for world-class research and technology development that benefits people around the world.

This strategic roadmap lays out the directions the CFI will take over the next five years to meet the challenges of today's changing research environment and help enhance Canada's capacity for innovation. It builds on the three specific areas of opportunity identified in our previous strategic roadmap (2012–17):

- Sustain and enhance the world-class capacity of Canada's research institutions;
- Foster collaboration and integration between academic research and the private, public and not-for-profit sectors; and,
- Increase the global influence of Canadian research in ways that benefit society.

The CFI prides itself on being a responsive organization, one that listens to Canada's research community and acts in its best interest. To serve this community, we regularly convene discussions among our stakeholders to advance understanding of their evolving needs. Because of our unique position that reaches across sectors, disciplines, agencies and research institutions, we will continue to bring a broad range of stakeholders to the table to engage them on the most pressing challenges and the most promising opportunities.

Through our interactions with the research community, we have focused our attention on **three major trends** that will help inform the way the CFI provides research infrastructure support.

The first trend is **convergence**, where a specific and compelling problem is identified that requires the deep integration of disciplines, knowledge, theories, methods, data and communities. Convergence goes beyond interdisciplinarity by bringing many fields of research together, eliminating silos and creating systematic cohesion and thinking. Convergence can also be understood in an institutional context as universities and colleges build core facilities to better

manage and maximize the shared use of their infrastructure, combine their strategic research priorities and research facilities to take on specific challenges and develop partnerships around the world. As well, convergence can be understood as the deepening collaboration between researchers and research organizations in academia, the private sector, government and non-governmental organizations that share an interest in addressing social, economic and environmental challenges, fostering innovation, and improving quality of life.

The second trend is a **strong and growing emphasis on international collaboration and engagement**. Across Canada, we see Canadian researchers and their institutions increasingly collaborating with the best in the world and engaging in global research enterprises. This is bringing Canadian research expertise and strengths to the global stage and is attracting international researchers and research organizations to Canadian institutions. Increasingly, research infrastructure is seen as the key enabling factor in developing international collaborations. The sharing of research tools, equipment and facilities draws researchers together to define and tackle a broad range of questions in areas such as astronomy, physics, environmental observation, human health, and many others. International collaboration is also being driven by the development of very large-scale research facilities; those that by the nature of their cost, scope and complexity cannot be built by one nation alone.

Finally, the pool of talent within Canada's research community is broadening to include a **greater diversity of individuals** of varied ages, backgrounds, ethnicities and genders. This greater diversity within the research community improves the quality of research by leveraging the talents of a broader range of qualified individuals and incorporating a greater variety of perspectives in the ways that research is conducted. By ensuring that all qualified Canadians have opportunities to build research careers, succeed in generating new knowledge and contribute to quality of life, we ensure Canadian research meets high standards of excellence and has meaningful impact.

A new context for CFI

In Budget 2018, the Government of Canada announced an investment of $763 million over five years for research infrastructure. In addition, it proposed to establish permanent funding for the CFI at an ongoing level of $462 million per year as of 2023–24. This sustained commitment to the funding of research infrastructure will allow us to better, and more systematically, support institutions in acquiring research tools and equipment, and in developing nationally important research facilities. It will also allow institutions and their funding partners to better plan their infrastructure requirements, be more ambitious in their research trajectories, and produce the knowledge that Canadians need to thrive. Over the next five years, the CFI will transition to accommodate this new funding model.

This strategic plan identifies and articulates directions that will shape how we respond to this new context and the evolving needs of Canada's research community.

Changes in the way the Government of Canada invests in research infrastructure through the CFI, as well as increased investment in fundamental research, will provide a significant boost to Canada's research capacity. As the 2018 assessment of R&D in Canada by the Council of Canadian Academies points out, Canada's standing as one of the top 10 research and technology development nations in the world is eroding. And although Canada remains home to a broad base of research talent and world-class research facilities, increasingly greater investments are being made in other countries. In 2015, Canada's R&D intensity, or gross expenditures on R&D as a share of GDP, was 1.7 percent, well below the Organisation for Economic Co-operation and Development average of 2.4 percent, and less than half of the four percent invested by leading research countries. The significant investments in fundamental research and research infrastructure in Budget 2018 have begun to reverse this trend.

Who we are and how we work

The CFI's vision

Canada's institutions and their researchers shape the future by creating the knowledge and technologies communities need to thrive, making Canada a smarter, more innovative and more inclusive nation, capable of playing a stronger role on the global stage.

The CFI's values

	How we live it externally	How we live it internally
Responsible	We remain transparent and accountable by monitoring and communicating the outcomes of our activities and investments	We are objective, ensuring the integrity and independence of our processes and decisions
Collaborative	We are client-focused, providing effective, efficient services and actively consulting with our stakeholders	We foster teamwork, valuing and considering the opinions, and trusting the skills and knowledge of our colleagues
Innovative	We believe in a bright future for Canada's research community. Our investments allow researchers to think big and have a profound, transformative impact on society	We bring fresh ideas into a work environment that fosters excellence and creative thinking

The CFI's objectives

As an independent organization, the CFI enters into Contribution Agreements to secure the transfer of funds from the Government of Canada. Each agreement includes the CFI's objectives:

- Increase Canada's capability to carry out important world-class scientific research and technology development;
- Support economic growth and job creation, as well as health and environmental quality through innovation;
- Expand research and job opportunities by providing support through research infrastructure for the development of highly qualified personnel; and,
- Promote productive networks and collaboration among Canadian universities, colleges, research hospitals, non-profit research institutions and the private sector.

In achieving these objectives, the Government of Canada expects that the funding provided through the CFI will enable Canada's research institutions to:

- Attract and retain the world's top research talent;
- Train the next generation of researchers;
- Enable researchers to undertake world-class research and technology development that lead to social, economic and environmental benefits for Canada; and,
- Support private-sector innovation and commercialization.

Ultimately, our goal is to benefit Canadians by contributing to building stronger, healthier and more prosperous communities. This means providing graduate students and postdoctoral fellows with opportunities to hone their skills and build their careers. It means building an environment where Canadians and researchers from around the world collaborate to find solutions to pressing global issues, and it means enabling research that has an impact on our health, quality of life, economy and environment.

The directions outlined in this plan continue our more-than-20-year pursuit to equip research institutions with the facilities they require to be among the best in the world. We will achieve this by relying on our most valuable assets: highly skilled staff, rigorous decision-making processes and accountability, and a modern system of governance. Underlying these assets is a commitment to continuous improvement in everything we do.

This commitment includes:

- Keeping our program architecture simple, encompassing and responsive to needs identified through a bottom-up approach, while being guided by the strategic priorities of the institutions the CFI is mandated to support;
- Evaluating new approaches to contributing to the support of research infrastructure, such as full-cost or lifecycle funding, combining capital with operations and maintenance support where appropriate, and examining all aspects of eligibility; and,
- Enhancing our merit-review assessment process with new perspectives and innovative approaches, while ensuring that the administrative burden placed on our client institutions is limited.

In today's world, organizations that aspire to be best-in-class cannot stand still. The CFI has always understood this — constantly seeking ways to achieve excellence and be innovative in the way we design, deliver and evaluate our programs, communicate our activities and successes, and contribute to both the Canadian and the global science policy environment. With a commitment to permanent funding in place, the CFI can now begin to shape its activities, policies and programs with a longer-term perspective in mind and do so in ways that will meet the needs of a new generation of researchers over the coming decades.

Being accountable

Created through federal legislation as an independent foundation, the CFI is accountable to Parliament and, ultimately, to the people of Canada. Accountability is a central consideration in everything we do and is reflected in all our programs and funding mechanisms. Aligned with our mandate, the CFI's funding mechanisms are designed to meet both the needs of the research community and support the government's science and innovation policies and priorities. The CFI engages experts from around the world to deliver a highly respected merit-review process that ensures only the best proposals receive funding. To ensure the CFI is fully accountable for these activities, we will:

- **Maintain rigorous financial monitoring.** CFI awards are closely monitored to ensure that expenditures of public funds conform to the budgets laid out in specific applications. We achieve this through: ongoing monitoring and authorization of expenditures, including any changes in expenditures as projects are implemented; institutional monitoring visits and contribution audits; interim and final financial reports; and the sharing of best practices in institutional award management.
- **Examine the impact of our funding.** As an independent foundation the CFI can explore new ways of assessing, evaluating and understanding the impacts of our funding. While we have always taken advantage of this position to develop innovative ways of measuring impact, we continue to refine our evaluative methodologies and approaches to better know the impact of the research enabled by CFI-funded infrastructure, not only on the creation of employment and economic growth, but also on the establishment of stronger, healthier and safer communities.
- **Communicate success.** Effectively and creatively telling the stories of our researchers, and of how their work benefits Canada and the world, is vital to sustaining Canada's research enterprise and is a central element of our accountability to Canadian citizens. In a public environment transformed by new modes of engagement such as social media, and new imperatives such as reaching out to youth and private enterprises, communicating the successes of the Canadian research enterprise has never been more important.

Core funds

Innovation Fund: Makes a broad range of awards available for leading-edge research infrastructure across all disciplines and areas of research.

John R. Evans Leaders Fund: Supports institutions in securing the infrastructure resources necessary to attract and retain top research talent.

Major Science Initiatives Fund: Provides unique, large-scale national research facilities with the operating support necessary to produce excellent, world-class science and technology development.

College-Industry Innovation Fund: Supports emerging applied research capacity in Canada's colleges and polytechnics, with the goal of assisting business innovation.

Exceptional Opportunities Fund: Gives institutions the opportunity to seek funding for exceptional and time-sensitive initiatives that would be missed within the regular CFI competition cycles.

Infrastructure Operating Fund: Offers a 30 percent supplement to CFI capital awards to cover a portion of the operating and maintenance costs of CFI-funded projects to help ensure their optimal use.

The CFI's strategic directions for 2018–23

The CFI's strategic directions for 2018–23 are based on its objectives and the evolution of Canada's research community. Canada's universities, research hospitals, and increasingly, colleges, are home to outstanding researchers, who work across the full breadth of disciplines and areas of inquiry. To a great extent, they are the source of knowledge, new ideas and technological innovations that form the basis of Canada's prosperity now and in the future. Ensuring that they have the full range of tools they need to accomplish their goals, contribute to quality of life in Canada and help address global challenges, is the core consideration for setting the CFI's strategic directions. Most importantly, it is the people that matter. These strategic directions will help ensure that Canadian researchers who have the determination, skills and commitment to be world-class also have the opportunity to employ the most advanced technologies.

Going forward, we will focus on the following strategic directions.

1 Support the full range of research infrastructures required by Canada's research institutions to achieve excellence

Links to national objective:

Increase Canada's capability to carry out important world-class scientific research and technology development.

The CFI's research infrastructure investments enable Canada's leading researchers to help build communities that are healthy, environmentally friendly, technologically savvy, safe, secure, and culturally rich. In order to achieve these benefits, highly talented researchers must have the tools they need to create new knowledge and develop cutting-edge technologies. In turn, these tools, laboratories and research facilities act as powerful magnets that allow research institutions to attract and retain the best researchers from around the world. In addition to offering environments conducive to engagement, collaboration and the convergence of disciplines, CFI-funded facilities allow Canadian researchers to build on each other's achievements and contribute to our global stock of knowledge.

Research infrastructures come in a wide variety of types and scales and provide a broad range of research capabilities — from departmental laboratories used by individual researchers and small teams to core facilities that bundle together many types of equipment and serve multiple research teams across an institution. At a larger scale, research infrastructures include unique national facilities such as those supported through the CFI's Major Science Initiatives Fund. These unique research facilities provide outstanding capabilities to researchers across the country, and are increasingly instrumental in facilitating international collaborations.

At a still larger scale, major research facilities, such as accelerators, telescopes and ice breakers, act as magnets for large, often multinational teams of researchers, and are sites for extensive collaboration. Many of these facilities, including synchrotrons and neutron sources, are used by researchers across a broad spectrum of disciplines, and thus enable highly convergent research. A small number of these facilities are so large that they can only be built through contributions from many countries and require long-term resource commitments.

Because of their very large scope and long lifecycles, major research facilities are generally funded by national governments and often require international partners. Currently, the Government of Canada is developing a framework and assessment process to make evidence-based decisions on these proposals when they do come forward. Given its expertise in policy development, adjudication and financial

monitoring, the CFI is well-positioned to collaborate with the federal government and other key stakeholders, and contribute to the development of a Canadian-made approach to the funding of major research facilities that rests on the sound principles of due diligence, needs assessment, scientific excellence and benefits to Canada.

In certain instances, Canadian researchers require access to unique research facilities outside of Canada. As the CFI transitions to a permanent funding model, it will be possible to investigate new ways of facilitating such access, for example, through memberships in consortia that operate large-scale research facilities.

The CFI's mission is to ensure, as much as possible, that our best researchers have access to the full range of infrastructure, regardless of size, complexity, location or cost. In order to achieve this mission, the CFI will ensure that funding mechanisms are open, flexible and comprehensive, while providing the resources institutions need to attract and retain their top research talent.

Actions

In order to meet the needs of Canada's research community, the CFI will:

- Maintain flexible funding mechanisms that are scalable and that provide the appropriate level of both support and accountability for all types of research infrastructure;
- Where appropriate, promote and encourage inter-institutional strategic planning and the development of multi-institutional research facilities;
- Design funding mechanisms that, where appropriate, address both the capital and ongoing operational costs of major research facilities;
- Explore innovative arrangements to ensure Canadian researchers have access to unique research facilities outside Canada; and,
- Offer its unique mandate and expertise to assist with the development of an evidence-based framework for funding major research facilities.

2 Spark innovation by strengthening linkages and encouraging collaboration among research institutions, the private sector and not-for-profit organizations

Links to national objectives:

Support economic growth and job creation, as well as health and environmental quality through innovation.

Promote productive networks and collaboration among Canadian universities, colleges, research hospitals, non-profit research institutions and the private sector.

In today's globally competitive and interconnected world, increasing productivity through the creation of new products and services, improving public-sector performance, and building an inclusive, compassionate society will be critical to Canada's success as a caring, efficient and prosperous nation. As key drivers of prosperity and quality of life, innovation and entrepreneurship are fundamentally important for progress and can have transformative, positive impacts in all sectors of society. With eyes on the future, the CFI will continually engage with early career researchers and entrepreneurs as well as the students who will follow them to be sure we pave the way to enable their visions and design ways that will enable them to take on the role of creative leadership.

To be successful, meet their mission and sustain vibrant and healthy communities, Canadian organizations in all sectors increasingly rely on collaborations with researchers working in CFI-funded facilities to develop value-added products, policies, processes, services and technologies. Doing so effectively and efficiently allows them to contribute to the innovation capabilities of Canadians across the country.

To enable Canada's researchers and their institutions to imagine the future and contribute to innovation, the CFI will support the environments that enable them to take on the role of creative leadership. In doing so, the CFI will help them develop the most advanced technologies, promote the convergence of disciplines to tackle specific and compelling problems facing society and provide access to the tools they need to drive economic growth, fuel the sustainability of communities and improve the well-being of Canadians.

Actions

In order to accelerate engagement between academic researchers and organizations in all sectors, the CFI will:

- Enhance the CFI Research Facilities Navigator to include a broader range of research facilities;
- Convene multi-sectoral discussions around new areas of technology development, such as quantum research and artificial intelligence;
- Promote the development of multi-sectoral networks that bring together researchers and knowledge users;
- Explore new opportunities to support the infrastructure necessary for knowledge transfer; and,
- Develop new ways to measure the impacts of research enabled by CFI-funded infrastructure and communicate how Canadian researchers are contributing to the creation of innovative products and services.

3 Supporting global research to find solutions to Canada's and the world's most pressing challenges

Links to national objectives:

Increase Canada's capability to carry out important world-class scientific research and technology development.

Promote productive networks and collaboration among Canadian universities, colleges, research hospitals, non-profit research institutions and the private sector.

State-of-the-art research infrastructure is essential for world-leading research and technology development, and for engaging effectively in global research endeavours. The 2018 Council of Canadian Academies report on the state of R&D in Canada states that 60 percent of the international researchers surveyed felt Canada boasts world-leading research infrastructure across a broad range of research areas. This is a strong basis on which to build international engagement and contribute to addressing global challenges, such as reducing greenhouse gas emissions, building sustainable cities, improving food security as well as water and sanitation systems and addressing human health challenges. In many ways, and in many areas of inquiry, Canadian research is global in scope and impact. By supporting and reinforcing this through the funding of internationally

relevant research infrastructures, the CFI can continue to help Canadian researchers have a positive and meaningful impact on the world.

The search for solutions to global challenges often requires large, expensive infrastructure that is beyond the capacity of any single country to support or that, by its very nature, spans a number of national jurisdictions and requires international involvement. This is particularly the case for projects like large-scale observational systems for oceans and the Arctic, massive research facilities for clean energy such as fusion reactors, or multinational collaborations in health genomics. The CFI can play a central role supporting the participation of Canadian researchers in initiatives like these by assessing the excellence of the research enabled, the infrastructure needs of the Canadian research community and the benefits that will result from Canadian involvement.

Actions

In order to engage in global research to find solutions to the world's most pressing challenges, the CFI will:

- Continue to maintain a global standard of excellence by recruiting the best reviewers from around the world for its merit-review process;
- Communicate success broadly both within Canada and around the world;
- Explore opportunities for international partnerships to leverage our investments and increase access to specialized facilities;
- Enhance the international standing of Canada's unique, national research facilities;
- Invite proposals aimed at addressing global research challenges, such as those identified by Global Challenges Canada and the United Nations Sustainable Development Goals; and,
- Promote Canadian leadership on the world stage in areas of recognized leadership.

4 Strengthen Canada's global competitive advantage by supporting the institutions that are home to researchers throughout their careers

Links to national objective:

Expand research and job opportunities by providing support through research infrastructure for the development of highly qualified personnel.

CFI investments create state-of-the-art research environments, where students find rich experiential learning opportunities, new researchers are able to launch successful careers, and established researchers have access to the best technologies to advance their work. Infrastructure support at each stage of a successful research career creates a tremendous competitive advantage for Canada.

The Canadian research community is facing a period of intense renewal, creating opportunities for a new generation of students and researchers. At the same time, women and researchers from diverse backgrounds are playing a greater role in Canada's research enterprise. The broader range of perspectives, talents, experiences and insights that result from the mobilization of this talent will strengthen Canada's research enterprise.

These demographic changes are taking place in the context of rapid technological development, where new forms of research infrastructure, such as big data, artificial intelligence, robotics and quantum materials are emerging. The CFI's challenge is to ensure that an increasingly diverse cadre of researchers have access to the infrastructure they need to launch and pursue successful careers. In meeting this challenge, we must also ensure that Canada's research institutions take full advantage of the strength that diversity brings, and that both new and established researchers have access to the most advanced technologies. Doing so will help optimize the performance of Canada's research community.

Enabling this diverse group of researchers requires the support of the extraordinary and highly specialized technicians who operate and maintain research infrastructure across the country. They are crucial for the success of the Canadian research enterprise.

Actions

In order to create a competitive advantage for Canadian researchers, the CFI will:

- Support research infrastructure through mechanisms that allow institutions to attract and retain the very best researchers, at all stages of their careers;
- Consider policies that provide new researchers, women, Indigenous persons, persons with a disability and members of visible minority groups opportunities to take leadership roles in research initiatives;
- Ensure that researchers, and particularly those at the early stages of their careers, have the tools they need to compete at the highest levels of excellence; and,
- Ensure that researchers have the support they need to adopt and use the cutting-edge technologies required to advance their work and collaborate with the best in the world.

A final word

This strategic roadmap begins to trace the route that will lead the CFI and the research community in Canada toward a most promising future where we will build on our dedication to excellence while embracing new ideas and modes of achieving them. Our researchers will push beyond the limits of time and space, velocity and size that we know today. Global teams of researchers will surpass the artificial boundaries that have been created between disciplines. We see this starting to happen across the nation as researchers turn their attention to solving problems of ever-greater scope and importance.

We are witnessing the disruptive force and extraordinary creative energy generated by the disintegration of disciplinary boundaries and the consideration of all problems, all research and science as parts of a vast whole. When the energy resulting from this convergence, this collision of ideas, is focused on solving some of the enormous problems facing the world, we will undoubtedly see great strides in research and significant improvements to our quality of life.

The route we have begun to outline is one on which all are welcome to travel. Bringing together researchers of all cultures, genders, backgrounds and ages will result in achievements we cannot yet imagine. And, as the Canada Foundation for Innovation, is it not our task to invite others to join in imagining the future?

The road we have chosen wraps around our globe, extending into space and beneath the oceans. It embraces the world we know and those worlds we have yet to encounter. We recognize Canada as a partner in global research initiatives, an environment that provides a home to international innovation and a springboard from which Canadians will reach out to join in the research that will change lives and build the economy.

This is not, despite the title, the final word. Our strategy is to enable our research community to dream and to create new visions for a future that is inclusive, global and stresses convergence of ideas, disciplines and infrastructure.

Appendix A

Over the past year, CFI staff have undertaken a number of investigations and discussions around strategic issues. Leading up to the drafting of this strategic roadmap, we asked ourselves and our stakeholders a series of key questions about the evolving nature of the research environment and where the CFI might be able to make a difference. These included:

- **Strengthening strategic investments:** Initiatives such as the federal supercluster program seek to build on past investments while reshaping the economy. In conjunction, how can we best continue to build an environment that fosters growth in the knowledge economy?
- **Building capacity across the system:** Are there ways the CFI can help enable regional clusters and small institutions to mirror the successes of the superclusters?
- **Investing in data and connectivity:** Given the ongoing digitization of research and technology development, should the CFI place greater focus on more high-powered digital capacity?
- **Fostering partnerships and networks:** Can encouraging the sharing of physical resources help bring together disciplines and institutions?
- **Building research teams both in Canada and internationally:** Solving big problems requires collaboration. Ideas from across our country need to be considered and nurtured and major equipment must be shared. What additional steps can the CFI take to promote collaboration and the sharing of research infrastructure?
- **Supporting new and early career researchers:** The latest technologies enable young researchers to explore bold ideas, launch new enterprises and work with all sectors of society. What actions can the CFI undertake to ensure these researchers have the support they need?
- **Building spaces for innovative thinking, cross-disciplinary work and ideation labs:** Can supporting such infrastructure help break down silos to drive discovery and innovation?
- **Maintaining cutting-edge capacity with the latest technology:** In the global race for talent, state-of-the-art infrastructure is essential to attract world-class researchers to Canada. What will it take to maintain capacity at this level?
- **Responding to national needs, including the development of the North:** Issues such as food and water security, cyber security, health, social engagement and a changing environment require the mobilization of talent and flexible approaches. Are there possibilities for the CFI to play a role in supporting national priorities?

INNOVATION.CA

CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION