Report of the Advisory Panel on the Federal Research Support System

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Message from the Panel

Our talented and determined researchers drive the creation of new knowledge that improves our wellbeing as well as our economic competitiveness and prosperity. Moreover, their research and innovations are crucial to helping us answer environmental, social and health challenges facing our country and the world such as climate change, food security, and pandemic preparedness. In short, research and innovation are critical to maintaining and improving every aspect of our lives.

While Canadians can be rightfully proud of their country's achievements in science, technology, research and innovation, we currently find ourselves in a precarious situation. Canada's research support system funds academic research to investigate fundamental questions, and supports new ideas, transformative knowledge creation and ground-breaking discoveries. It also supports the training of highly qualified people (HQP) deployed across all sectors of society and the economy. Although Canada has made significant investments in the past to develop, attract and retain world-class researchers, it does not have the appropriate structures to fully leverage these investments. Moreover these investments have not kept pace with the actions taken by our international competitors and with the transformation of the research enterprise.

The critical challenges of today and tomorrow transcend disciplines and national borders and require a serious commitment on the part of governments and research ecosystem partners. A new mechanism that leverages on existing strengths is urgently needed to drive this change. In the Canadian context, existing funding issues are compounded by a support system that is not optimally designed to respond to multi- and interdisciplinary, collaborative and international approaches to research. As a result, we are not well positioned as a country to address the complex challenges that we are–and will be—facing.

The picture for Canada becomes even bleaker in light of the serious commitments that peer countries and competitors are making in science, research and innovation. Canada's wellbeing, prosperity, and global competitiveness will hinge ever more on how well we can nurture and empower our talented minds. When other countries are setting their sights on becoming global science and innovation powers, it is critical that we buttress a strong, well-funded research enterprise with a system that is agile and capable of addressing emerging research, economic and societal needs and interests in an efficient and effective way.

Thankfully, through our existing knowledge and talent advantage, Canada has immense potential to lead the world into a more prosperous, just, and sustainable future. Our success is conditioned on our ability to strategically position our research and talent assets and build on them across society. Canada will continue to fall behind if we cannot evolve our research support system to ensure that it meets the needs of the modern research enterprise in a world where the most innovative and prosperous countries use their own scientific potential as a national strategic asset. We must continue to examine ways to enhance the system of supports to ensure that Canada's research and talent remain among the best in the world so that we can tackle challenges and seize opportunities facing us today and in the future.

This report is intended to provide the government with a suite of bold, yet feasible, measures that will put the Canadian research ecosystem where it deserves and needs to be—among the best in the world. The panel's

recommendations will enhance the research excellence that is the hallmark of Canadian science, while enabling greater agility, flexibility and responsiveness to support transformative research and innovation.

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Executive Summary

Mandate and Consultations

The **Advisory Panel on the Federal Research Support System** was launched in October 2022 with a mandate to advise the Government of Canada on how to modernize the federal system supporting academic research to ensure agility and coordination across its components and to maximize the impact of investments and position Canadian researchers for success. The panel was asked to focus on the structure and governance of the federal research support system, particularly the relationships among the federal research granting councils—the Natural Sciences and Engineering Research Council of Canada, the Social Sciences and Humanities Research Council of Canada and the Canadian Institutes of Health Research—and the relationship between these councils and the Canada Foundation for Innovation.

The panel was also asked to provide advice on structures and governance to better support talent development and retention, and knowledge mobilization, innovation and commercialization, as well as provide feedback on a proposed framework for federal decision-making on investments in major research facilities (MRFs), developed by Innovation, Science and Economic Development Canada.

Consultations with stakeholders and experts, both in Canada and internationally, played a critical role in the panel's process to address this mandate, informing the panel's discussions and deliberations at every step. The panel heard from over one thousand stakeholders across Canada through in-person and virtual meetings with the panel, written submissions, and responses to an online questionnaire. The panel's recommendations have also been informed by reviews of backgrounders, studies, reports, international comparators, and assessments and evaluations of various programs and organizations within the Canadian support system.

Governance and Structures: What We Heard

Through the panel's process, several key messages emerged from stakeholders:

- Canada has been **highly successful** at generating research excellence across a broad range of disciplines, and the granting councils have excelled at their core mission of knowledge creation and talent development. However, their funding levels have not kept pace with evolving needs, which hinders existing initiatives and new programming.
- There is significant fragmentation across the system, with granting councils and a number of other different and disconnected entities often tasked with similar but uncoordinated mandates, many of which are sub-scale.
- The fragmentation has led to a lack of clarity among the various players with respect to their individual roles and responsibilities, non-complementary overlaps, inconsistency in supports between disciplines, and increased administrative burden for the research community.
- Fragmentation has also led to **significant gaps in research support**. This has made it more difficult to fund certain types of initiatives that fall between or outside programs or organizational mandates,

including (but not limited to) intersectoral[1] research, urgent societal need research, ambitious international programming, and pre-commercialization activities.

- The impact of the fragmentation is worsened by the lack of an independent, external advisory body to provide strategic advice and broad oversight and a national strategy or shared vision/objectives for the Canadian science, research and innovation ecosystem to orient the various players in the same direction.
- The Canada Research Coordinating Committee (CRCC) and other efforts have not fully achieved harmonization and the support system remains fragmented. While the CRCC has contributed to a better understanding of the needs and constraints of the various actors in the system, its design was not fit for the purpose of resolving inefficiencies and inequalities, barriers for both researchers in Canada and international partners, high levels of burden on researchers, and challenges addressing urgent needs and strategic issues (particularly evident during the pandemic).
- The CRCC was implemented within a system that was not designed to drive coordination and broad strategic perspectives or address emerging and urgent issues. As a result of the current governance structure, this is not a challenge that the granting councils and other players in the system can easily overcome.

Core Recommendations

THE CREATION OF THE CANADIAN KNOWLEDGE AND SCIENCE FOUNDATION

It is clear to the panel that the granting councils have a strong reputation of excellence in their support of investigator-initiated research in specific disciplines and training of talent. They should be commended and better supported for this foundational role. The panel is strongly supportive of retaining and strengthening this role for the councils. Based on the input received by the panel, there is also a need for a new, complementary governance mechanism to work alongside the existing system, with a clear division of responsibilities between it and the councils. This new governance mechanism would be designed to better support coordination and encourage urgent, international, multi- and interdisciplinary and mission-driven research in Canada. The mechanism would supplant the CRCC and redeploy resources from the current ecosystem to help support its mandate.

This new governance mechanism, which the panel calls the Canadian Knowledge and Science Foundation (CKSF), would foster collaboration across the system to support urgent, multi- and interdisciplinary, mission-driven research to help address pressing social, technological, economic and health challenges. The CKSF would also improve support for the talent continuum through greater coordination of programming. It would build on the mandate of the CRCC, which would be discontinued, and take on the mission-driven aspect of research funding. It would be designed to rapidly coalesce the research community across all sectors around missions that could be cross cutting, interdisciplinary and high risk. It would be headed by a new leader with

[1] The panel defines “intersectoral” research as broad interdisciplinary research that crosses the boundaries of multiple granting councils.

excellent scientific, leadership and managerial credentials, who would report to a board with academic, industry, government, Indigenous and other pertinent representation.

Given that incremental changes have not addressed the identified gaps, the panel is recommending that the new governance mechanism be given a bold mandate to bring about significant changes in the Canadian research landscape, enhance the global reputation of Canadian science and research, and enable Canada's research enterprise (including government) to be more nimble in times of urgent societal need or when faced with novel opportunities.

Need for a National Strategic Vision and a Strategic Advisory Body

Following the discontinuation of the Science, Technology and Innovation Council and the delay in launching the Council on Science and Innovation (CSI), Canada has a worrisome vulnerability in independent strategic advice capacity. The lack of a long-term strategic vision, and priorities to achieve it, puts us out of step with our global competitors and makes Canada a second-tier option when it comes to global strategic partnerships, despite the fact that our individual researchers are globally recognized. The panel consistently heard these messages from national and international stakeholders.

At a time when other countries are launching bold, ambitious and coherent research and innovation strategies to propel themselves to become global science, research and innovation powers, Canada is pushing ahead with various sector-specific strategies, but lacks a cohesive, common vision that would coalesce the science and research community to work toward common strategic objectives.

We need to signal to our researchers and our global peers that Canada aspires to be among the best research and innovation countries in the world with a clear national vision and strategy.

The panel strongly recommends that the government proceed with the creation of an independent advisory body to provide the government with strategic policy advice on science, research and innovation, and evaluate and publicly report on the support for, and performance of these activities in Canada. This body would also play a key role in setting a vision for the future, shaping Canada's longer-term science, research and innovation priorities and an ambitious, multi-year national strategy to achieve them. It is expected that the strategic plans for the CKSF and individual funding organizations would seek to align with the national strategy. In addition to research and innovation expertise, we recommend that the membership of the proposed advisory body include representation of the Indigenous research community, as well as other equity-seeking and rights-holding groups in order to encourage diversity across the research and innovation ecosystem.

The advisory body would provide guidance to the government on the priorities of a national science, research and innovation strategy, with the support of the science, research and innovation community.

A strategic advisory capacity and national strategy for science, research and innovation would provide a coherent, focused and long-term approach to advancing Canadian research success (from investigator-

initiated curiosity-driven research to interdisciplinary and/or mission-driven research), and would signal to our global peers that Canada is serious about research and innovation and is a worthy partner.

Other Recommendations: Enablers of Research Excellence

A NEW PARADIGM FOR RESEARCH INFRASTRUCTURE

To be successful, Canadian researchers need access not only to research funding but also to state-of-the-art research tools, instruments, and facilities. Several stakeholders have emphasized the importance of better coordinating infrastructure, operating and research funding. The proposed CKSF would be tasked with working with the granting councils and Canada Foundation for Innovation (CFI) to address this fragmentation and identify opportunities for streamlining processes.

The need for a more coherent approach is even more relevant with respect to large research facilities. The panel strongly endorses a portfolio and lifecycle approach to funding major research facilities (MRFs), with funding through the planning, construction, operation, maintenance and decommissioning of the facility.

The panel supports the directions in the proposed framework for federal decision-making on investments in MRFs, as it would establish a funding model that provides more predictable and appropriate support for MRFs over their lifecycle. With this in mind, the panel recommends that a national road-mapping exercise be developed to guide priority-setting and planning for large-scale research infrastructure investments, as part of the national science, research and innovation strategy.

The panel also identified several ways to better integrate and consolidate support for research infrastructure, including research tools and instruments, such as streamlining and simplifying some CFI processes and improving support for operating research tools and instruments.

SUPPORTING THE TALENT CONTINUUM

The panel heard clearly from students, early career researchers, senior university administrators and student associations that the programs addressing the talent continuum must be simplified and harmonized to reduce the burden on students, postdoctoral fellows and early career researchers, thereby enabling them to focus on their research.

A well-coordinated, agile federal support system that is responsive to the talent it supports means having simplified support mechanisms. The panel has made recommendations to better support talent at each stage of the continuum, including giving the proposed CKSF responsibility for streamlining and harmonizing the suite of scholarship and fellowship programs and streamlining the delivery of the Canada Research Chairs (CRC) program.

CONNECTING RESEARCH AND INNOVATION

Recognizing the important role of innovation and commercialization in translating research results to further benefit of Canadians, the panel recommends that the proposed CKSF have clear linkages to the future work of the Canadian Innovation and Investment Agency and the government's business-facing innovation and commercialization programming. The CKSF should also be responsible for convening the right players to support entrepreneurial training for researchers, better utilize research-to-market programs, and invest in the required culture change to support a more entrepreneurial mindset among the research community.

EQUITY DIVERSITY AND INCLUSION (EDI), AND SUPPORT FOR INDIGENOUS AND FRANCOPHONE RESEARCH AND TALENT

For Canada to lead the pack in the global science and innovation race and address key societal challenges, we need to foster a truly inclusive research environment. In particular, addressing complex problems requires a broad range of perspectives and experiences. Achieving this necessitates eliminating barriers to entry and success.

The panel recommends that the federal research support system should continue to advance the implementation of the Tri-Agency EDI Action Plan and other complementary work that will serve to improve the underrepresentation and underparticipation of certain groups and encourage diversity across the research ecosystem such as the funding for Black students and researchers (Budget 2022), the SSHRC Advisory Committee to Address Anti-Black Racism and the CIHR Anti-Racism Advisory Committee. Canada's diversity is an asset at home and on the global stage, and it is in our best interest to better encourage and empower it.

The panel also looks forward to seeing the continued implementation of the interagency strategic plan for Indigenous research developed in partnership with the Indigenous Leadership Circle in Research. The panel recommends that Indigenous research be a component of a national science, research and innovation strategy and that representation from a cross-section of players in the ecosystem and relevant communities be involved in gathering the input and advising the proposed advisory body on this component.

The panel also recommends improving support for francophone research and ensuring there is an equitable treatment within the federal research support system of research funding applications submitted in French. As supporting francophone research is a common priority across the federal research support system, the CKSF should ensure existing programs are equally accessible to francophones and identify opportunities to encourage the production and dissemination of knowledge and research in French in Canada and around the world.

Conditions for Success: Increased Funding for Investigator-Initiated Research and Competitive Support for Talent

A coordinated and agile federal support system that is equipped to respond to the needs of the modern research enterprise as well as emerging government priorities would provide great benefits to all Canadians. That said, success in science, research and innovation that is competitive on the global stage hinges first and foremost on being able to effectively support and retain Canada's top research talent and build a research enterprise that fosters discovery of new knowledge through investigator-initiated research.

Given the staggering investments we see in other countries and the stagnating investment levels we see in Canada, a top priority must be increasing funding for research and talent. For the panel's recommendations to be successful , it is critically important that core funding of the granting councils be significantly increased to address:

1. the pressures resulting from the growth in the system (e.g., increasing number of graduate students and postdoctoral fellows);
2. the effects of inflation; and
3. the importance of nurturing a globally competitive research and talent base.

Research funding simply has not kept pace with these pressures over the past twenty years. An initial step would involve an increase of at least ten percent annually[2] for five years to the granting councils' total base budgets for their core grant programming. New funding is also required for the CKSF in order to ensure its success, although the government can also leverage existing resources that currently support coordination functions with the granting councils to cover some of the costs. It is important to recognize that improved governance achieved through the CKSF is expected to lead to efficiency gains in other parts of the support system.

It is also clear to the panel that current support for graduate students, the researchers of tomorrow, is at a breaking point. The values of the government's awards for university research trainees have remained virtually stagnant for the past 20 years. As a result, they have not kept pace with increases to the cost of living nor with research trainee compensation trends around the world. This situation has significantly eroded Canada's position as a global hub for the attraction and retention of research-enabled talent and this erosion will be accelerated by the increase in investments by our global peers. As a result, the panel also urges the government to significantly increase funding for students and postdoctoral fellows to an internationally competitive level. It should be noted that many, if not most, students are not funded via scholarships and fellowships, but rather via research assistantships through their professors' grants. This is another reason why an increase in funding for the core grants of the councils is so important. Given the international competition for talent, Canada is at serious risk of another brain drain without reinvestment.

[2] Other organizations (e.g., U15) have reached similar numbers.

Conclusion

The panel's recommendations serve to ensure and enhance the research excellence that is the hallmark of Canadian science, while enabling greater agility, flexibility and responsiveness to support transformative research and innovation. The panel recognizes that implementing these recommendations can be challenging, but the cost of complacency and inaction is dire.

Canada has immense potential to lead the world into a more prosperous, just, and sustainable future through our knowledge and talent advantage, but we must double down on our efforts if we aspire to be among the global leaders. We must increase our investments in Canada's research enterprise and design our support system to maximize the impact of these investments so that we can thrive as a country and ensure continued improvement to the quality of life for all who live here.

The Necessity for Enhanced Research Support

Setting the Stage

Societies that invest in their research enterprise thrive while those that do not falter. Every aspect of our individual and collective wellbeing is improved by science and research and, more importantly, by the effective sharing and mobilization of scientific advances. As the global pandemic and the rapid discovery of health solutions made abundantly clear, the patient and determined investigator-initiated research activities that have unfolded through decades can be marshalled seemingly miraculously in a matter of months to answer a pressing need. We witnessed the amazing realization of the promise of scientific research to transform curiosity into answers. However, the pandemic also made a lesson painfully clear: we witnessed the vulnerability of countries that depend too much on other countries for the valuable solutions and tools necessary to ensure their wellbeing and prosperity. There is great risk in outsourcing talent development and invention to other countries hoping that they will help us readily in difficult times. There is immense importance and opportunity in investing strategically in our own national research and innovation capacity.

In a turbulent future, when climate and markets lose their bearings and when far away friends may be preoccupied by their own challenges, Canada's flourishing and prosperity will hinge more than ever on training, retaining, and nurturing our talent advantage, and on leveraging the great ideas and inventions that they will generate and apply. Research informs every step of our path to creating a strong, prosperous and resilient economy and society, and knowledge will be the basis for our individual and collective success going forward.

The good news is that on many metrics of knowledge and talent development, Canada has traditionally performed among the best in the world. Canadian research and talent are recognized globally, and our research system has been punching above its weight. Thankfully, Canada has made important investments in its research ecosystem to ensure that we can develop, attract, and retain world-class researchers, support a strong education and talent continuum, and develop strong and accessible research institutions. Herein lies the more portentous news: Canada is not the only country to have done so, and many countries have recently made substantial new commitments to rethink and turbocharge their research support system.

The **Advisory Panel on the Federal Research Support System's** discussions with stakeholders and partners across the research and talent continuum underscored that the current research support system has important features and strengths that we can celebrate. However, our consultations have also highlighted that the current system is under-resourced and existing structures may not be fit for purpose to keep up with the evolving nature of research and the increasingly diversified uses of scientific outputs. This will hinder our ability to address major challenges and capitalize on opportunities. This also may limit the impact of our investments in the research enterprise.

Other countries have realized the strategic imperative of a strong research and talent ecosystem and they are responding to the urgency to take action. Countries such as the United Kingdom (UK) and the Netherlands have made substantial changes to their research support systems to achieve greater impact on the generation of knowledge and its application to address key opportunities. Peer countries are significantly increasing their support for science and research to ensure their global competitiveness.

However, as other countries have made increasing their investments in research, innovation and talent a national priority, Canada has been losing ground.

As a result, Canada is at risk of operating from a position of weakness, which will become more pronounced as other countries reinvest heavily in research. Underfunding limits our ability to attract and retain talent, to address global challenges, and to maintain Canada's standing among the best in the world for quality of life. This underfunding has also exposed where Canada has historically underperformed, such as translating the strengths in our research and science into innovations that reach the marketplace and benefit Canadians and the world. The Innovation Report Cards from the Conference Board of Canada have consistently outlined Canada's habitually weak innovation performance, which further undermines our global competitiveness. If Canada aspires to a globally competitive knowledge and innovation-based economy, it needs to increase its investments in research and innovation and enact better and smarter support for its research. This starts with ensuring that we make investments in research and talent, and improve mechanisms to leverage their potential.

The global and national challenges are evident: Canada will fall behind if we cannot evolve our research support to ensure that it continues to meet the needs of the modern research enterprise in a world where countries use their own scientific potential as a national strategic asset. We must continue to examine ways to enhance the system of supports to ensure that Canada's research and talent remain among the best in the world and that we are positioned to tackle challenges and seize opportunities facing us today and in the future.

The New Reality of Research

Comparatively low funding levels for research are a critical part of the story; however, even with the necessary reinvestments, Canada also has to be smarter in how it organizes its scientific and research enterprise. Our success depends on designing the elements of the research support system to ensure that ambitious research is not only realized but conducted and used effectively. This includes how we design our system to support multi- and interdisciplinary[3] research and international partnerships, how we ensure agility to address urgent challenges and capitalize on emerging opportunities, how we coordinate funding for research and research infrastructure, and how we connect research, innovation, and talent to work together to address the major science-based challenges of our age.

[3] The panel understands "multidisciplinary" research as research involving researchers from multiple individual disciplines working together on a common problem. "Interdisciplinary" research is understood as research undertaken by researchers that crosses disciplinary boundaries and integrates knowledge from two or more disciplines.

The nature of research has changed significantly over the past several decades. Our most complex societal challenges increasingly require creative solutions that bring together multiple perspectives from diverse domains. As a result, research is now more international, collaborative and multi- and interdisciplinary than ever. Critical challenges, such as food security, transformation of work and income inequality, infectious and chronic disease, the energy transition, and climate change, transcend disciplines and national borders; we must work across traditional boundaries to find answers and to offer solutions that work for Canadians.

A world-class research system that encourages collaborative approaches is not only critical to support our scientists and scholars, but is also critical to ensure Canada's ability to respond to societal challenges as they arise. The COVID-19 pandemic and the issue of adaptation to climate change highlight the importance of a collaborative and agile research system to address new challenges as well as the importance of coordination across the research support system to leverage the resources and strengths of its constituent parts to address government priorities and support decision making.

To keep pace with other leading research countries, Canada requires a research and talent support system that enables connections between disciplines and the structures that Canada has created to support them (e.g., granting councils), as well enabling connections between institutions, and researchers from across the research system, including industry, not-for-profit organizations and government. Our research support system must be designed to encourage partnerships where relevant, to secure Canada's future and enhance the impact of our investments in research.

Historical and Current Context of Canada's Research Support System

Canada's current research support system has adapted over decades, reflecting shifting research priorities and the nature of research itself. A number of previous reports have provided insightful overviews of the historical context for Canada's current research support system, including the 2017 report of the **Fundamental Science Review** panel.

In general, the current structures and governance of the support system were developed when most research activities were aligned to the development of individual academic disciplines. Each of the three granting councils (Natural Sciences and Engineering Research Council (NSERC), Social Sciences and Humanities Research Council (SSHRC), and Canadian Institutes of Health Research (CIHR)) were created separately with legislated roles along disciplinary lines and with accountability to different ministers (NSERC and SSHRC are linked to the economic and innovation portfolios while CIHR is linked to the health portfolio). The granting councils were designed to—and continue to—excel at supporting talent and research in their respective domains.

While the granting councils have mandates specific to broad research domains, there has also been a growing need to support multi- and interdisciplinary research to answer complex scientific questions and address key priority areas and opportunities. The councils were not created with collaborative mandates to coordinate programs and policies nor to provide coordinated strategic responses to intersectoral (i.e., broad interdisciplinary) challenges that are increasingly common within the research community and necessary to

answer pressing societal needs. Accordingly, a number of tri-agency programs were created to fill that gap. These large programs (e.g., Canada First Research Excellence Fund, Canada Excellence Research Chairs, New Frontiers in Research Fund, Canada Biomedical Research Fund) are largely managed by the Tri-Agency Institutional Programs Secretariat (TIPS), which is housed within SSHRC, which delivers some tri-agency programs on behalf of the three granting councils.

In addition to the granting councils, the federal government has created and/or funded a number of other important third-party organizations to support talent, research, research infrastructure, knowledge mobilization and innovation, including the Canada Foundation for Innovation (CFI), Genome Canada, Mitacs, and CIFAR, among others.

Finally, to augment capacity and spur increased innovation potential in certain priority areas, a number of sector-specific strategies and/or consultations have been developed, or are currently being developed, to leverage capacity and promote collaboration across academia, industry and government (e.g., genomics, artificial intelligence, quantum technologies, biomanufacturing and life sciences). These strategies are managed by Innovation, Science and Economic Development Canada (ISED) in collaboration with other relevant departments (e.g., Health Canada) with the intent of fostering targeted talent training, knowledge mobilization, innovation and commercialization.

In short, the granting councils play a key and specific role in the research ecosystem while a number of other entities and programs have been created in a somewhat ad hoc manner to address research, talent and innovation needs that cross multiple council mandates or fall between or outside existing programs or organizational mandates.

Challenges in the Current Research Support System

Despite the current limitations of our research support system, Canada has been quite successful at generating research success across a broad range of disciplines, and the granting councils have excelled at their core mission of knowledge creation and talent training. However, the approach has also resulted in significant fragmentation across the system, with distinct granting councils and a number of other different and disconnected entities often tasked with similar but uncoordinated mandates, many of which are sub-scale and minimally resourced.

The fragmentation has led to a lack of clarity on individual roles and responsibilities and increased administrative burden for the research community (due to different systems, rules and requirements, policies, non-harmonized deadlines, etc.). Fragmentation has also led to significant gaps in research support: it has made it more difficult to fund certain types of initiatives that fall between or outside programs or organizational mandates, including (but not limited to) intersectoral research, research to address urgent societal needs, ambitious international programming, and pre-commercialization. The impact of the fragmentation is further worsened by the lack of a national strategy or shared vision/objectives for Canadian research to orient the various players in the same direction.

Recognizing the need for greater coordination, some measures have been taken to bridge the different players in the system, with a particular focus on the three granting councils (SSHRC, NSERC, CIHR) and the

CFI. In particular, in 2017, the Minister of Science launched the Canada Research Coordinating Committee (CRCC), which was tasked with bringing greater coordination to research-related programs and policies in Canada. Members of the CRCC include the presidents of the three granting councils, CFI, and the National Research Council (NRC), the Chief Science Advisor (CSA), and the Deputy Ministers of ISED and Health Canada. The CRCC was created after the **Fundamental Science Review** panel (2017) observed the challenges flowing from the fragmentation of Canada's research support system. The work of the current **Advisory Panel on the Federal Research Support System** can be seen, in part, as a means of assessing the effectiveness of certain measures implemented by the government in response to the **Fundamental Science Review**.

Despite genuine efforts and goodwill on the part of all involved in the CRCC, the panel heard from various stakeholders that the design and operation of the CRCC did not generate the results envisioned by the government when the CRCC was created. While the CRCC has contributed to a better understanding of the needs and constraints of the various actors in the system, its design was not fit for the purpose of resolving the challenges of the system today.

The CRCC was implemented within a system that was not designed to drive coordination and broad strategic perspectives, and address emerging and urgent issues. This is not a challenge that the granting councils and other players in the system can easily overcome within current structures and without compromising their core mandates.

However, Canada's future research success and realization of the downstream benefits of its research enterprise depend on finding solutions to this challenge. The panel has heard that the current reality:

- limits the development, attraction and retention of talent;
- restricts Canada's ability to undertake important research involving multiple disciplines;
- hurts responsiveness and agility of the system to urgent societal needs;
- limits opportunities for international partnerships and weakens Canada's reputation with global peers;
- limits opportunities for intersectoral knowledge mobilization;
- limits opportunities to foster pre-commercialization activities and link them to commercialization activities;
- inhibits the capacity to set forward-looking strategic direction for science, research and innovation; and
- imposes ever increasing administrative burdens on students, researchers and research institutions.

The research support system needs to evolve to advance Canada's national interest and international competitiveness. Our research support system needs strategic changes so that Canada can address significant current and future challenges.

Mandate and Approach

PANEL'S MANDATE AND SCOPE

The Honourable François-Philippe Champagne, Minister of Innovation, Science and Industry, and the Honourable Jean-Yves Duclos, Minister of Health, launched the **Advisory Panel on the Federal Research Support System** in October 2022. As stated in the panel's terms of reference, the mandate of the panel is to:

> "…provide independent, expert policy advice to support the Minister of Innovation, Science and Industry and the Minister of Health in delivering on their mandate letter commitment to "modernize the federal research funding ecosystem to maximize the impact of investments in both research excellence and downstream innovation". To better respond to government priorities and the needs of the modern research enterprise, the panel will review and recommend improvements to the structure, governance, and management of the federal system of support for academic research, with particular focus on the three federal granting councils and the Canada Foundation for Innovation (CFI)."

In particular, the Ministers asked that the panel's advice be directed towards ensuring that federal support for Canada's academic research enterprise is:

- coordinated and cohesive, balancing respect for the needs of disciplinary communities with a holistic perspective across disciplines and across research, training, and associated infrastructure;
- responsive to the multi- and interdisciplinary, collaborative, and international approaches that are increasingly the hallmark of transformative research and innovation; and,
- sufficiently agile to seize new opportunities and address emerging research, economic and societal needs and interests.

The Ministers also asked the panel to provide:

- advice on the structures and governance to better support talent development and retention, as well as knowledge mobilization, commercialization and innovation; and
- feedback on the proposed framework for federal decision-making on investments in major research facilities as it relates to its recommendations on the broader academic research enterprise.

The scope of the panel's mandate arose at various points throughout the panel's discussions, including with stakeholders. Given the latitude afforded by the terms of reference, the panel approached its scope as follows:

- **Levers/tools**: The panel's mandate is explicit about its focus on "structure, governance, and management" of the federal research support system. It is not surprising that "funding" and "programs" were mentioned at various points throughout the panel's consultations, including by both panel members and stakeholders due to their interconnectedness. Funding, in particular, is a condition of success for any research support system, and thus too critical to ignore within this report, especially given the recent vigorous investments by peer countries. While the recommendations of this panel will focus on governance, the panel also wishes to reinforce the messages contained in the **Fundamental Science Review** around increasing research funding, as well as flag the critical importance of funding

for our graduate students and postdoctoral fellows to stave off a brain drain on a scale not seen in many decades.

- **Key Players**: The panel's mandate makes specific mention of the "three federal granting councils and the Canada Foundation for Innovation (CFI)" as well as the "academic research enterprise". There are also several other important research funders (and performers) that are necessary to consider if the panel's advice on coordination is to have maximum impact. These include third party research organizations (e.g., Genome Canada, Mitacs), federal science-based departments and agencies (e.g., NRC, Fisheries and Oceans Canada, Environment and Climate Change Canada, Natural Resources Canada), other not-for-profits, provincial and territorial governments, and the private sector. The breadth of the **academic research enterprise** must include a broad range of institutions, including universities, colleges and CÉGEPS, polytechnics, and research hospitals.

- **Activities**: The panel was also asked to provide "advice on the structures and governance to better support talent development and retention, and knowledge mobilization, commercialization and innovation". Consequently, the panel's primary focus was (extramural) academic research support, with attention also paid to the full continuum of supports from talent and research through to knowledge mobilization, innovation, pre-commercialization, and commercialization. Failing to take this perspective on the full continuum risks overlooking important aspects of the system as researchers increasingly occupy multiple roles on the continuum (e.g., researcher entrepreneurs).

- **Disciplines**: Given the prominence of multi- and interdisciplinarity in the panel's mandate, the panel necessarily considered all scholarly disciplines within its scope. The panel recognizes the importance of supporting excellence across a broad range of disciplines, which enriches Canada. The panel also broadly understood "research" to include the continuum of research from fundamental research through to applied research and innovation and included both investigator-initiated and mission-driven research within its deliberations.

ENGAGEMENT WITH PARTNERS AND STAKEHOLDERS

The panel undertook its work over a period of roughly three months, starting with a first meeting in mid-October 2022. The efficiency gains enabled by virtual meetings allowed the panel to review and discuss a wide range of issues and topics in a short period of time.

Consultations were a key part of the panel's process. The panel met with dozens of stakeholders and experts between October and December 2022, as well as officials from selected provincial and international jurisdictions to help identify best practices and lessons from elsewhere.

The panel's outreach included meetings with a variety of groups, including student associations, faculty groups, university and college associations, researchers (including Indigenous researchers), research hospital stakeholders, national and provincial research funders, and industry. Internationally, the panel met with officials from Germany, Norway, the United Kingdom (UK), France and the US.

In addition to meetings (both virtual and in person), the panel launched an online consultation to seek the views of a broad range of stakeholders. A total of 682 individuals/organizations responded to the online questionnaire. In addition, the panel received 28 submissions by email.

The panel also hosted a session at the 2022 Canadian Science Policy Conference (Ottawa), which gave approximately 200 stakeholders the opportunity to hear directly from the panel on its mandate and approach, and to provide verbal comments or ask questions to panel members.

The panel is grateful for the time and effort of the over a thousand individuals and groups who provided their valuable perspectives, either through in-person or virtual meetings, or through email submissions or the online questionnaire.

Guiding Principles for Recommendations

Based on the feedback received and the panel's own deliberations, several principles guided the panel's recommendations. They include:

- **Seek bold and feasible solutions**: As an overarching guiding principle, the panel sought to develop recommendations that are both bold and feasible. The panel recognizes that incremental tweaks to the system have not been and will not be enough to drive the change required to ensure Canada's competitiveness in research and innovation. At the same time, recommendations must be feasible from both the perspective of government and other stakeholders within the system. This means that they must not add undue burdens to stakeholders, and they must take into account government policy realities (including budgetary aspects) among other considerations.
- **Preserve excellence and the elements that work well**: Excellence is the hallmark of Canadian science and research, and recommendations need to ensure that the proposed changes protect and promote this important feature of the system. Moreover, the three granting councils and the CFI have a well-deserved global reputation for excellence related to their core mandates (i.e., support for investigator-initiated disciplinary research and research infrastructure, respectively). Recommendations should not disrupt what is already working well, but rather continue to build on our successes and address the gaps and weaknesses in the system.
- **Contribute to clarity of the system**: Recommendations should help clarify and offer coherence to the system, rather than contribute to further fragmentation and confusion. The panel heard from several stakeholders that we need a clearer understanding of the roles and responsibilities of the players in the system, particularly with respect to their purpose and the expected outcomes delivered to Canadians.
- **Build on previous advice to ensure coherence of advice**: As noted earlier, this panel is part of a lineage of panels and other expert committees that have reviewed and advised government on various aspects of the Canadian research and innovation system. Among the most important (and recent) of these is the **Fundamental Science Review**. The assessment of the panel is that the key findings and recommendations of previous reports are still relevant. Rather than rewriting these reports, this panel seeks to reinforce and build on key messages as the Canadian ecosystem and global context continues to evolve. In particular, our review builds upon their focus on funding to encompass broader collaborative frameworks as well as the structures and governance of the system through which funding is deployed.

- **Seek efficiency**: Recommendations pertaining to governance should seek to leverage—or make use of—existing resources as much as possible. Recognizing the urgent need to increase funding directly to students, postdoctoral fellows, researchers and research institutions, recommendations should seek to minimize any new administrative and/or overhead costs. That said, ensuring that administrative structures are sufficiently resourced can also lead to efficiency gains through better responsiveness to the needs of researchers and national interests.

- **Support talent**: All regions of Canada require talent to flourish economically and socially. Talent is fundamental to the competitiveness and success of Canada and needs to be a top priority across all aspects of the research support system, including funding and governance. Ensuring that the system sufficiently supports students, postdoctoral fellows, and other highly qualified people (HQP), and supports the full career arc of researchers, is critical to the success of the system itself.

- **Ensure balance in modes of inquiry**: While the need for new mechanisms to support interdisciplinary research is evident, the panel heard concerns that requirements for multidisciplinary research teams can impede important disciplinary research, which is also necessary for transformative knowledge creation. In particular, there were concerns that in encouraging multidisciplinary, innovative approaches, the system may swing too far so that the newest modes would be prioritized over other considerations, even where more traditional approaches (with more conventional resource needs) might make the most sense. Accordingly, the system should be flexible to meet a diverse range of research needs, and enable multidisciplinary, innovative research when relevant while ensuring that fundamental disciplinary research is adequately supported.

- **Provide effective support for mission-driven research and agility to respond to new opportunities and challenges**: Among the greatest gaps of the current system is the ability to respond quickly and in novel ways to emerging societal and economic need. The system needs to be equipped with a capacity to answer such challenges effectively while not distorting existing research support.

- **Recognize the importance of fundamental and investigator-initiated research**: Fundamental, investigator-initiated research is the cornerstone of the research endeavour and must be supported at internationally competitive levels. Mission-driven priorities will depend crucially on established expertise and breakthroughs generated by investigator-initiated research. New talent will be attracted to Canada by the excitement of discovery research and its future applications. In this light, investigator-initiated research is the foundation of the overall talent pool.

- **Promote inclusivity**: The structures and governance of the research support system must promote inclusivity and diversity. This requires a governance structure that, itself, includes a diversity of perspectives. To ensure that the research enterprise realizes its full potential, the governance structures should seek to build capacity among diverse communities, particularly those that are underrepresented in research and face structural impediments to progressing in their training or career trajectory, and ensure that researchers can flourish in their official language of choice.

- **Draw inspiration from international models**: Adapting a research support system to the new realities of the modern research enterprise is not unprecedented—the UK and Netherlands, for example, have adapted their funding systems in recent years, as has Québec. Other countries, such as Germany and

the US, continue to be among the global leaders in terms of the outputs of their research systems. While the Canadian context is unique among its peers, there are important lessons that can be learned from other jurisdictions to inspire a uniquely made-in-Canada approach.

- **Adopt an ecosystem approach**: The recommendations must adopt an ecosystem approach, whereby individual organizations will consider themselves part of an interconnected system rather than a constellation of isolated entities. Together the pieces will collectively contribute to positive outcomes for Canadians.

It is the panel's hope that its recommendations, which are discussed in the next sections of this report, are viewed and analyzed through the lens of these principles.

A Bold Approach for Research Support

The Case for the Canadian Knowledge and Science Foundation (CKSF)

Canada is not alone in seeking new and improved approaches to support multi- and interdisciplinary, urgent, and mission-driven research. Even before the pandemic, many countries were examining this issue in light of the evolving nature of research as well as the potential for enhanced knowledge mobilization and commercialization.

As described in the previous section, the granting councils were designed first and foremost to support research along disciplinary lines. In most instances, this model has suited the nature of research as reflected in the predominance of similar approaches in many other jurisdictions (particularly with respect to health research, which is often supported separately from other disciplines). While this approach has ensured success in the past, the modern research enterprise has developed additional modes of inquiry and is increasingly characterized by multi- and interdisciplinarity. Moreover, a strategic system-wide perspective is increasingly required to address major global challenges. For example, the panel heard that interdisciplinary researchers, or researchers who operate near the boundaries between the granting councils, often face challenges accessing funding opportunities. While the Tri-Agency Interdisciplinary Peer Review committee (TAIPR) established for the major programs of NSERC, SSHRC and CIHR partially addresses this issue, success rates are low and scaling up successful new initiatives is challenging.

The roles of the various players in the research support system, including those charged with supporting coordination, are not always well defined or well understood and the ad hoc addition of new programs to address gaps or emerging opportunities has induced a greater fragmentation of the system. This in turn has resulted in a high level of complexity, adding administrative burdens to both funders and researchers and institutions. This hinders the speed and efficiency at which the system can address emerging challenges in an effective way. The CRCC was created with the recognition that the system requires greater harmonization, integration, collaboration, and coordination of programs, processes and policies among the granting councils and CFI. However, the panel heard of significant discrepancies between stakeholders and some CRCC members themselves on the effectiveness and progress achieved through the CRCC. In particular,

researchers and institutions have difficulty finding their way through the full array of support and programs, and continue to observe major differences in processes across the councils. Fragmentation and complexity have reduced efficiencies and impeded agility.

Consistent with the views of many stakeholders, the panel has observed a variety of challenges that impede effectiveness, including:

- The CRCC is not empowered to induce change in the operations of the granting councils to enhance coordination. Moreover, there is no distinct body (e.g., board of directors) that provides oversight of the CRCC.
- The requirement for the CRCC chair to be held by a granting council president is problematic as it relates to the independence of the CRCC and creates the potential for real or perceived conflicts of interest.
- Given the number of other important research funders in the system, the narrow membership of the CRCC (i.e., granting councils, CFI, NRC, CSA, ISED and Health Canada) limits its ability to achieve broader coordination.
- Discussions at the CRCC appear to have focused on operational issues rather than strategic issues with a system-wide perspective. In particular, the panel notes the absence of an overarching strategic plan with which the councils could align their individual strategic plans to better leverage and coordinate existing research support. At present and in line with existing mandates and customs, each council's strategic plan is developed independently with little focus on alignment or harmonization.

The panel observes three other key gaps in the system that neither the CRCC nor the CSA are well positioned to address given existing mandates. Namely, Canada lacks:

1. a mechanism with a clear mandate to facilitate urgent, international, multi- and interdisciplinary, and mission-driven research, as was required during the pandemic;
2. the right mechanisms to enable the federal government to work with non-council/CFI instruments, such as Indigenous partners and provinces/territories; and
3. a single, coordinated voice for Canadian science and research, which presents challenges for strengthening support for science and research in Canada and seizing international opportunities.

As a result, the panel concludes that a new approach to governance is required to address the persistent gaps in the system. This conclusion is consistent with the view expressed by the **Fundamental Science Review** panel, which noted that more oversight may be necessary if measures taken to date (such as the CRCC) have not resulted in a stronger culture of collaboration and coordination.

Models in Other Jurisdictions

The panel considered several models adopted in other jurisdictions to enhance coordination and address the other gaps identified. Perhaps the best known of these is UK Research and Innovation (UKRI), which was launched by the UK government in 2018. The UKRI brought together the UK's seven previously separate disciplinary research councils, as well as two additional funding bodies (i.e., Innovate UK and Research England), into a single organization under a common chief executive officer and board of directors. In doing

so, the UKRI's intent is to facilitate multi- and interdisciplinary research, improve linkages between research, innovation and commercialization, and provide a unified voice to the government and international partners.

The UKRI is a relatively new organization and, as its preliminary reviews have suggested, it is still too soon to fully assess whether its goals have been met. Some preliminary signs give hope that it will indeed offer a strong research and innovation environment for the UK, but there are also signs that this high level of centralization has increased administrative complexity and expense while not increasing coordination to the level intended or at the speed desired. The experiment is still unfolding.

The UK, however, is not alone in reforming its governance for research and innovation. For example, the Netherlands undertook an organizational overhaul in 2017 by creating an umbrella organization (Nederlandse Organisatie voor Wetenschappelijk Onderzoek) to better facilitate multidisciplinary collaboration. Even in Canada, the creation of the Fonds de recherche du Québec (FRQ) in 2011 sought to establish a single voice for research and promote synergies between disciplines through restructuring Québec's three previously autonomous research funding agencies under a shared governance structure. While approaches with greater harmonization have been adopted by some peer jurisdictions, others such as France, Germany and the US, which have strong traditions of research excellence, have adopted relatively decentralized approaches with entities focused on specific and distinct roles in the research and innovation continuum, including some focused on investigator-initiated research and others focused on specific mission-driven programming.

The evolution of these national systems reflects their own histories, needs and institutional landscapes and cannot be imported wholesale to address Canada's circumstances. They all offer key lessons that should inform our approach for Canada, but the panel ultimately concluded that a uniquely Canadian approach inspired by elements of these approaches would best serve the future of Canada.

Creation of the CKSF

The panel recommends that the Government of Canada establish a new organization to address the challenges in the existing system while preserving the granting councils as independent entities that continue to excel at funding investigator-initiated research. This new organization would fill the gaps identified by the panel and provide a more agile mechanism for answering emerging needs and opportunities without disrupting the existing strengths of the Canadian research system. This would also help to clarify the complementary roles of the various players in the ecosystem. The new organization would incorporate and build on the objectives of the CRCC, thereby replacing it.

Recommendation 1: The Government of Canada should create a new organization, referred to as the Canadian Knowledge and Science Foundation (CKSF), as a mechanism to rapidly address emerging research and innovation[4] needs, deliver most tri-agency programming, and enhance coordination, planning and policy capacity across the research and innovation system.

The panel strongly suggests giving the new organization a name that would make it easily recognizable among our international partners as well as in our own civil society. The panel offers the name Canadian Knowledge and Science Foundation (CKSF) (Fondation canadienne pour le savoir et la science–FCSS) for the government's consideration, which would help ensure a high profile for the organization (similar to the strong brand of the National Science Foundation in the US). The panel recommends including the word "knowledge" in the name to ensure that Indigenous perspectives, as well as arts and humanities research and other communities with different knowledge systems, see themselves reflected in the new organization. This also provides a linkage to knowledge mobilization, which is an important goal of the new organization. While the panel refers to the organization as a "foundation" to reflect its ability to blend funding from various sources (discussed below), the panel envisions the organization as a government agency, not an autonomous not-for-profit corporation.[5]

Roles and Responsibilities of the CKSF

While the CKSF would absorb the mandate of the CRCC, the panel envisions a much broader set of roles and responsibilities for the new organization to comprehensively address the range of gaps identified by the panel in the current system.

Accordingly, the panel envisions three key roles for the CKSF:

First, the CKSF would support a more rapid and effective response to address emerging research and innovation needs, including those facing the Government of Canada as experienced during the pandemic by identifying and delivering programs that mobilize the community through support for strategic, mission-driven, multi- and interdisciplinary and intersectoral, urgent and high-risk/high-reward research as well as some talent and knowledge mobilization objectives (expanded on below). For example, tri-agency programming would be delivered through the CKSF, allowing the granting councils to focus fully on their core mission of knowledge creation and excellence in fundamental and investigator-initiated research. When relevant to achieving the objectives of a mission, the CKSF should have the authority to provide funding to project partners such as industry (including researcher start-ups) and other non-academic partners. The CKSF would work with other organizations, where relevant, to leverage existing mandates and authorities to avoid duplicating the capabilities of others. In acknowledgement that mission-driven research can only advance with solid fundamental research programming in place, as offered by the councils, we expect that most mission-driven funding would include corresponding funding to the existing councils. The CKSF would also identify other

[4] As described later in this report, the CKSF would address for example low to mid-technology readiness levels (TRLs), and other organizations (such as the NRC and the recently-announced Canadian Innovation and Investment Agency) would focus on higher TRLs.

[5] Other names may be considered, such as the Canadian Knowledge and Science Agency.

organizations best placed to deliver on elements of targeted mission-driven programming (e.g., Indigenous organizations, Mitacs) and would provide the government with the flexibility to either fund these organizations directly (e.g., through contribution agreements) or via funding distributed by the CKSF. For direct funding from the government to other funding bodies (e.g., Mitacs) for targeted mission-driven programming, the CKSF would advise the government on the allocation.

The CKSF would further facilitate rapid response by providing a novel mechanism to deliver research solutions across the federal government by launching and administering funding calls on behalf of government departments (not limited to ISED and Health Canada). It would also enable mission-driven research and pre-commercialization calls with external partners when requested by combining (or blending) funds, including from provinces/territories and international partners. However, this would not preclude others from launching their own calls. The CKSF would then facilitate the knowledge mobilization of the research solutions and outcomes generated by the research community. This blended funding and multi-department approach, while not prescriptive, would provide government with more expansive and integrated tools to better answer some of the major multi- and interdisciplinary challenges that await us all such as climate change adaptation and energy transition, pandemic preparedness, resiliency of democratic societies and shifting economies, and global food security. These challenges, which are global in nature, will affect all countries and it is essential that Canada provides its own solutions to address them. At the same time, certain challenges are specific to Canada and the government may wish for research solutions to guide evidence-based policy in the coming years on a number of key challenges. Examples of these challenges include preparing for public health risks in an aging society, mitigating the impacts of climate change in the North, reconciling national debt with increasing pressure on social programs, and understanding transformation of the economy induced by artificial intelligence and friend-shoring.

Second, the CKSF would support coordination and planning across the research system by providing a mechanism for the granting councils, CFI, Mitacs, Genome Canada, and other key funding partners (as relevant) to streamline, harmonize, integrate, and coordinate programs, processes and policies where relevant. At present, Canada does not have the right instrument to do this. This should include, but not be limited to, coordinating approaches to advance objectives related to equity, diversity and inclusion (EDI) such as Indigenous research, Black Scholar advancement and ensuring that research capacity in both official languages is encouraged and supported. To drive greater alignment within the system, a key function of the CKSF would be development of an integrated strategic plan for the research support system that would inform individual strategic plans of the councils and other funding partners (e.g., CFI) to promote an ecosystem perspective. The government should examine options to help ensure that all funding partners consider the integrated strategic plan in the development of their own plans.

Third, the CKSF would be the home for coordinated planning and implementation of talent development programs including, but not limited to, scholarships and fellowships, Canada Research Chairs (CRC) and Canada Excellence Research Chairs (CERC) programs. Recognizing that the core of the research and innovation ecosystem lies in the development of talented researchers and innovators, a coordinated and equitable approach to supporting the next generation of Canadian talent is key. With increased funding for trainees across the ecosystem (see Recommendation 6), the CKSF will ensure that innovative programs are developed to train the interdisciplinary scientists and scholars needed to keep Canada at the forefront internationally, and attract and retain the very best talent from home and abroad.

As the organization responsible for coordination, the CKSF should serve as a portal for government and international partners wanting to deliver on strategic mission-driven research or broad international collaborations, including through a triage function to ensure that partners can connect with the right point of contact. The CKSF should also provide a harmonized voice for Canadian science and research with government decision makers, civil society and international partners.

The new organization will fill the gaps observed by the panel in the current support system and develop an integrated strategic plan in collaboration with the various players in Canada's research ecosystem. This will allow the granting councils, with their relative autonomy and their own mandates, to focus on what they do well while preventing mission drift. It will also provide a better balance and distinction within the support system between entities that support investigator-initiated research and mission-driven research. The panel's recommendation for the structure of the CKSF hinges on the preservation of the existing granting councils as funders of excellence in investigator-initiated research. The CKSF is not designed to replace the existing granting councils. Our approach recognizes the value of having distinct entities (much like the US and Germany) with complementary mandates to let them focus on areas of excellence, while providing a higher-level harmonization body that offers a clearer outward facing point of contact (much like the UK and the Netherlands). In a thoroughly Canadian fashion, the CKSF could enable novel provincial and territorial experimentation and partnerships via the possibility of blended-funding mission-driven calls.

Recommendation 2: The existing granting councils should be preserved as critical mechanisms to support excellence in investigator-initiated research and talent development.

Governance and Leadership

Strong oversight and clear accountabilities are necessary for the success of the CKSF. The panel recommends the following organizational structure for the CKSF.

BOARD OF DIRECTORS

The CKSF should be governed by a board of directors that would lead on the governance of the organization, including identifying priorities and establishing and overseeing strategic directions and goals of the organization. The board would also evaluate the overall performance of the CKSF, including with respect to the achievement of its objectives. In addition, the board would provide input to the government on allocation of funding for mission-driven research initiatives.

The board could be chaired by the Chief Science Advisor (CSA). This would help to better connect government science with the broader research community and provide a stronger voice for the CSA within the Canadian and international research communities. For programs delivered through the CKSF, strategic oversight would be provided by the CKSF board.

Board members should be drawn from various parts of the research ecosystem, including academia (with consideration given to representation of a diversity of universities—from large universities in city centres to smaller institutions playing key roles in their communities—as well as other academic institutions such as colleges, CÉGEPS and polytechnics), industry (especially in sectors tied to innovation), and not-for-profits.

EDI considerations should also be a criterion in determining membership and required expertise. Deputy Ministers of ISED and Health Canada would also sit on the board as would the chairs of the councils or boards of the three granting councils, CFI, Mitacs, and Genome Canada.

PRESIDENT

Implementation of the strategic goals and day-to-day operations of the CKSF would be overseen by a dedicated, full-time president with resources to support the organization's mandate and strategic direction. The president's mandate would include, but not be limited to, ensuring that the design of CKSF programming aligns with the capabilities of other organizations in the ecosystem. The president, along with the board, would be the conduit between the organization and the government. The president would also advise the board on strategy and keep the board apprised of the organization's performance.

The president should not be cross-appointed as a granting council president or other government official. The president should also be an observer on the CKSF board of directors. The government could draw inspiration from the role of the UKRI chief executive officer in determining the appropriate profile for the president (i.e., a highly distinguished academic or scientist with strong management experience).

COORDINATION COMMITTEE

The main responsibility of the coordination committee would be providing strategic input on the design of programs under the responsibility of the CKSF, including ensuring alignment with government missions, complementarity with other programs, and linkages to the capabilities of other organizations. The committee would support the president in triaging questions and requests that are received by the CKSF. In addition, the coordination committee would take leadership on coordination/harmonization of activities across the committee members, including development of an integrated overarching strategic research plan. As the CRCC would be dissolved, the coordination committee, in partnership with Indigenous Peoples, would also maintain and update the existing strategic plan for Indigenous research and research training developed through the CRCC.

The coordination committee would be modelled on (but not identical to) the CRCC, consisting of the presidents of the CKSF, granting councils and CFI and expanded to also include the heads of Genome Canada and Mitacs. The inclusion of the granting council presidents on the coordination committee ensures that the CKSF discussions are truly interdisciplinary and that the presidents are included in decision-making on all CKSF activities. The coordination committee would provide the linkage among research, talent and infrastructure with a system-wide perspective. Given ISED and Health Canada's transversal role with respect to the research enterprise, it is expectedly that they would partake regularly in the committee. Other contributors could be invited by the president to provide input to the coordination committee as relevant (e.g., mission-driven research, innovation, talent), including representatives from science-based government departments (e.g., Environment and Climate Change Canada, Fisheries and Oceans Canada) as well as heads of the NRC and CIFAR, among others.

POLICY DIRECTORATE

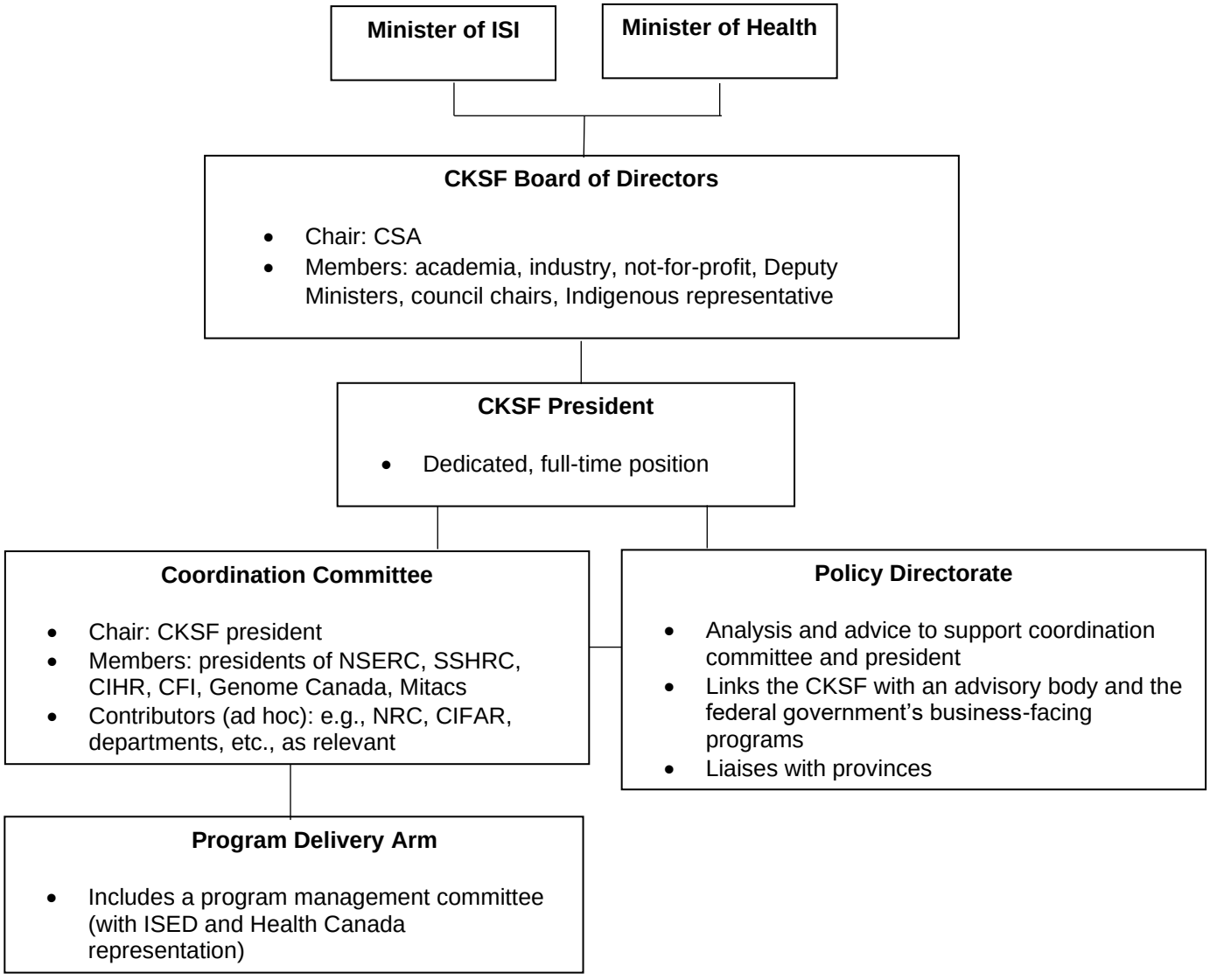
The policy directorate would support the president and the coordination committee by providing analysis and policy advice on state-of-the-art approaches to supporting research and other key issues (e.g., examining

barriers to participation in research and talent support programs) to inform and support decision-making related to programming. In doing so, it would complement the role of ISED and Health Canada, which would continue to lead on work related to policy authorities that govern new programs, ensuring alignment with government priorities, and playing a role in ongoing monitoring to ensure continued alignment between programs and their policy mandates. Accordingly, there should be a linkage between the policy functions of ISED, Health Canada and the CKSF.

The policy function should also link with other parts of the system outside the CKSF, including other key federal departments, a new advisory body (discussed in the next section) and innovation and business-facing programs/initiatives. Given that some provinces have expressed a desire to the panel for the federal government to enhance consultation and coordination on programming and funding, the policy directorate should also provide a liaison function with provinces and territories to discuss and share information on policies and programs related to research and innovation, in order to better support both provincial/territorial and federal research and innovation capacities.

The policy directorate should also include Indigenous, EDI, anti-racism and francophone advisors to ensure these perspectives are incorporated in its analysis and advice. The CKSF is also expected to partner with the Indigenous Leadership Circle in Research, which was announced in early 2022.

PROPOSED CKSF STRUCTURE



CKSF Programming

Based on the roles and responsibilities of the CKSF identified above, the panel envisions four types of programming within the scope of the CKSF to address existing gaps or other challenges.

MULTI- AND INTERDISCIPLINARY INITIATIVES

The panel heard from stakeholders that the granting councils excel at supporting disciplinary research, but researchers who operate near the boundaries of disciplines or across disciplines struggle with the existing funding mechanisms as programs to support multi- and interdisciplinary research are still administered within the context of the disciplinary councils. Going forward, under this proposal, the CKSF would be responsible for most multi- and interdisciplinary initiatives going forward, including the existing New Frontiers in Research Fund (NFRF).

The CKSF is also expected to support other true intersectoral research initiatives, such as those associated with One Health (for example); however, as would apply to other intersectoral projects, this would not preclude CIHR (or other councils) from undertaking some associated initiatives when relevant. In addition, further consideration should be given to the benefits of the CKSF assuming the delivery of the Strategic Science Fund, although priority should be given to the integration of existing programs noted above that have come to play a significant role in the research support system.

Finally, the CKSF would be called to administer the Canada First Research Excellence Fund (CFREF) (currently administered by TIPS), the College and Community Innovation Program, the Dimensions awards (pilot), and the Equity, Diversity and Inclusion Capacity Building grants (pilot) (currently administered by NSERC).

MISSION-DRIVEN RESEARCH INITIATIVES

There have been notable efforts to address the need for mission-driven programming, but it remains one the greatest gaps in the current ecosystem. This gap was particularly evident during the pandemic as the government sought to address an urgent need across all disciplines. To address this gap, the CKSF would assume responsibility for mission-driven research programs. This would include moving the existing Canada Biomedical Research Fund (CBRF) (which is also multidisciplinary) under the CKSF (currently administered by TIPS).

It should be recognized that mission-driven programming often exerts a strong gravitational pull towards certain disciplines or topics. In designing mission-driven multi- and interdisciplinary programming under the CKSF, care should be taken to ensure that programs are designed in a way that not only allows but also encourages diversity of leads, including those from the social sciences and humanities. Moreover, given the diversity of scientific and societal needs, care should be taken to ensure that programs do not structurally advantage solely economic, technological or health related projects. For example, mission-driven research initiatives could support public policy development, such as policies to better support civic participation or enhance food security. By design, the CKSF must be attentive to the full spectrum of expertise and knowledge that research can foster.

Researchers from all academic institutions (including research hospitals) can contribute to mission-driven research initiatives, from large research-intensive universities to regional community colleges and CÉGEPS. All academic institutions are called upon to play an increasing role in research and innovation. For example, many community-embedded regional universities as well as colleges, CÉGEPS and polytechnics have developed mission-driven research activities, and are connected to local small and medium-sized enterprises (SMEs) and local organizations. In this light, all of these types of institutions should be eligible for support through mission-driven research initiatives where warranted. If we aspire to build Canada's research capacity and develop the full spectrum of talent (not just PhDs, but all HQP), we need to empower all institutions across the country to maximize impact.

TALENT

The panel heard from students, postdoctoral fellows, and researchers that the federal government's talent programs are fragmented, resulting in inefficiencies for applicants. The CKSF would bring the suite of talent support[6] within the same organization thereby creating a single portal of entry and helping to ensure harmonization across the suite of talent programs. It would also better enable support for both domain-specific and interdisciplinary talent. That said, the panel agrees that the granting councils should retain the ability to deliver research-driven talent initiatives (i.e., individually-held research grants). Accordingly, NSERC would retain delivery of the Undergraduate Student Research Awards (USRA) and councils would retain their new USRAs for Black Scholars (however, discussions should take place at the CKSF coordination committee with respect to harmonizing these awards across the councils). There may also be disciplinary reasons for delivering a talent initiative through a specific council; for example, new funding initiatives that seek to increase the participation and success of Black and other racialized groups in particular fields.

KNOWLEDGE MOBILIZATION

Knowledge mobilization is critical for translating research results into benefits for Canadians. However, researchers have expressed frustration with the current approach to support for knowledge mobilization, innovation and commercialization, which has a number of gaps, particularly with respect to the needs of researcher entrepreneurs. The panel envisions that the CKSF, the councils, and other key players would share responsibility for delivery of programming in this space, recognizing that knowledge mobilization, innovation and commercialization should be encouraged and supported across the system. The panel holds the view that, in general, the granting councils would focus for example on low technology readiness levels (TRLs), while the CKSF would address low to mid-TRLs, and other organizations (such as the NRC and the recently-announced Canadian Innovation and Investment Agency) would focus on higher TRLs that are closer to deployment or to commercialization activities (note that the panel does not envision removing I2I from NSERC). This is also consistent with the core roles envisioned by the panel for the granting councils and the CKSF, as projects are more likely to involve a greater number of disciplines as they ascend TRLs. The CKSF could particularly play a role in supporting multi- and interdisciplinary pre-commercialization projects, a gap

[6] This would include support for graduate students and postdoctoral fellows, such as the Vanier Canada Graduate Scholarships and Banting Postdoctoral Fellowships (currently administered by CIHR) and the Canada Graduate Scholarships (for which each council administers its own portion of awards) as well as the various tri-agency research chairs programs under TIPS that are intended to attract and retain talent, including the Canada Research Chairs, the Canada 150 Research Chairs, and the Canada Excellence Research Chairs.

identified by several stakeholders. The CKSF would also be responsible for identifying gaps in knowledge mobilization programming and approaches to better position the research community for innovation and commercialization outcomes, particularly in multi- and interdisciplinary and mission-driven projects. In addition, the CKSF would link to other organizations that offer business-facing support through its policy directorate to hand off projects to the right partner as projects move closer to commercialization.

Process to Determine Delivery Mechanism

The preferred delivery mechanism of a new initiative would be determined through consultation with the CKSF coordination committee based on alignment with the roles of the CKSF vis-à-vis the granting councils and other organizations. In general, initiatives that are multi- and interdisciplinary in nature and mission-driven would be delivered by the CKSF. However, this does not preclude the granting councils—or other departments and agencies—from conducting priority calls that are more multi- and interdisciplinary and/or mission-driven in nature. Such calls should be launched only after engagement with the CKSF to ensure coordination with other relevant initiatives. In particular, the panel recognizes the more priority-driven nature and the successes of the CIHR Institutes and the crucial role research hospitals play in the research ecosystem. For this reason and because of the fundamental role they play in CIHR design and operation, the panel recommends such Institutes remain within the CIHR mandate.

The CKSF would also seek to leverage other funding mechanisms/organizations for components of strategic projects that fall within the scope of those other mechanisms/organizations. For example, the panel expects that some funding for strategic mission-driven initiatives that it leads would still be delivered by the granting councils or other partners (e.g., Genome Canada). The CKSF board could provide advice to Ministers on the allocation of new funds to partners for such initiatives based on recommendations from the CKSF coordination committee. In particular, research funding allocation recommendations should always include consideration of the research infrastructure needs.

To enhance the agility of the CKSF, research funding should be available to support international research initiatives and other exceptional opportunities that may arise from time to time. The timing of international competitions and partnership opportunities is not always aligned with existing funding opportunities. The panel heard that international partnerships demand agility and flexibility if we are to maximize the participation of Canadian researchers in international research opportunities.

While the panel recognizes the risk that the CKSF could be perceived as competing with other funding organizations within the ecosystem for resources, this risk is partially mitigated through the governance structure of the CKSF, particularly the representation of key funding partners on the coordination committee and the board of directors. To further reduce this risk, the panel recommends that clear key performance indicators (KPIs) be established for the leadership of the CKSF and federally-funded research support organizations (including, but not limited to, the granting councils) that focus on coordination and collaboration outcomes and that a routine evaluation of coordination efforts be undertaken by an external advisory body (discussed in detail in the next section).

SUMMARY OF PROPOSED CKSF PROGRAMMING VIS-À-VIS THE GRANTING COUNCILS

CKSF Programming	Councils' Programming

- Most current tri-agency programming, including:
  o Talent programs (i.e., Vanier Canada Graduate Scholarships and Banting Postdoctoral Fellowships, Canada Graduate Scholarships)
  o Research programs (i.e., CFREF, NFRF, CBRF)
  o Partnership programs (i.e., College and Community Innovation Program)
  o Dimensions awards (pilot) and Equity, Diversity and Inclusion Capacity Building grants (pilot)
- Multi- and interdisciplinary research that falls between the traditional fields of research supported by the three councils
- Low to mid-TRLs, pre-commercialization and some business-facing research
- Mission-driven research (with exceptions for those that relate exclusively to one council's mandate or that fall under a single scientific field)
	- Programs specific to fundamental or investigator-initiated research, including current flagship programs such as (but not limited to) Project and Foundation Grants at CIHR, Discovery Grants at NSERC and Insight Grants at SSHRC
	- Programs specific to investigator-initiated applied research in collaboration with industry or international partners, including NSERC Alliance Grants
	- Research-driven talent initiatives, including NSERC Collaborative Research and Training Experience (CREATE) program
	- CIHR Institute-specific programs
	- Low TRLs

Reporting Lines

Recognizing that the mandate for funding extramural academic research is shared by the Minister of Innovation, Science and Industry (through NSERC and SSHRC) and the Minister of Health (through CIHR), the CKSF board and president would be appointed by the Governor in Council (GIC) on the recommendation of both Ministers, and would report to both Ministers. This would also help to ensure that both Ministers have access to perspectives from across the full research and innovation ecosystem rather than just the perspectives of the organizations that fall within their own portfolios.

A note on the division of the granting councils between two Ministries: No strong message emerged from stakeholders with respect to the impact of this on coordination within the research support system. Instead, there were strong concerns voiced by the health research community that moving CIHR over to the ISED portfolio would come at a cost given the role of CIHR in supporting health policy and the strong

appreciation of health research that exists within Health Canada. As a result, the panel feels that objectives are best achieved by keeping CIHR under the responsibility of the Minister of Health while creating a stronger mechanism for coordination through the CKSF. That said, enhanced coordination could be achieved through a stronger Health Canada role with respect to the government's policy responsibilities vis-à-vis the CKSF and the councils. Consideration should be given to creation of a joint ISED-Health Canada secretariat for this purpose. A more formalized structure to facilitate coordination between ISED and Health Canada could help to ensure greater alignment and efficiency across research support.

With respect to the relationship between members of the coordination committee (including the council presidents) and the CKSF president, the panel emphasizes that the CKSF president would not have any control over the day-to-day activities of the other presidents and their organizations, which would remain autonomous from the CKSF. However, the CKSF president should be empowered to direct members of the coordination committee on issues within the scope of CKSF roles and responsibilities. This could be done through parameters of funding (provided through, or on the recommendation of, the CKSF) or through direction provided by Ministers to individuals appointed by the government. To set clear expectations that the committee members will work together through the CKSF, the Ministers should specify this expectation to members through tools such as funding parameters and contribution agreements, and KPIs related to cooperation should be established where possible. Where presidents or board members are appointed by the Ministers, particular consideration should be given to individuals with a track record of collaboration.

Operational Resources

For the CKSF to succeed, it must be appropriately resourced. While the panel acknowledges that some new resources will be required, the government can also leverage existing resources that currently support coordination functions within the granting councils.

In particular, there is already a secretariat for the CRCC, housed within SSHRC, that could be moved over the CKSF to support the coordination committee. This secretariat is currently responsible for the organization, preparation and recording of CRCC meetings and follow-up activities.

With respect to the program delivery function, this would be fulfilled by moving TIPS (along with the corresponding management committee structure), which is currently housed at SSHRC, to the CKSF. This would ensure more effective strategic oversight of the tri-agency programs given the multi- and interdisciplinary mandate of the new organization. Moving the resources associated with TIPS to the CKSF (along with most programs administered by TIPS[7]) would also help to reduce the need for new resources. Resources at CIHR for delivery of the Vanier Canada Graduate Scholarships and Banting Postdoctoral Fellowships could also be reallocated to the CKSF to continue to support these programs.

That said, the panel expects that new resources would be required to build out the policy capacity and for hiring of a CKSF president. In particular, the policy directorate of the CKSF will require full-time staff to

[7] Consideration should be given to the best delivery agent for the Research Support Fund given that it pertains to council-specific programming, even though it is administered by TIPS.

undertake research and analysis and liaise with the granting councils, provinces/territories, and other partners in the research and innovation ecosystem to inform policy development.

It is important to recognize, however, that there can be efficiency gains in other parts of the support system through improved governance. Moreover, the panel expects that those elements brought over to the CKSF from other parts of the support system (e.g., TIPS and CRCC secretariat) would operate with greater efficiency as they now have a tighter link to an oversight mechanism (i.e., CKSF) that better aligns with their objectives.

Finally, the panel wishes to emphasize that, aside from the resources reallocated from the granting councils associated with the programming placed under the CKSF, the creation of the CKSF must not come at the cost of the councils' ability to deliver their core programming, which is the basis of current scientific excellence in Canada.

A Few Thoughts on Implementation

The government needs to ensure that the new organization is implemented in a way that enables it to fulfil the roles and responsibilities as recommended by the panel. Given that ISED and Health Canada live the practical realities of implementation on a day-to-day basis (and based on their excellent track record on implementation), the panel feels that the two departments are best placed to determine the details on how best to implement the new organization, while maintaining the efficiency and excellence of the granting councils and in accordance with the principles and recommendations of our panel.

The panel wishes to flag a couple of key issues with regard to implementation.

First, investment in data and information technology (IT) for the new organization is critical to its success. This issue was highlighted by a UKRI official in discussion with the panel as well as the 2022 independent review of the UKRI. Investing in data platforms across the CKSF, granting councils, and other organizations that are funded by the federal government to support research and innovation would allow for better monitoring and assessment of performance across the support system, including collaboration, and provide a better evidence-base for future decision-making to enable continuous improvement. Moreover, given that stakeholders consistently expressed concerns about the lack of efficiencies resulting from different processes across the councils, greater integration of data and IT platforms would help improve the agility of the system, the delivery of services to the research community, and the user experience. Making these investments now would improve efficiency of the overall support system in the long term. Some harmonization of data systems could begin before the CKSF is established.

Second, the appointment process for the new board and leadership of the proposed CKSF needs to be nimble and timely. A number of positions would be filled by ministerial appointment. The panel heard that this can result in lengthy processes that lead to leadership vacuums on the coordination committee or the board while appointment decisions are being made. While the panel feels that these positions are rightly ministerial appointments, ISED and Health Canada should give consideration to the appointment process with a view to ensuring efficiency, timeliness and credibility of nominations among the stakeholders.

Benefits of the CKSF

Creation of the CKSF would provide a number of benefits that the existing structures are not designed, or able, to realize. These include:

- **Rapid, mission-driven research**: The CKSF would provide Canada with an instrument to rapidly support mission-driven research across the research ecosystem through agile, responsive tailor-made programming to address emerging research challenges and specific needs (e.g., biomanufacturing). The CKSF would allow government, academia, business, and not-for-profits to coalesce around emerging challenges by providing a mechanism for blended funding, offering flexibility in terms of eligible recipients, and linking with Canadian Innovation and Investment Agency and other business-facing support programs. This could also help induce greater business investment in R&D and innovation in Canada.
- **Research and innovation that falls between, or outside, programs or organizational mandates**: The panel heard from a number of stakeholders in the research and innovation space who felt that their roles and activities within the ecosystem are not well supported by existing structures. This included representatives from smaller community-embedded universities, Indigenous researchers, colleges/CÉGEPs/polytechnics, and researcher entrepreneurs. The panel also heard about the challenges experienced by researchers such as those in veterinary science, food systems and environmental sciences who operate near the boundaries of disciplines or across disciplines. The mission-driven and multi- and interdisciplinary orientation of the CKSF would raise the profile of these activities and provide them with a clear organization in which they would see their activities reflected.
- **Clarification of roles**: The panel repeatedly heard that the roles of the various players within the ecosystem are poorly defined and that organizations have been asked to do more than they were intended to do, leading to further uncertainty and perceived mission-drift. Creation of the CKSF would establish a new organization with a clear mandate for mission-driven, multi- and interdisciplinary and intersectoral research initiatives while also reaffirming the core role of the granting councils in supporting investigator-initiated research.
- **Portal for strategic international partnerships**: The panel consistently heard from our international partners that the fragmentation of the Canadian research support system makes it difficult to initiate and negotiate strategic research partnerships. As Canada's *primus inter pares* research support organization, the CKSF would provide Canada's international partners with a clear portal for initiating and coordinating discussions about strategic international research partnerships. This will also improve Canada's ability to seize these international opportunities in a timely way.
- **One-stop shop for research solutions**: Given the ability of the CKSF to coordinate the research support system and launch calls on behalf of other federal government departments and agencies, the CKSF provides a mechanism for departments with mission-driven research needs. The profile and capacities of the CKSF would enable the CKSF to rapidly respond to these needs and, when relevant, triage them to other organizations within the research support system.
- **Reduction of burden on students and researchers**: The panel repeatedly heard from students and researchers that cumbersome, repetitious and opaque processes have left many with the impression that the government does not value their time. The CKSF provides an empowered forum for the

granting councils and other key players in the support system to coordinate their processes and reduce the burden on students and researchers. In particular, harmonization of talent programs under the CKSF will help to ensure a better client experience for students and postdoctoral fellows.

- **Clearer role of the CSA**: The panel heard from several stakeholders that the role of the CSA is not effectively used. This largely results from the mandate of the CSA, which is focused on intramural science. As potential chair of the CKSF the CSA could play a strategic role over extramural research including international research opportunities and partnerships.

Strategic Advice for Future Success

The Case for an Independent Strategic Advisory Body

Unlike other countries such as the US, which has many levels of strategic science and technology advice, Canada lacks an independent body to provide oversight and strategic advice to the Government of Canada over science, research and innovation. The lack of such a body limits critical inputs to decision-making on the support mechanisms and funding for research and innovation, thereby restricting the coherence of our research support framework and the impact of our investments.

Canada has had various advisory bodies over the last 35 years. Most recently, the Science, Technology and Innovation Council (STIC), which was created in 2007, was mandated to provide independent, confidential, external advice to the government on science and innovation issues and report publicly on the state of science and innovation in Canada. However, STIC was dissolved around 2015 and there is currently no body fulfilling this function.

Recognizing the importance of independent advice, the **Fundamental Science Review** panel recommended the creation of the National Advisory Council on Research and Innovation (NACRI) to provide broad oversight and advice, and to foster coordination of the federal research effort.

In response, the Government of Canada set out to create the Council on Science and Innovation (CSI), and launched a process to seek a chair and members in 2018-19. As described in the 2019-2020 ISED Departmental Plan, the CSI would be a more transparent advisory body to replace STIC and would provide independent, expert policy advice to Ministers to support government efforts to strengthen the science and research ecosystem and stimulate innovation across the economy. The CSI would cover the breadth of activity from fundamental research through applied research to commercialization of innovations. More specifically, the call for applications for the position of chair and members noted that the council would be mandated to:

- provide evidence-based analysis and policy advice to the Ministers on complex issues that require background research and consultations/engagement with experts, stakeholders and/or civil society;
- provide a “sounding board” for the Ministers on short-term and/or urgent issues; and,
- publicly report on science and innovation issues of importance to the Government of Canada and the public.

According to the call for applications, the government envisioned that the CSI members would be ministerial appointments and the council would be composed of a chair and 11 other members drawn from the scientific and research community, the private sector, and civil society. In addition, the CSA would serve as ex-officio vice-chair, and the Deputy Minister of ISED and Deputy Minister of Health would serve as ex-officio members.

However, there have been no public details on the CSI since 2019 and the CSI has never been made functional. The panel consistently heard that the lack of a body like STIC or CSI has been problematic. The factors highlighted by the **Fundamental Science Review** panel in 2017 that necessitate an external strategic advisory capacity are even more relevant today, including the importance of global challenges and the increasingly highly complex research landscape.

Consequently, the panel recommends that the government follow through with the creation of an external, independent advisory body that enables the research and innovation communities to advise the government on research and innovation support and to assess coordination across the support system. An appropriate degree of independence is important to ensure a consistent voice is sustained over the longer term.

Recommendation 3: The Government of Canada should create a new independent advisory body to provide strategic science, research and innovation advice to Ministers on funding and national strategy, and to provide broad oversight of the research and innovation support system.

Roles and Responsibilities

Based on the feedback received from stakeholders and building on the mandates envisioned for NACRI and CSI, the panel recommends the following roles and responsibilities for the new advisory body:

- Provide strategic advice to Ministers and the Prime Minister on issues related to science, research and innovation to help support a coherent national science, research and innovation policy. These issues can be identified either by Ministers/Prime Minister or by the advisory body itself. This would differentiate it from STIC, which only provided advice at the request of the government. For advice requested by the government, Ministers would determine if the advice should be public or confidential.
- Evaluate and publicly report (annually or biennially) on the overall support for, and performance of, science, research and innovation in Canada (similar to STIC's State of the Nation reports) through international benchmarking and key metrics.
- Provide input on strategic priorities and a big picture vision for Canadian science, research and innovation priorities, including supporting development of a national strategy on science, research and innovation (more on this in the next section).
- Advise the government on funding allocations, particularly (but not limited to) the balance of funding between mission-driven and investigator-initiated research, and disciplinary and multi- and interdisciplinary research (thereby supporting decision-making related to the CKSF).
- Provide research and analysis on the efficacy of federal science and research policy (including identification and assessment of gaps and barriers—including regulatory barriers).
- Assist in improving coordination and strategic alignment of different elements of the federal support system for science, research and innovation.

- Liaise with parallel bodies in the provinces and territories as well as internationally.

In fulfilling these roles, the new advisory body would complement and enhance the role of the CSA.

Composition

Similar to the previous proposals (i.e., NACRI and CSI) and consistent with previous panels (STIC), the advisory body should consist of between 12 and 16 members composed of eminent and highly credible individuals from a variety of disciplines and representing broad sectors, including academia, industry and civil society/not-for-profit, including representation of the Indigenous research community and other equity-seeking and rights-holding groups. Given Canada's aspiration to compete with the best in the world, the advisory body should also include at least one international member.

To reflect the advisory body's broad mandate for both research and innovation, the body should be co-chaired by a prominent senior scientific statesperson and a prominent senior leader from industry with an innovation track record. The co-chairs should be known and respected by decision-makers in government. Members should be selected to ensure the advisory body is highly respected and has the perspective and moral heft to represent Canada's diverse research and innovation community and advise the government on issues of national importance.

Reporting Lines

In the UK and US, similar strategic advisory bodies report to the prime minister or president rather than a minister, which connects them to the top decision maker and better enables them to consider the full ecosystem that transcends individual ministerial/departmental mandates.

In the Canadian context, an advisory body that links solely to the Minister of Innovation, Science and Industry may limit its ability to consider issues of relevance to other ministries, such as Health Canada, Environment and Climate Change Canada, Natural Resources Canada, and Fisheries and Oceans Canada, among others. However, there are also benefits to having a close relationship to a particular minister—in particular, it can help ensure the body receives more attention.

In balancing these considerations, the panel feels that reporting lines for the advisory body should be similar to those of the CSA, with members of the advisory body appointed by the Prime Minister and a close relationship to both the Minister of Innovation, Science and Industry and the Minister of Health. While the advisory body would have a closer relationship with two ministries, it should also be able to accept requests for advice from the Prime Minister and other Ministers.

Serious consideration should be given to establishing the advisory body in legislation to ensure continuity. This was flagged by both the **Fundamental Science Review** panel in its recommendation on NACRI as well as some submissions received by this panel.

Linkages to the CKSF and Other Entities

The panel considered whether the advisory role could be played by other entities in the ecosystem, including the board of the proposed CKSF or the CSA. Ultimately, the panel concluded that no other entity in the ecosystem could fulfill the roles of the advisory body. Stakeholders were consistently clear that the advisory function must be independent in the ecosystem.

While the CKSF board may have a similar composition, it would be in conflict to provide strategic advice to the government on research and innovation support and undertake performance assessments of coordination efforts. Whereas the board of the CKSF would provide oversight of the CKSF itself, the advisory body would provide advice on strategic science, research and innovation objectives, which would require different profiles for its members.

That said, the advisory body should have a close connection to the CKSF, the CSA and other important advisory or governance bodies related to research and innovation (e.g., major research facilities). The CSA as well as the Deputy Ministers of ISED and Health could participate as observers to help ensure cohesiveness.

Given the potential for confusion within the ecosystem with respect to the roles of the advisory body, the CSA and the CKSF, care will need to be taken to ensure clarity of the roles and responsibilities.

Secretariat Support

The supporting staff for the advisory body could be housed within ISED, similar to the office of the CSA. Similar to the panel's observations on the CKSF, the advisory body must be sufficiently resourced in order to achieve success.

A Common Vision for Collective Impact

The Case for a National Strategy for Science, Research and Innovation

One of the strongest and most consistent messages heard by the panel from stakeholders pertained to the need for a national strategy for science, research and innovation to drive the whole ecosystem toward common strategic objectives. In the absence of such a national strategy, the government and its agencies appear to be making decisions on science, research and innovation priorities and programs with no obvious process to link them to what the government aspires to achieve. The lack of a national science, research and innovation strategy also affects the way Canada is perceived internationally, as Canada's strategic objectives for international partnerships remain unclear.

While the panel heard that the government is essentially setting priorities for players in the ecosystem through funding allocations, this is done through an ad hoc process with no overarching strategic vision, which creates

uncertainty within the ecosystem, and leaves research funders and performers guessing about the next direction of government.

Without such a strategy, Canada is at a disadvantage among its global peers, many of whom have developed strategies of their own. For example, in 2022, the UK announced an ambitious strategy[8] to make the country a science and technology superpower. Japan also launched its Sixth Science and Technology Basic Plan[9] in 2021, which seeks to maintain Japan as a global innovation leader and outlines the process for using science, technology and innovation to achieve both economic growth and resolution of social challenges. The US *CHIPS and Science Act* also serves as a national strategic vision, seeking to increase research and commercialization leading to improved economic performance and national security.

Recommendation 4: The Government of Canada should launch a process to develop a national science, research and innovation strategy to establish a common vision and objectives for Canada's research and innovation ecosystem and to achieve greater alignment across the players in the ecosystem.

A national science, research and innovation strategy is not a new concept for Canada. Canada has had multiple strategies, including *Science and Technology for the New Century* (1996), *Mobilizing Science and Technology to Canada's Advantage* (2007), and *Seizing Canada's Moment* (2014). More recently, Canada has developed, or is in the process of developing, a series of more specific strategies, including pan-Canadian strategies for artificial intelligence and genomics, a national quantum strategy, a digital research infrastructure strategy, and the 2017 **Innovation and Skills Plan**. The panel strongly endorses the sentiment of many Canadian stakeholders that the time has come for the Government of Canada to recommit to an overarching science, research and innovation strategy to guide strategic investments and activities across the full research and innovation continuum and to express Canada's ambition to be a global science, research and innovation leader.

Scope and Components of the Strategy

Like Canada's 2014 strategy (*Seizing Canada's Moment*), the panel recommends that the strategy take a full ecosystem perspective, encompassing both research and innovation and reflecting the continuums of talent, research and innovation. The national strategy (as well as the composition of the advisory body) must also reflect a range of perspectives, including those from Indigenous, Black and other racialized groups and francophone communities, as well as other EDI considerations.

Input received from stakeholders included several suggestions with respect to the elements of a strategy, ranging from high-level, aspirational objectives, to specific priority areas, to targets for investment levels.

At its core, the strategy should define a clear vision and speak to Canada's global ambition with a strategy for how to achieve this. A good starting point is the framework of the 2014 strategy, which was organized around the themes of people (i.e., talent), knowledge (i.e., research) and innovation. These themes remain relevant.

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[8] UK Research and Innovation, UKRI strategy 2022 to 2027: transforming tomorrow together (accessed 8 January 2023).
[9] Government of Japan, 6th Science, Technology, and Innovation Basic Plan(accessed 8 January 2023).

In the panel's view, areas of particular concern that should be reflected in a national strategy include development, attraction and retention of talent and enhancing the research and innovation continuum from discovery through to translation and commercialization. To support our ambitions, the strategy should identify aspirational levels of support or targets for key research and innovation inputs and outputs, including research intensity across the ecosystem and development of talent. The strategy should also speak to Canada's strategic objectives for international research and innovation partnerships, which could include science diplomacy, enhancing Canada's reputation on the global stage, supporting research excellence, and building opportunities for industrial collaboration.

The idea of research priorities came up frequently in discussions with stakeholders on national strategy, and both the 2007 and 2014 strategies identified research priority areas. Consistent with the panel's recommendation on the CKSF, the panel is supportive of mission-driven approaches that are reinforced through the identification of research priorities related to areas of critical importance to Canada (as well as building on our strengths), but also emphasizes that support for mission-driven research must be accompanied by substantial support for investigator-initiated research that can lead to unexpected breakthroughs that might influence the missions and priorities of the future. In the development of priorities, consideration should be given to how these link to the priorities of our international partners to support advancement of our collective research pursuits.

Developing the Strategy

The panel heard various views on who would be best placed to lead on development of a national strategy for science, research and innovation, whether the development process should be more top-down or bottom-up, and who should ultimately be responsible for the strategy.

As to who should lead the development of a science, research and innovation strategy, while the panel heard some views that the strategy should be apolitical (and therefore led by the research and innovation community), the panel feels that the strategy must ultimately be defined by the government as the implementation of the strategy depends on buy-in and receptivity from the political level. Moreover, the government is best positioned to define an overall vision for Canada and action on the national level.

That said, the process to develop the strategy requires a degree of independence and broad engagement across the research and innovation ecosystem, seeking meaningful participation in the process from academia, industry, and other research and innovation stakeholders. In particular, the community should drive identification of the tactics to achieve the high-level objectives of the government. Ultimately, both the government and the research and innovation community must feel part of the process to develop and execute on the strategy and see themselves reflected in the final product.

Both the proposed advisory body and the CSA could play an important role in supporting the government's development of a national strategy, which would be consistent with the role of advisory functions in the development of strategies for other countries (e.g., Australia). As leaders in research and innovation representing the full ecosystem, the advisory body would be particularly well positioned to convene stakeholders across the ecosystem to feed into the development of the strategy and provide independent advice on a high-level vision and research priorities.

Conditions for Success

A coordinated and agile federal research support system that is equipped to respond to the current and emerging research needs is critically important to the well-being and prosperity of Canadians. That said, a research and innovation ecosystem that is competitive on the global stage hinges first and foremost on being able to effectively support and retain Canada's top research talent and build a research enterprise that fosters discovery of new knowledge.

Canada's world-class research enterprise is supported through the $4 billion annual investment[10] through the granting councils and the CFI, which feeds the pipeline of novel ideas and HQP that underpin and drive innovation. Within this are flagship programs that support independent, investigator-initiated research (e.g., NSERC Discovery and Alliance Grants, SSHRC Insight and Partnerships Grants, and CIHR Project Grants). These programs provide funding to cover a range of direct costs associated with research projects.

As highlighted at the outset of this report, it has become abundantly clear that new investments in research are critical for Canada to remain competitive and secure the pipeline of ideas and talent that are needed for long-term economic success and for flourishing communities. For Canada to maximize research impacts, respond to government priorities and contribute to the economic and societal goals, research funding must be a priority.

The panel's discussions with stakeholders, as well as input received from researchers across Canada and comparisons to peer countries, consistently revealed that the Canadian research ecosystem is now at serious risk due to inadequate support for research and researchers. As mentioned previously, it is critically important that core funding for each of the granting councils be significantly increased to address the pressures resulting from:

1. the growth in the number of graduate students and postdoctoral fellows in the research ecosystem;
2. the effects of inflation; and
3. the importance of nurturing globally competitive research, including the talent base.

Research funding over the past 20 years simply has not kept pace with these pressures on the research support system. Given the international competition for talent, Canada is at serious risk of another brain drain without reinvestment.

The lack of adequate support is limiting the research activities, and ultimately outcomes and impact, of today's researchers. It makes it more difficult to engage in new collaborations and bolder and riskier projects and reduces the bandwidth necessary to entertain novel knowledge mobilization efforts. As a result, the lack of sufficient funding is compromising the success of the research support system of today and tomorrow, and will continue to do so until addressed. Without a significant effort, the relative standing and therefore the

[10] The roughly $4 billion annual investment includes funding of approximately $2 billion annually for the three federal granting councils' individual grants and scholarships programs, approximately $1.4 billion annually for tri-agency programs operating expenses for the three agencies, and $339.1 million for the CFI for research infrastructure.

competitiveness of Canadian researchers will inexorably decline, thereby affecting Canada's standing as a whole.

Funding for Investigator-Initiated Research

Reinvestment in Canadian research is needed to make up for recent declines in funding for the granting councils and CFI (measured in constant dollars), which have been exacerbated by the exceptionally high inflation experienced in 2022[11]. In particular, a widespread view across the community is that there is a growing imbalance between investigator-initiated and mission-driven research. Support for investigator-initiated research has plateaued while new funding has been earmarked for mission-driven or targeted research projects. A balanced approach to research funding is in the interest of Canada, as knowledge acquired through investigator-initiated research today may be crucial to address the targeted missions of tomorrow. Although Budget 2018 invested $925 million over five years and $235 million ongoing to increase support for fundamental research through the three granting councils, these investments have plateaued at a time when many of Canada's allies and competitors are re-investing heavily in research and positioning science as a key pillar of their future growth strategies. For example, NSERC's budget is currently about 3.7 percent lower than it was in 2007 (in 2007 constant dollars), while the US National Science Foundation (NSF) saw its budget grow by 5.2 percent and the Australian Research Council (ARC) by 1.1 percent (in 2007 constant dollars) over roughly the same time period (2007 to 2022).[12]

Moreover, Canada's peers are committing significant resources for the future. For example, in 2022, the US committed US$200 billion over ten years for science through the *CHIPS and Science Act*, which includes major investments in research and talent to boost American research excellence, innovation, commercialization and competitiveness.[13] About US$81 billion of this is earmarked for the NSF, which represents an increase of about US$36 billion over the existing baseline.[14] Japan has also announced plans for historic increases to support for research through the creation of a US$87 billion fund to promote Japan as a science and technology leader and support economic growth.[15] Moreover, the UK has committed to increasing annual government investment in research and development to £20 billion by 2024-25, which is a record level.[16] This is part of the UK's strategic pivot to becoming a science superpower. Importantly, these commitments include investments in both investigator-initiated and mission-oriented research, recognizing that both are critical. The US NSF, for example, intends to significantly increase the budget for fundamental research as a consequence of the *CHIPS and Science Act*. All of these bold and ambitious actions are anchored explicitly in the recognition of science as a pillar of national interest: research is understood as a

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[11] The cost of some research materials have particularly increased, such as helium (an essential resource for many research projects in health and natural science research), which has risen from less than $200 per cylinder to over $700 per cylinder.
[12] NSERC data from GC Infobase; NSF Budget Requests to Congress and Annual Appropriations; ARC Budget; Canada CPI data; US CPI data; Australia CPI data.
[13] McKinsey & Company, The CHIPS and Science Act: Here's what's in it (accessed 8 January 2023).
[14] Senator Chris Van Hollen, CHIPS and Science Act of 2022 (accessed 8 January 2023).
[15] Reuters, Japan unveils $88 bln university fund in growth strategy (accessed 8 January 2023).
[16] The Academy of Medical Sciences, Investing in UK R&D (accessed 8 January 2023).

necessary condition of wellbeing and prosperity at the individual and collective level as well as an additional tool for global diplomacy and influence.

Data from the Organisation for Economic Cooperation and Development (OECD) consistently shows that Canada underperforms against global peers in terms of research and development (R&D) investment intensity (i.e., R&D investment as a share of GDP), performing well below the OECD average. While Germany plans to increase research investment to 3.5 percent of GDP by 2025[17] and Finland to 4 percent of GDP by 2030[18], Canada currently sits at about 1.6 percent. Canada particularly lags in terms of business investment in R&D, which is an important driver of economic competitiveness.

Without internationally competitive funding for investigator-initiated research, Canada will fall behind in an increasingly competitive global marketplace and lose its status as an international magnet for talent and a research collaborator of choice.

While Canada still ranks highly in some metrics of scientific output (e.g., 10th globally in number of scientific publications), these indicators are on a downward trend. In 2019, the number of researchers per 1,000 employed in Canada returned to its 2011 level, the high point of the last two decades. During that period, Canada's ranking on this measure slipped from 8th in the OECD in 2011 – ahead of the US, UK, and Germany – to 18th in 2019, at a time when there is increasing demand for HQP to drive innovation across all sectors of the Canadian economy.

For the new CKSF to be successful in the delivery and support of mission-driven research, thereby enabling the granting councils to continue to excel at supporting investigator-initiated research across a range of disciplines, and to stabilize the research ecosystem, the Government of Canada needs to significantly increase its investments in the granting councils. These new investments need to address the pressures identified above resulting from:

1. the growth in the research ecosystem;
2. the effects of inflation;
3. and the importance of nurturing globally competitive research and talent.

As an initial step, we recommend an annual increase of at least ten percent for five years to the granting councils' total base budgets for their core grant programming. This reinvestment is needed in order to reverse the decline in the real value of academic research funding in Canada.

However, given the added pressure of intensifying international competition, an additional increase in research investment will be needed if Canada aspires to compete with the best in the world. The level of this additional investment should be determined in consultation with the proposed advisory body based on international benchmarking and other considerations, and allocated to support both discovery and mission-driven research through the CKSF. Once the CKSF is established, the rate of the annual increase to the

[17] German Federal Ministry of Education and Research, High-Tech Strategy 2025 (accessed 8 January 2023).
[18] Science Business, Finland seals political commitment to raise R&D spending to 4% of GDP (accessed 8 January 2023).

granting councils should be re-examined to assess the need across both investigator-initiated and mission-driven research.

Recommendation 5: The Government of Canada needs to significantly increase its investments in the granting councils. These new investments need to address the pressures resulting from the growth in the research ecosystem (increasing number of graduate students and postdoctoral fellows), the effects of inflation and the importance of nurturing globally competitive research, including the talent base. As an initial step, the government should commit to an increase of at least ten percent annually for five years to the councils' total base budgets for their core grant programming. The required level of additional investment should be determined in consultation with the proposed advisory body based on international benchmarking.

By reinvigorating federal support for research, alongside a series of proposed changes to the governance of the federal research support system, Canada will support research success and our standing in the global research enterprise. These investments will also have the added benefit of strengthening support for talent development, attraction and retention of a diversity of researchers. Talent is a continuum beginning with students through to postdoctoral fellows and on to academic, industry and government employment; as such, training is needed at many levels, which makes investment in the enterprise as a whole essential.

Competitive and Sustained Support for Canada's Research Talent

Research talent is critical for generating the ideas and intellectual property that solve important challenges and lead to increased prosperity and wellbeing for Canadians. Plain and simple, if researchers do not view the research enterprise as offering a promising career, we will continue to lose talent to other activities or to other countries. Canadian science and research will suffer, and there will be fewer HQP and fewer transformative ideas that can strengthen performance across all social and economic sectors.

We must reaffirm Canada's competitive standing to attract, maintain and develop leading-edge talent or Canada will continue to fall behind. While efforts can be made to establish a modernized, agile, and well-coordinated federal research support system, if comparable investments are not made to develop, attract, and retain the knowledge workers whose ideas and skills are the drivers of solutions to complex societal challenges, we will collectively falter. As we know, Canada's top researchers are highly mobile. Priority must be placed on taking the necessary steps to support a world-leading research and innovation ecosystem that develops, attracts, and retains world-class talent.

To put it starkly, current support for graduate students—the researchers of tomorrow—is at a breaking point. The values of the government's awards for university research trainees have remained virtually stagnant for the past 20 years. As a result, they have not kept pace with increases to the cost of living nor with research trainee compensation trends around the world—a situation that significantly dampens Canada's position as a global hub for the attraction and retention of research-enabled talent. Recent analyses show that the award levels offered by Canada's federal scholarship and fellowship programs result in a lower material standard of living for our graduate students and postdoctoral fellows than those available in comparable countries. The panel heard from several student groups, including the Canadian Association of Student Associations (CASA)

and the Quebec Student Union (QSU) who focused on the implications of the underfunding of student scholarship programs by the three federal granting councils. When student researchers are not paid a living wage and are required to take on additional jobs, productivity of research outputs will suffer as will mental and physical health. This has a disproportionate impact on marginalized or underrepresented groups, affecting diversity in the talent pool for years downstream. Given the crucial role that student researchers play in the research enterprise, it should not be surprising that a call for urgent action on this front was made by the vast majority of the stakeholders (beyond student groups) heard by the panel.

Canada has a high cost of living with low research trainee salaries compared to many other countries, making it difficult to recruit international talent as well as retain Canadian researchers at all levels. While the public focus has been on the stagnant value of scholarships and fellowships, a crucial aspect of trainee support is offered via research grants. A significant portion of support for graduate students and postdoctoral fellows is paid not through scholarships but through stipends or salaries out of grant funding awarded to supervising professors. By involving trainees in their research, grantees help trainees gain research experience and skills and develop greater research capacity. Roughly 35,000 trainees are supported indirectly in this way, totalling an estimated $726 million annually. This is almost three times the current annual spending by the granting councils for direct support via their scholarship and fellowship programs. Support for highly qualified personnel, including trainees and other technical research personnel, typically constitutes the majority of research grant funding awarded. Research grants are currently insufficient to support competitive salaries for trainees or staff scientists.

For any hope that Canadian science and research maintains its global relevance, it is critical that funding for students paid through scholarships and those paid through grants from the granting councils be increased to an internationally competitive level. Appropriate financial support for research grants led by talented investigators and attractive stipends for trainees will enable the recruitment, retention, and training necessary to sustain Canada’s scientific enterprise.

Recommendation 6: Funding for graduate students and postdoctoral fellows should be increased to an internationally competitive level.

A senior level body, such as the proposed advisory body, should also review funding levels regularly with consideration of international funding benchmarks. Raising funding levels will ensure talent attraction and retention in Canada, increase diversity in academic research and other parts of the innovation economy, and boost Canada’s innovation potential. Moreover, these investments will better position Canada to address key challenges such as climate change, demographic change, health challenges and cybersecurity. Canada has an educated and curious youth and a reputation for welcoming talent from all over the world; however, without significant reinvestment in talent support, we will squander this advantage, leading to our collective decline.

SUPPORTING THE TALENT CONTINUUM

Canada’s students and researchers are key contributors to Canada’s research enterprise; as trainees across the talent continuum, (i.e., undergraduate and graduate students and postdoctoral fellows), as emerging and early career researchers, and then as established researchers. CIHR, NSERC, and SSHRC contribute to talent development, attraction and retention throughout the research career life cycle, through a broad range of tri-agency and council-specific programs and awards.

While it is clear that increased funding is required for Canada's graduate students and postdoctoral fellows, the development of Canada's research talent across the continuum must be nurtured and supported. Talent, in particular, should form a critical component of a future science, research and innovation strategy as our economic and societal success requires that we better develop, attract, retain, and integrate the research talent needed across all sectors of the Canadian economy and society.

The panel heard clearly from students, student associations, early career researchers and senior university administrators that the programs addressing the talent continuum need to be simplified and harmonized to eliminate the inequities in research support and reduce the burden on students so that they can focus on their research. There is also a need for enhanced programming to support early to mid-career professors to accelerate their pathway to becoming leaders of tomorrow. Pre-tenure competitive programming to reward early-career research excellence will boost Canada's capacity to retain top talent, while enabling the scientific leaders of tomorrow to build ambitious, world-leading programs that will attract and fund trainees at all levels. A well-coordinated, agile federal support system that is responsive to talent development means having simplified support mechanisms.

Canada's scholarship and fellowship programs are delivered at both the granting council and tri-agency levels. Multiple bodies play different roles in the governance of the various scholarship and fellowship programs, and more than one body appears to be responsible for providing high-level strategic direction on the granting councils' training programs. The panel heard that the continuous addition of new programs to the suite has resulted in a complex program landscape. This is particularly evident at the doctoral and postdoctoral levels, for which there are multiple programs with similar overall objectives, but different target populations and award characteristics.

Following from the recommendations of the **Fundamental Science Review**, the CRCC was asked to identify the means to improve support for the next generation of scholars, including advancing harmonization efforts for scholarship and fellowship programs across the granting councils and addressing issues affecting early career researchers. Since 2021, the CRCC has been working on a tri-agency training strategy to coordinate and streamline the suite of scholarship and fellowship programs. The granting councils are also looking at policies and practices to improve the training experience. These include: addressing barriers to Indigenous participation in research; addressing barriers to Black Scholar participation in research; harmonizing the scholarship and fellowship programs across the three councils; expanding the Undergraduate Student Research Awards (USRA) program; reviewing the portability of scholarships and internationalization of awards; and placing more emphasis on experience when assessing students for scholarship and fellowship awards.

Based on comments from stakeholders, the panel feels that more work remains to be done to harmonize and streamline key talent programs to better support students and researchers. The coordination committee of the CKSF should be responsible for providing direction on streamlining and harmonizing with a view to ensuring greater funding equity across students from different disciplines. Harmonization of the talent program suite will also support new types of interdisciplinary PhDs and PhD projects.

In addition, the government should streamline the delivery of the Canada Research Chairs (CRC) program. The panel heard that the existing CRC process is not responsive enough to the needs of researchers and

institutions. Under the current process, CRCs are allocated to universities based on an institution's success in tri-agency programs with institutions receiving a set number of chairs by council. Currently, proposals are submitted to TIPS for peer review. The CRC success rate is upward of 95 percent. In an effort to streamline the process, reduce the burden on reviewers and be more responsive to the attraction and retention of exceptional researchers, it is recommended that universities manage their CRC allocation directly, in conformity with the program's policies and requirements, and report back to the CKSF on how they have used their CRC allocation to support excellence, attraction/retention of talent, and EDI objectives. This approach will foster the allocation of chairs in emerging, multi- and interdisciplinary, non-traditional areas that are frequently disadvantaged by the current peer review process.

Recommendation 7: The CKSF should prioritize the simplification and harmonization of the talent suite of programs. The coordination committee of the CKSF should be responsible for providing direction on streamlining and harmonizing scholarship and fellowship programs.

Recommendation 8: Delivery of the CRC program should be streamlined by allowing universities to manage their CRC allocation directly, in conformity with the program's policies and requirements, and report back to the CKSF on how they have used their CRC allocation to support excellence, attraction/retention of talent, and EDI objectives.

Recommendation 9: Consideration should be given to enhanced programming to support early to mid-career professors to accelerate their pathway to becoming leaders of tomorrow.

Other Enablers of Research and Innovation Excellence

Research Infrastructure and a New Paradigm for Major Research Facilities

Research success depends on quality talent with access to state-of-the-art research tools, instruments and infrastructure. The panel looked at how Canada could enhance its support for state-of-the-art tools and research equipment to support world-class research and talent from a governance and structural perspective.

Several stakeholders clearly communicated to the panel that improving coordination and streamlining among programs should be explored, including exploring the feasibility of a single application window for capital, operating and research funds. Currently, researchers are required to submit many applications to access funding needed to conduct their research (e.g., a Research Tools and Instruments Grant application, a Discovery Grant application and a John R. Evans Leaders Fund (JELF) application). This fragmentation needs to be addressed.

The need for a more coherent approach is even more salient for large research infrastructure. Many ground-breaking scientific projects depend on access to complex and large-scale research facilities. Be it a particle

accelerator, a vaccine research centre or an Arctic icebreaker, Canadian research and innovation depends on a reliable access to Major Research Facilities (MRF).

As part of its mandate, the panel was asked to provide feedback on the proposed framework for federal decision-making on investments in MRFs as it relates to its recommendations on the broader academic research enterprise. The panel examined whether the proposed framework will help to address some of the challenges and opportunities identified to modernize the federal research support system and if there are opportunities for greater coordination between the CFI and the granting councils that could be part of the MRF framework.

The panel supports the directions of the proposed framework for federal decision-making on investments in MRFs, as it would establish a funding model that provides more predictable and appropriate support for MRFs over their lifecycle. With this in mind, the panel recommends a national road-mapping exercise (along the lines of those completed by Australia and the UK) to guide priority-setting and planning for research infrastructure investments across the ecosystem, as part of the proposed national science, research and innovation strategy. This road-mapping exercise would include (but not be limited to) MRFs as well as other nationally significant research infrastructure[19] investments across the ecosystem.

Such an approach would be an important first step in establishing a clear role for the federal government in the decision-making process and the ongoing role of the granting councils and CFI in supporting the research and training undertaken at the facilities.

Under the current approach, MRFs are often a significant responsibility for universities in terms of both their construction and maintenance. Many facilities endure heightened funding pressures due to rising maintenance costs for ageing equipment that is essential for scientific discovery in Canada. The panel recognizes the need for the federal government to support MRFs more holistically, through the consideration of a facility's full lifecycle costs and the integration of capital and operating funding decisions. MRFs are national assets that support research and innovation across the country and should be managed with this in mind.

LIFECYCLE, ROAD-MAPPING AND PORTFOLIO APPROACH

Although owned and operated by institutions, MRFs are primarily funded by the federal government, with contribution from institutions and provinces. Many of these facilities serve the role of national laboratories, which are the purview of governments in many countries. The panel's view is that, moving forward, it will be important for the federal government to have a better understanding of the facilities' operations and missions—including their link to national interests—and their role in addressing emerging opportunities and challenges more effectively.

[19] Nationally significant research infrastructures can be understood as significant facilities and equipment, whether single-sited, distributed or virtual, that address the needs of a community of researchers and stakeholders representing a critical mass of users distributed across the country. This is done by providing shared access to substantial and advanced specialized equipment, services, resources, and scientific and technical personnel.

A portfolio approach to MRFs would also better enable governments of various levels to apply a broader range of criteria in their decision-making, such as regional distribution, economic development, and national security.

Recommendation 10: Given their national importance as assets that support research and innovation, a more strategic approach to the management of MRFs should be implemented that should include:

a. A lifecycle approach to fund MRFs adequately through the planning, construction, operation, maintenance and decommissioning of the facility, including equipment and personnel, recognizing the long-term value of these facilities. This will be important to improving predictability and support greater coherence in funding of MRFs.

b. Priorities for MRF investment as part of a broader research infrastructure road-mapping exercise, to ensure that investments support Canada's broader science, research and innovation needs and priorities and provide greater transparency while engaging the research community, provinces and territories, industry and other stakeholders. Decisions would be made based on relative scientific merit, performance and strategic considerations such as alignment with national interests as well as economic and social impacts.

c. Maintaining a broad, comprehensive perspective on the suite of MRFs that the government funds and the relationships among them, identifying diverse and complementary assets within a single portfolio, including provincial participation as contribution to the portfolio.

COST-SHARING AND OTHER FINANCIAL CONSIDERATIONS

Given their scale and complexity, MRFs are unique in the support they require from funders. MRFs require significant resources and long-term financial commitments to plan, construct, maintain, and operate, as costs routinely run in the tens or even hundreds of millions of dollars. Their scale is typically beyond the capacity of a single university, region, or province to fund, and their long lifecycles require extensive planning and upgrades if they are to operate successfully and remain relevant.

Under the current funding approach, funding is fragmented across federal and provincial governments, host institutions and stakeholders. In fact, the level of federal funding is lower in Canada than it is among comparable countries, which treat MRFs as national assets and fund the facilities at higher levels. National governments in peer countries require less of a cost-match from other partners or no matching funding at all. At the same time, the significant funding increases for science and research in peer countries all include substantial increases in support for MRFs and large-scale infrastructure projects.

Stakeholders also noted that operational support for on-site research technicians at MRFs is not adequately supported through the CFI and is not always eligible for funding from the granting councils. This creates a funding gap that limits the impact of our investments in MRFs and affects career development of scientific staff working at MRFs. Consequently, support for infrastructure for MRFs should come with complementary research support to enable researchers to use the infrastructure. Moreover, the scientific and technical staff at the MRFs should be eligible for research funding in order to allow them to participate in experiments, hire students and establish a scientific career, and to allow the facilities to attract and retain top talent.

Recommendation 11: The requirement for matching funds for MRFs should be removed or significantly reduced and funding levels for MRFs should be increased to international standards.

Recommendation 12: *S*upport for infrastructure at MRFs should come with sufficient operational research support to enable research technicians to better support the infrastructure.

ROLE OF THE CFI AND THE PROVINCES

The CFI is well positioned to contribute to the development of a roadmap collaboratively with federal, provincial and territorial governments. This could include participating in the development of medium (5-10 years) and long-term (10-20 years) road-mapping exercises through consultations and collaboration with academic institutions, research hospitals, federal and provincial governments and industry, and informed by national surveys on how research infrastructure is currently used and can address future trends, needs and challenges.

It is clear to the panel that, as co-funders and significant investors in Canada's research infrastructure, provinces will continue to have a significant role to play in both the strategic and operational decision-making related to research infrastructure. Given the nature of MRFs as national assets that provide access to users across the country, a table should be convened for recurring federal-provincial-territorial discussions at a strategic level focused on national infrastructure priorities as part of the road-mapping exercise. This will facilitate joint priority setting (where applicable), earlier communication and better understanding of the contribution of a province and its willingness to invest in a shared priority area. Consideration should be given to who would be best placed to convene such a table. Options could include the CKSF (as part of meetings with provinces and territories on a broader range of issues), the CFI and the federal government (e.g., the CSA).

The panel discussed, but did not reach a clear conclusion on, whether the independent third-party status of the CFI poses a challenge or not for the implementation of the proposed MRF recommendations. However, the question could be revisited when the government considers adoption of the MRF recommendations.

BETTER INTEGRATION OF RESEARCH INFRASTRUCTURE SUPPORT

The panel identified several ways to better integrate and consolidate support for research infrastructure, including tools and instruments, for smaller projects up to MRFs.

With respect to the CFI application process, stakeholders indicated that there is room to streamline and better coordinate CFI applications with other research funding programs. The new organization (CKSF) should work with the CFI to identify opportunities to improve coordination and streamline the application processes for research infrastructure including projects for mission-driven research projects across the councils (e.g., examine the feasibility of a single application window for capital, operating and research funds). Because the mandate and structure of the CFI may not enable a timely response to emerging research infrastructure needs, consideration could be given to whether some infrastructure funding should be delivered by the CKSF to address critical mission-driven projects.

Funding provided to institutions through the JELF helps institutions to recruit and retain outstanding researchers, acquire the tools that enable the innovative work of leading researchers, and offer research

support that, when combined with research support from the granting councils, makes for an internationally competitive offer for top talent. Currently, JELF awards are based on an annual institutional allocation; proposals are then submitted to the CFI for peer-review. The JELF success rate is upward of 80 percent. Allowing institutions to directly manage their allocations in lieu of an application process would help reduce the burden on researchers, reviewers and institutions and be more responsive to the attraction and retention of exceptional researchers. Similar to the recommendation for CRCs, further streamlining could be achieved by allowing universities to manage their CFI JELF allocation directly and report back to the CFI on how they have used the allocation to support excellence, attraction/retention, and EDI objectives.

Additional harmonization and access to research instruments could be considered by the CKSF in collaboration with the granting councils and the CFI. While most funding for research infrastructure and equipment is provided through the CFI, some funding is also delivered through the granting councils, particularly for smaller scale equipment. The panel heard that this creates some uncertainty within the research community. Moreover, given the limited funding under the granting councils for smaller equipment and the focus of the CFI on larger infrastructure, researchers are sometimes compelled to create larger, bundled requests to the CFI than are actually necessary in order to obtain funding for essential smaller equipment. Rethinking and increasing support for research tools and instruments could provide greater clarity of roles, ensure more simplicity for the research community and provide greater access to equipment for researchers in fields that did not require research tools and instruments in the past.

Recommendation 13: The CFI application process should be streamlined and better coordinated, where possible, with other research funding opportunities.

Recommendation 14: Universities should manage their JELF allocation directly and report back periodically to the CFI on how they have used the JELF allocation to support excellence, talent attraction/retention, and EDI objectives, in compliance with program requirements.

Recommendation 15: The CKSF, in collaboration with the granting councils and the CFI, should rethink and increase support for research tools and instruments in order to facilitate, increase and diversify access to such tools.

Connecting Research and Innovation

Canada’s post-secondary students are drivers of innovation through science, research and inquiry at universities (including affiliated research hospitals), colleges, CÉGEPs and polytechnics. The panel was asked for advice to support the Minister of Innovation, Science and Industry and the Minister of Health in delivering on their mandate letter commitment to "modernize the federal research funding ecosystem to **maximize the impact of investments in both research excellence and downstream innovation**".

First, the panel recognizes that the granting councils have a selection of knowledge mobilization programs[20] and all three councils highlight the importance of knowledge mobilization in their respective strategic plans and policies. They should continue these efforts to encourage academic researchers to collaborate with private, public or not-for-profit partner organizations and support the capacity of colleges, CÉGEPs and polytechnics to work with SMEs to support technology transfer and the adoption of technology. However, as noted earlier in this report, the proposed CKSF would be responsible for identifying gaps in knowledge mobilization programming and approaches to better position the research community to achieve innovation and commercialization outcomes. It would also ensure better lines of communication between industry and academic institutions on the connection between research and innovation through the proposed advisory body.

Innovation and commercialization depend on the ideas and talent that come from Canada's labs, colleges/CÉGEPS/polytechnics, universities and research hospitals and institutes. Moreover, researchers and highly qualified people are critical to knowledge mobilization and innovation. The panel recommends that the federal research support system build on the knowledge mobilization and commercialization efforts taken thus far and advance them further, by addressing gaps in support and governance, to have a more significant impact on innovation.

Through discussions with the research community, senior officials responsible for innovation programming in government, and industry representatives, the panel identified a clear need to better connect research with the innovation continuum and better identify the gaps faced in support for researchers related to knowledge mobilization and commercialization efforts (e.g., pre-commercialization or early commercialization). Based on the panel's discussions with stakeholders, there is a need for a continuum of support to promote success. While there are funding opportunities at the beginning and end of the research and innovation continuum (including at later stage commercialization), there are evidently gaps in the middle to be addressed, such as the lack of support for research entrepreneurs in scaling up initiatives.

Researchers with entrepreneurial skills are a critical enabler of knowledge mobilization, from scientific entrepreneurship to industry research. There is an opportunity within the research enterprise to foster a more entrepreneurial mindset at the early stage of a researcher's career (e.g., entrepreneurial training, culture change) and monitor indicators of success. Another challenge is that researchers lack access to the training to develop the knowledge and skills necessary to transform their research into a solution for the market. Seasoned expertise or mentorship is needed to guide researchers to ensure that they can position their technologies to be attractive to business. The panel sees the government's proposed lab-to-market program, announced in Budget 2022, as a positive step forward in this regard and looks forward to seeing the roll-out of the program.

Some stakeholders also noted that there are constraints created by certain policies and programming that lead to obstacles for talented researchers participating in training opportunities connected to entrepreneurship and innovation. For example, current constraints limit the usefulness of Mitacs as the requirement for

[20] NSERC's Alliance Grants, SSHRC's Partnership Grants and CIHR's Project Grants & Collaborative Health Research Projects; NSERC's Idea to Innovation Program; and Tri-Agency College and Community Innovation Programming.

matching funds can hinder participation by certain groups, such as researchers, community groups, or start-ups lacking access to capital.

The proposed CKSF should examine how innovation programming could be more thoughtfully aligned with research support. Programs in other jurisdictions should be explored that provide more entrepreneurial support to researchers (e.g., Innovative Postdoctoral Entrepreneurial Research Fellowship in the US).

Granting councils would continue to have a role in knowledge mobilization (e.g., low TRL) and encourage higher TRL research, but the mandate of the proposed CKSF would also include knowledge mobilization functions, including relevant expertise and programming (low to mid-TRLs), as well as a clear connection to business-facing programming. The new organization would include a mechanism to better connect research to innovation and identify gaps in support. Currently, instruments vary from one region or institution in terms of research-to-market programs.

Recommendation 16: The government should recognize the role that research plays in the innovation continuum. The proposed CKSF and a future national science, research and innovation strategy should have clear linkages to the future work of the Canadian Innovation and Investment Agency and the government's business-facing innovation and commercialization programming. The CKSF would include a mechanism to mobilize the research and business communities to support emerging research and innovation needs facing the Government of Canada like those experienced during the pandemic.

Recommendation 17: The CKSF should be equipped to use flexible instruments (including blended funding from various partners and broad eligibility criteria when relevant) so that it has the capacity to support other parts of the innovation continuum (e.g., R&D projects in start-ups or businesses) when a program gap is identified.

Recommendation 18: The CKSF should be responsible for identifying training support for researchers to develop the knowledge and skills necessary to translate research to impact. Moreover, the CKSF should identify pathways to support the continuum of ideas to products and eventually benefits for Canadians. Specifically, a review should be undertaken of the constraints created by certain policies and programming that lead to obstacles for talented researchers' participation in innovation.

Strengthening Equity, Diversity and Inclusion

The CRCC should be commended for the work it has done to better understand and address the disparities facing underrepresented groups within the research ecosystem, such as the release of the Tri-Agency EDI Action Plan and leadership on the Dimensions Charter. The council presidents, ISED and Health Canada also oversaw the changes to the CRC program such as setting population-based equity targets to ensure representation of racialized groups, Indigenous Peoples, women and persons with disabilities aligns with Canada's diversity.

Building on this, the CKSF should be responsible for examining barriers to participation by underrepresented groups across the research and talent continuum, and seeking to coordinate efforts to address these barriers,

particularly since the CKSF would have the mandate for key talent programs and a knowledge mobilization mandate.

Recommendation 19: The federal research support system should continue to advance the implementation of the Tri-Agency EDI Action Plan and other complementary work through the CKSF that will serve to address the underrepresentation in certain fields of equity-seeking and rights-holding groups (e.g., Black and other racialized groups) and encourage diversity across the research ecosystem.

Indigenous Research and Talent

The **Fundamental Science Review** recommended that the three granting councils collaborate in developing a comprehensive strategic plan to promote and provide long-term support for Indigenous research. Subsequently, the CRCC was tasked to support SSHRC's leadership, working in collaboration with the other granting councils, the CFI and Indigenous communities, in responding to the Truth and Reconciliation Commission's call for the establishment of a national research program to advance understanding of reconciliation. This includes supporting research by and with Indigenous communities and increasing the capacity of Indigenous communities to conduct research and partner with the broader research community.

Since 2019, the Strengthening Indigenous Research Capacity (SIRC) initiative has been laying the foundation to implement Canada's first-ever interagency strategic plan for Indigenous research and research training (Setting New Directions to Support Indigenous Research and Research Training in Canada 2019–2022). Representatives of the granting councils and the CFI came together throughout 2020–21 to coordinate implementation of the Indigenous research and training strategy across existing programs and policies.

The panel looks forward to the seeing the continued collaboration with Indigenous partners and implementation of the interagency strategic plan for Indigenous research and research training developed in partnership with the Indigenous Leadership Circle in Research. It would also like to see representation of the Indigenous research community on the proposed advisory body.

Recommendation 20: Indigenous research should be a component of a national science, research and innovation strategy and representation from a cross-section of players in the ecosystem should be key partners in gathering the input and advising the proposed advisory body on this component.

Supporting Francophone Research

Recognizing actions already taken by the granting councils, the panel heard from stakeholders that there is a need to better support and fund francophone research and to ensure there is an equitable treatment within the federal research support system of research funding applications submitted in French. First and foremost, it is imperative that funding applications submitted to any federal funding organization be treated and supported in the same way regardless of the official language in which it is written. Second, for Canada to truly maintain research excellence we must support world class research across all regions of the country, in institutions of all sizes, and whether undertaken in either of Canada's official languages. Third, there is a need to identify opportunities to encourage the ongoing production and dissemination of knowledge and research in French in

Canada and in the world. Finally, we should examine means of providing French language upgrading opportunities to support outstanding non French-speaking researchers who aspire to greater research collaboration and leadership in both official languages.

Recommendation 21: As supporting francophone research is a common priority across the federal research support system, the CKSF should ensure existing programs are equitable to francophones and identify opportunities to encourage the production and dissemination of knowledge and research in French in Canada and in the world.

Proposed Timeline

The panel understands that it may not be feasible or practical to implement all of the recommendations contained in this report in fiscal year 2023-24. Should there be acceptance for the main components, a potential sequencing could be as follows:

SHORT TERM (2023)

- Announcement of intent to establish the CKSF to rapidly address emerging research and innovation needs, and to enhance coordination and integrated planning across the research and innovation ecosystem.
- Announcement of intent to establish the new advisory body to provide strategic science, research and innovation advice to Ministers on funding and national strategy, and to provide broad oversight of the research and innovation ecosystem.
- New funding for the three granting councils to support fundamental and investigator-initiated research.
- New funding to provide competitive and sustained support for Canada's student research talent.

MEDIUM TERM (2023-2024)

2023:

- Streamlining of specific programs (e.g., CRC, research infrastructure) .
- Advance the legislative, policy and program authorities to implement the CKSF.
- Launch the new advisory body.

2024:

- Launch CKSF.

Closing Reflections

If we cannot evolve our research support system to ensure that it continues to meet the needs of the modern research enterprise in a world where countries use their own scientific potential as a national strategic asset, Canada will fall behind. Over the course of its deliberations, it became clear to the panel that a vibrant and

ambitious research enterprise is not only the mark of an advanced and future looking society but is increasingly a matter of strategic national interest for social, economic and even geopolitical reasons.

The granting councils play a key and specific role in the research support system and, along with the CFI, have a deserved global reputation for excellence related to their support for investigator-initiated disciplinary research and research infrastructure, respectively. Ultimately, Canada's ability to answer mission-driven priorities hinges on the foundation of talent, expertise and ideas generated by investigator-initiated research funded by the councils.

Alongside an appropriate re-investment in investigator-initiated research and talent is the importance of designing and maintaining a support system that can better sustain knowledge mobilization, innovation and commercialization. It is in our interest as a country to ensure that the ambitious research funded by the federal support system is undertaken efficiently and effectively and leveraged to have maximum impact. This is why the panel engaged in several discussions on the research support system's structure, governance, programs and processes with the objective to ensure that the federal support for the research enterprise is:

- sufficiently agile to seize new opportunities and address emerging research, economic and societal needs and interests;
- coordinated and cohesive, balancing respect for the needs of disciplinary communities with a holistic perspective across disciplines and across research, training, and associated infrastructure; and
- responsive to the multi- and interdisciplinary, collaborative, and international approaches that are increasingly the hallmark of transformative research and innovation.

Our most complex societal challenges increasingly require creative solutions that bring together multiple perspectives from diverse domains. Research is now more international, collaborative and multi- and interdisciplinary than ever. A competitive research support system that facilitates a collaborative approach is not just critical to support our scientists and scholars, but is also critical to ensure Canada's ability to respond to societal challenges as they arise.

The panel has recognized that among the greatest gaps of the current support system is the ability to respond quickly and in novel ways to emerging societal and economic needs. Canada requires a support system for research and talent that enables connections between disciplines and the structures that Canada has created to support them (e.g., granting councils), as well as enabling connections between institutions, and researchers, including those in industry and government. Our research support system for the future must be designed to encourage partnerships where relevant, to secure Canada's future and enhance the impact of our research investments.

It is the panel's view that the support system should be flexible to meet a diverse range of research needs, and enable multi- and interdisciplinary and mission-driven research when relevant while ensuring that fundamental, discipline-specific and investigator-initiated research is supported with the highest standards. In order to protect and enhance Canada's stature in the world, we also need to improve our support across the research, innovation and commercialization continuum—this requires cooperation and coordination across the full continuum.

The panel recommends the creation of the Canadian Knowledge and Science Foundation (CKSF) to provide Canada with an instrument to rapidly fund mission-driven research across the research ecosystem through agile, tailor-made programming to address specific needs (e.g., biomanufacturing, food security). The CKSF will allow government, academia, business, and not-for-profits to coalesce around challenges resulting in greater agility and flexibility to achieve research solutions. This new approach to governance is necessary so that the persistent gaps in the support system can be addressed. It becomes evermore pressing as Canada must be prepared to address the policy research needs of today and tomorrow linked to emerging local and global challenges. The panel considered alternative solutions to achieving these goals, which would have led to more incremental change. However, the seemingly simpler execution of these options hid increased bureaucratic burden without strategic benefits.

The panel recognizes that implementing changes to governance can be challenging but maintaining the status quo is too risky to contemplate as it would leave the enterprise in the precarious position of losing talent, expertise and research capacity for the future. While implementation of the CKSF is a substantial undertaking, it is clear, based on the panel's deliberations and feedback from stakeholders, that incremental changes have not been adequate to affect the change needed to respect the needs of disciplinary communities, respond to multi-and interdisciplinary approaches and be sufficiently agile to address emerging needs and interests in a globally competitive manner.

Other measures should be taken as well, including launching the advisory body (particularly recognizing that much work has already been done around the CSI) and looking for opportunities to streamline programming and processes, particularly JELF and CRC. Other work could include supporting development of improved data platforms and tasking CRCC to begin working on some of the roles that will be taken on by the CKSF, including an integrated plan and further streamlining of policies, etc. (this would help pave the way for the CKSF, so that it can hit the ground running once it launches).

Given the increasing investments we see in other countries as they set their sights on becoming global science and innovation powers, the panel strongly recommends that the immediate priority be increasing funding support for both research and talent to an appropriate and competitive level. Such re-investment is a critical condition of success for the panel's other recommendations. Moreover, investments in Canada's research ecosystem are investments in our collective well-being and prosperity as they will strengthen our ability to attract and retain talent and address the critical problems we face today and tomorrow.

The panel's recommendations would serve to protect and promote the research excellence that is the hallmark of Canadian science, while enabling greater agility, flexibility and responsiveness to support transformative research and innovation, as well as equity and inclusion. Canada has immense potential to lead the world into a more prosperous, just, and sustainable future through our knowledge and talent advantage. To realize this potential and to attain our rightful place on the global science, research and innovation stage, we must redouble our efforts, enact the solutions and policies required, and fervently engage in the challenge at hand.

Annex A: List of Recommendations

As found within the text of the report, the panel makes the following recommendations (listed by order of appearance):

A BOLD APPROACH FOR RESEARCH SUPPORT

Recommendation 1: The Government of Canada should create a new organization, referred to as the Canadian Knowledge and Science Foundation (CKSF), as a mechanism to rapidly address emerging research and innovation needs, deliver most tri-agency programming, and enhance coordination, planning and policy capacity across the research support system.

Recommendation 2: The existing granting councils should be preserved as critical mechanisms to support excellence in investigator-initiated research and talent development.

STRATEGIC ADVICE AND A COMMON VISION FOR COLLECTIVE IMPACT

Recommendation 3: The Government of Canada should create a new independent advisory body to provide strategic science, research and innovation advice to Ministers on funding and national strategy, and to provide broad oversight of the research and innovation support system.

Recommendation 4: The Government of Canada should launch a process to develop a national science, research and innovation strategy to establish a common vision and objectives for Canada's research and innovation ecosystem and to achieve greater alignment across the players in the ecosystem.

FUNDING FOR RESEARCH AND COMPETITIVE SUPPORT FOR TALENT

Recommendation 5: The Government of Canada needs to significantly increase its investments in the granting councils. These new investments need to address the pressures resulting from the growth in the research ecosystem (increasing number of graduate students and postdoctoral fellows), the effects of inflation and the importance of nurturing globally competitive research, including the talent base. As an initial step, the government should commit to an increase of at least ten percent annually for five years to the councils' total base budgets for their core grant programming. The required level of additional investment should be determined in consultation with the proposed advisory body based on international benchmarking.

Recommendation 6: Funding for graduate students and postdoctoral fellows should be increased to an internationally competitive level.

SUPPORTING THE TALENT CONTINUUM

Recommendation 7: The CKSF should prioritize the simplification and harmonization of the talent suite of programs. In particular, the coordination committee of the CKSF should be responsible for providing direction on streamlining and harmonizing scholarship and fellowship programs.

Recommendation 8: Delivery of the CRC program should be streamlined by allowing universities to manage their CRC allocation directly, in conformity with the program's policies and requirements, and report back to the CKSF on how they have used their CRC allocation to support excellence, attraction/retention of talent, and EDI objectives.

Recommendation 9: Consideration should be given to enhanced programming to support early to mid-career professors to accelerate their pathway to becoming leaders of tomorrow.

RESEARCH INFRASTRUCTURE AND A NEW PARADIGM FOR MAJOR RESEARCH FACILITIES

Recommendation 10: Given their national importance as assets that support research and innovation, a more strategic approach to the management of MRFs should be implemented that should include:

a. A lifecycle approach to fund MRFs adequately through the planning, construction, operation, maintenance and decommissioning of the facility, including equipment and personnel, recognizing the long-term value of these facilities. This will be important to improving predictability and support greater coherence in funding of MRFs.

b. Priorities for MRF investment as part of a broader research infrastructure road-mapping exercise, to ensure that investments support Canada's broader science, research and innovation needs and priorities and provide greater transparency while engaging the research community, provinces and territories, industry and other stakeholders. Decisions would be made based on relative scientific merit, performance and strategic considerations such as alignment with national interests as well as economic and social impacts.

c. Maintaining a broad, comprehensive perspective on the suite of MRFs that the government funds and the relationships among them, identifying diverse and complementary assets within a single portfolio, including provincial participation as contribution to the portfolio.

Recommendation 11: The requirement for matching funds for MRFs should be removed or significantly reduced and funding levels for MRFs should be increased to international standards.

Recommendation 12: Support for infrastructure at MRFs should come with sufficient operational research support to enable research technicians to better support the infrastructure.

Recommendation 13: The CFI application process should be streamlined and better coordinated, where possible, with other research funding opportunities.

Recommendation 14: Universities should manage their JELF allocation directly and report back periodically to the CFI on how they have used the JELF allocation to support excellence, talent attraction/retention, and EDI objectives, in compliance with program requirements.

Recommendation 15: The CKSF, in collaboration with the granting councils and the CFI, should rethink and increase support for research tools and instruments in order to facilitate, increase and diversify access to such tools.

CONNECTING RESEARCH AND INNOVATION

Recommendation 16: The government should recognize the role that research plays in the innovation continuum. The proposed CKSF and a future national science, research and innovation strategy should have clear linkages to the future work of the Canadian Innovation and Investment Agency and the government's business-facing innovation and commercialization programming. The CKSF would include a mechanism to mobilize the research and business communities to support emerging research and innovation needs facing the Government of Canada like those experienced during the pandemic.

Recommendation 17: The CKSF should be equipped to use flexible instruments (including blended funding and broad eligibility criteria when relevant) so that it has the capacity to support other parts of the innovation continuum (e.g., R&D projects in start-ups or businesses) when a program gap is identified.

Recommendation 18: The CKSF should be responsible for identifying training support for researchers to develop the knowledge and skills necessary to translate research to impact. Moreover, the CKSF should identify pathways to support the continuum of ideas to products and eventually benefits for Canadians. Specifically, a review should be undertaken of the constraints created by certain policies and programming that lead to obstacles for talented researchers' participation in innovation.

STRENGTHENING EQUITY DIVERSITY AND INCLUSION (EDI), AND SUPPORT FOR INDIGENOUS AND FRANCOPHONE RESEARCH AND TALENT

Recommendation 19: The federal research support system should continue to advance the implementation of the Tri-Agency EDI Action Plan and other complementary work through the CKSF that will serve to address the underrepresentation in certain fields of equity-seeking and rights-holding groups (e.g., Black and other racialized groups) and encourage diversity across the research ecosystem.

Recommendation 20: Indigenous research should be a component of a national science, research and innovation strategy and representation from a cross-section of players in the ecosystem should be key partners in gathering the input and advising the proposed advisory body on this component.

Recommendation 21: As supporting francophone research is a common priority across the federal research support system, the CKSF should ensure existing programs are equitable to francophones and identify opportunities to encourage the production and dissemination of knowledge and research in French in Canada and in the world.