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CANADIAN COMPETITIVENESS IN THE HEALTH LIFE SCIENCES

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EXECUTIVE SUMMARY

The Canadian federal government's recently launched Biomanufacturing and Life Sciences Strategy (BLSS) arrives on the scene after several peer countries have been moving quickly, and seriously, with their own health life sciences strategies. While Canada's plan has much in common with the main themes of these other plans, it is questionable whether the proper policy infrastructure exists here for Canada to keep up in the highly competitive global health life sciences sector. It is within this context that the present report aims to present a high-level overview of Canadian competitiveness in the health life sciences sector.

Because an understanding of the past and current commitments from the federal government is vital to peering into Canada's health life sciences support apparatus, a necessary first step is as analysis of the current program landscape, which is marked by fragmentation and duplication. The resulting database of subsidies and programs, the first of its kind in Canada, will be useful to innovators, researchers, or others interested in the health life sciences.

A thriving life sciences sector projects the image of a society that values knowledge and innovation but also social responsibility, as beyond the pursuit of growth and profit, the life sciences sector is oriented towards public goods. The forces that shape the sector are truly global and governments around the world share the same three goals. The first is to support functional and productive knowledge networks engaged in basic and applied research. The second is to foster the development of a competitive market with players that can withstand financial risk and make long-term commitments. The third is to provide leadership to the sector, based on confidence and dialogue between stakeholders and government.

In light of what peer countries are attempting to do in support of their national health life sciences sector, what could or should be done to increase the relevance of the measures contemplated in the BLSS?

1. First, a formal program review is overdue. Programs are there to serve a policy and a purpose, and the continuation of those that cannot pass that test should be questioned. Funding agencies for health life sciences in Canada are often shared with other sectors, eligibility is often convoluted, and 80 per cent of programs target research, with only eight per cent dedicated solely to marketing, dissemination, and uptake. Ideally, this program review is not one that should be done only by bureaucrats, as usually happens. The government has pledged to foster collaboration with industry players in the life sciences sector. Trusting the experience and expertise of stakeholders in assessing existing programs and designing new ones would be truly aligned with the BLSS's principles.

2. The second measure would be the appointment of a federal champion for the sector. As there is a web of policies and regulations in Canada that limits patients' and providers' use of new treatments and other therapeutic innovations, a life sciences "champion," whose role it is to challenge obsolete or cumbersome regulations and to collaborate with public authorities and stakeholders would help provide real momentum for the sector. This is in addition to the need for a dedicated governance structure, whether a co-ordinating office within government or an arm's-length agency.

3. The third initiative relates to the complex and contentious file of a national health data system; progress in this area is vital to competitiveness and growth. The BLSS's goals will also be hampered by Canada's deficient data infrastructure. Valuable data and knowledge about patient care are lost for research, due to obstacles such as privacy laws or lack of co-operation. The federal government needs to leverage its unique strengths to provide the health life sciences sector with accurate, reliable, comprehensive, and well-integrated data systems.

Finally, it is not enough to provide more investments; success requires a rapid modernization of the regulatory environment. The BLSS offers modest expectations and is short on specifics about how to meet them. It provides little by way of measurable benchmarks for success or failure. Nevertheless, it at least provides the health life sciences sector with a sense of the federal government's direction and priorities. It has a chance to succeed if the government is prepared to go further than making vision statements, and implement real, meaningful action.

INTRODUCTION

On July 28, 2021 in Vancouver, François-Philippe Champagne, minister of innovation, science and industry, and Patty Hajdu, who was then Canada's minister of health, launched the Biomanufacturing and Life Sciences Strategy (BLSS), a document in which the federal government stated its ambition "to rebuild Canada's domestic biomanufacturing sector by focusing on both short-term strategic solutions and a long-term vision" (Government of Canada 2021a). The policy has been years in the making and followed a broad consultation with the life sciences sector. However, the tone and the somewhat limited scope of the proposed objectives were indicative of the context in which the strategy was drafted — during the second year of the COVID-19 pandemic. The underlying priorities were for the most part aimed at remediating, or at the very least mitigating the major vulnerabilities revealed by the public health crisis. From supply chain deficiencies to a lack of biomanufacturing capacity for vaccines and therapeutics, and from pandemic preparedness to the modernization of the regulatory environment, its tone and contents are reactionary, whereby a proactive approach can add insulation.

The best strategy in the world is useless if it is not properly executed. The corollary, of course, is that good execution of a modest plan could make a difference. In that sense, if the government of Canada is willing and able to implement each and every measure envisaged by the BLSS, the health life sciences sector will see some tangible benefits. As we shall see in this report, the five "pillars" that structure the policy aim at providing

the sector with more support, financial and otherwise, more investment, more certainty, and a better interface with decision-makers and the federal bureaucracy. This would certainly be progress.

The problem, however, is that even if those well-intended and long-awaited reforms are successful, they may still fall short of the efforts taken by other nations to foster the development of their own (and competing) health life sciences sector. Clinical trials are an example. While the BLSS expresses in a couple of sentences its support for a more effective "pre-clinical and clinical trials infrastructure," how does it compare with the aggressive strategies devised by countries such as Australia and Denmark to attract investors and world-class researchers? In the next section, we will provide more examples of areas in which the BLSS may still be lacking, compared with Canada's commercial partners or competitors.

Prior to the BLSS, Canada has typically taken the approach that fostering and adopting innovation in the health life sciences sector was not an essential component of the broader health policy of Canada. It is within this context that the present report was born. Consisting of three sections, this report aims to present a high-level overview of Canadian competitiveness in the health life sciences sector. The first section is devoted to an overview of the strategies adopted by other countries to develop their health life science industry and address the multiple (and often quite similar) challenges faced. Frequently with complex policy issues, there might not be "best" practices, but it is instructive to see how others have defined and solved common problems. The second section sets out comprehensive data on federal programs in support of the Canadian health life sciences sector. Finally, the third section will present a few recommendations aimed at making the Canadian strategy more concrete, more robust, and more effective.

SECTION ONE: VISION AND STRATEGIES

I. GOOD PRACTICES

As complex policy issues often do not come with "best" practices, an assessment of how others have defined and solved common problems can result with "good" practices, from which the Canadian sector can learn. As part of our review, we looked at initiatives in support of the health life sciences in six OECD countries that had developed and/or implemented strategies in the last five years: Australia (2019 and 2020), Denmark (2021), France (2021), the Netherlands (2019), Sweden (2020), and the United Kingdom (2017 and 2021). These strategies were all *specific* (i.e., aiming directly at the health life sciences sector) and *public* (i.e., issued by a government or a national public agency). Broader public initiatives, such as innovation policies in which health life sciences are only one among many other sectors and private sector policy papers are therefore outside the scope of this report.[1] A more detailed description on examination strategies can be found in Appendix A.

II. COMMON POLICY PERSPECTIVES

All the strategies included in this analysis are equally ambitious and tend to address the same issues and to aim at convergent, if not similar outcomes, including competitiveness and innovation. Where they differ, is on how they approach and prioritize common themes and policies. Broadly speaking, nine themes or policies have received the same degree of attention in each country's strategy (see **Table 1.1a** for a summary).

Table 1.1a. Common strategic considerations in the six OECD countries assessed

Policies common to all countries
Integrated data infrastructure
Enhanced public-private collaboration
Dedicated governance structure
Public support/funding for research and development
Support for commercialization and market access
International branding and positioning
Support for startups and/or small and medium-sized enterprises (SMEs)
Better interface with health system
Shortened access pathways to innovative treatments for patients

Sources:
Australia: MTPConnect 2019; MTPConnect 2020.
Denmark: Denmark Ministry of Industry, Business, and Financial Affairs 2021.
France: France Conseil stratégique des industries de santé 2021.
The Netherlands: Holland 2019; Health-Holland 2020.
Sweden: Government Offices of Sweden 2020.
United Kingdom: United Kingdom Office for Life Sciences 2017; United Kingdom Office for Life Sciences 2020; United Kingdom Office for Life Sciences 2021.

[1] "*Health life sciences* refers to the application of biology and technology to health improvement, including pharmaceuticals, medical technology, genomics, diagnostics and digital health. It has the advantage of very high productivity compared to other sectors, and generates a wide range of products including drugs, medical technology, diagnostics and digital tools, as well as products for consumer health." (Bell 2017, 3)

Data infrastructure and data interoperability come first in order of importance on that "A" list, closely followed by strong and productive relationships between public authorities and private sector stakeholders, and the establishment of a dedicated governance structure, whether a co-ordinating office within government or an arm's-length agency. Other priorities that receive unanimous approval include the ever-present funding needs of research and development institutions and measures such as dedicated programs in support of commercialization of discoveries and/or innovations, in support of attempts of small and medium-sized enterprises (SMEs) to scale, and in support of governments' promotion campaigns for the sector at large, notably on the world stage. Another common characteristic of all the strategies we reviewed is a preoccupation with the interface between a country's health system and its life sciences sector. There are several ethical and economic reasons why it is good policy to facilitate the access of patients and providers to new therapies and new devices, one of which is the opportunity to learn in real-life conditions about the costs and benefits of innovative treatments and to evolve accordingly our standards of care.

Regardless of the specific features of any given national strategy or whatever practices countries adopt or promote, all seem to pursue three fundamental goals in their quest for success. Quite obviously, the first objective is to support functional and productive knowledge networks engaged in basic and applied research. Second, fostering the development of a thriving and competitive market with players that can withstand financial risk and make long-term commitments is key. Third is the provision of inspired leadership to the sector, based on mutual confidence and open dialogue between stakeholders and government. Innovation in the health life sciences sector requires these three conditions to be met.

III. SPECIFIC POLICIES

In truth, the 11 other themes and policies we have identified (see **Table 1.1b** for a summary) are present in most if not all the different strategies, yet they don't necessarily get the same priority attention. For example, every country needs to train and retain qualified personnel with the unique skill set required of the life sciences sector. Even though each of the six countries in our sample mention this issue in their strategic documents, only two (Denmark and Sweden) see the development of the life sciences workforce as a full-fledged priority. It is the same for governments' international promotion campaigns (Australia and the Netherlands mention this) or even for major amendments to public procurement policies (noted, for example, by France and the United Kingdom): serious and important challenges, for sure, but not necessarily problems on which the sector wants government authorities and their industry partners to deploy all their best efforts.

Table 1.1b. Specific strategic considerations in the six OECD countries assessed

Specific policies	Number of countries
Clinical trials	4
Designated sector "champion"	4
Adoption of smart(er) regulations	4
Identified priority areas or "value chains"	4
Knowledge management (e.g., knowledge platforms, incubators)	3
Intersectoral perspectives (e.g., with IT sector)	3
Environmental and/or climate perspectives	3
Explicit political commitment from government leaders	2
Procurement policies favouring innovation	2
Support for international outreach	2
Health life sciences workforce development	2

Sources:
Australia: MTPConnect 2019; MTPConnect 2020.
Denmark: Denmark Ministry of Industry, Business, and Financial Affairs 2021.
France: France Conseil stratégique des industries de santé 2021.
The Netherlands: Holland 2019; Health-Holland 2020.
Sweden: Government Offices of Sweden 2020.
United Kingdom: United Kingdom Office for Life Sciences 2017; United Kingdom Office for Life Sciences 2020; United Kingdom Office for Life Sciences 2021.

On the other end of the spectrum, we find policies and priorities that would have made the "A" list if not for one or two exceptions. Top themes include substantive issues such as the hope of making one's country a destination of choice for clinical trials, or the decision to focus on a series of promising "value chains" — innovations with proven market potential that originate in local research. Adapting and modernizing regulation is another prominent theme of life sciences strategies — everyone agrees on the need for a regulatory structure or system that provides appropriate oversight of the sector in the public interest and is based on the best available science. Yet it is a real challenge to achieve a reform that leads to practices that are efficient, transparent and, importantly, predictable. An interesting innovation in Australia is one that has given the life sciences national champion the task of challenging obsolete or cumbersome regulations on an ongoing basis. But, at a minimum, all countries with an eye on a regulatory system fitted to the changing needs of the sector encourage collaboration and dialogue between public authorities and stakeholders (see for example Sweden or the United Kingdom). Finally, it is worth mentioning that some of the policies purposefully recognize and encourage linkages between the health life sciences sector and other scientific or economic sectors, either in the pursuit of societal goals or as part of a high-level vision of overall progress and growth (Australia, the Netherlands, and Sweden, for example).

The last two strategic priorities identified in the review are concerned with active knowledge management (Denmark and the United Kingdom provide great examples), which is supposed to foster knowledge-sharing and healthy competition among multiple innovators, and what we have called, for lack of a better word, "explicit political

commitment." This expression of support for the strategy comes from the highest levels of the state, such as the prime minister in the United Kingdom or the president in France. This, of course, bolsters confidence and encourages progress.

IV. COMMON ISSUES, CONVERGING SOLUTIONS

The health life sciences sector today is undergoing a true revolution, owing to a unique combination of scientific breakthroughs, sound investments, and supportive policies, against the backdrop of a globalizing industry. Quite naturally, countries that already had a competitive life sciences sector are eager to make the most of this opportunity, while others see it as a chance to pivot and find a seat for themselves at the table. There are not that many economic activities that can lead at the same time to innovation and growth, on the one hand, and to a direct and measurable improvement of the well-being and health of the public on the other (Blumenthal 2003; Cooke 2004; OECD 2012). No one should be surprised, incidentally, that all the strategies we reviewed try to combine, at a minimum, those two objectives: economic growth and population health.

Some countries have high hopes that a successful life sciences sector would result in a windfall for the whole economy, following the example of other technological and scientific revolutions, such as electronics or artificial intelligence (AI). To many, a visible life sciences sector projects the image of a society that values knowledge and innovation, but also social responsibility, as beyond the mere pursuit of profit, a successful life sciences sector is oriented towards public goods, such as people's health and the performance of health-care systems. Thus, we should not be cynical about it. In the end, we all benefit from improved access to better therapies and from a system that has learned to integrate innovation seamlessly, efficiently, and swiftly, due in part to enhanced interface with research and development organizations. If, in addition, the health life sciences sector contributes to competitiveness and an improved trade balance, it is truly an outstanding achievement (National Research Council 2014).

In the last couple of years however, the COVID-19 pandemic forced a challenge of some of the assumptions underlying the sector's phenomenal development. Governments and public health authorities struggling to contain the virus and to treat infected patients discovered with much anxiety (and sometimes with real despair) that global supply chains were not as reliable as they thought, and that outsourcing essential drugs and therapeutics beyond one's national borders could become a major vulnerability during a public health crisis. Increasing a country's "sovereign capabilities" and the capacity to be self-sufficient for strategic goods and services, such as vaccines or laboratories, became a common theme in recent iterations of life sciences policies, including of course, in Canada.

It is striking that, while the strategies differ in intensity, comprehensiveness, or even imagination, the initial diagnosis is often identical. In other words, the list of challenges each country tries to overcome points to the same obstacles, indicating quite clearly that the forces that shape the sector are truly global. Commonly identified issues include:

- *The interface with health systems.* More than a century since the advent of scientific medicine, a seamless transition from "the lab bench to the bedside" should be a given. Yet the scale of the transformations that have occurred in the health life sciences in the

last decades is such that only a handful of health organizations are truly keeping up. Valuable data and knowledge about patient care are lost for research, due to obstacles such as privacy laws or lack of co-operation, and in counterpart, access to new therapeutics or devices is delayed by multiple veto points.

- *A deficient data infrastructure*. It is not necessary to dwell on the role that data play in the current revolution within the health sciences, from drug discovery to "precision public health." Yet the absence of a proper framework for the sharing, access, and use of data is more the rule than the exception in many countries. It is still very difficult to link data from different sources and, even more, from different sectors.

- *Skills and talents.* How can highly qualified personnel be recruited, trained, and retained? There is a strong global demand for the top minds in the field and for the lead innovators looking for funding and state-of-the-art equipment and facilities. But the problem extends to a wide range of much-needed human resources, people who must be convinced to join a sector with demanding educational requirements and perhaps less-immediate gratifications than those offered by IT or finance.

- *Procurement policies and supply chains.* The connection between procurement policies — the criteria on which the purchasing decisions of governments and public organizations are based — and supply or logistical chains has never been more evident than during the COVID-19 pandemic. It is naive to think countries will go back to the long-gone world in which everything was produced locally. However, we should expect that countries will look more strategically at their interests and try to address some critical vulnerabilities in the near future.

- *Funding and finance, especially for SMEs.* The cost of bringing new health products to market could be prohibitive, especially for SMEs. It also requires long-term commitment on the part of investors, which can be difficult to achieve without some support from governments and a welcoming environment for innovation in areas such as patents, intellectual property (IP), and of course, regulation.

In the last two decades, health systems have attached a growing priority to the perspective of patients on the care they receive. Concepts such as quality or value are centred on the concrete experience of patients, who are often consulted on the allocation of resources and the organization of services. The health life sciences sector is closely involved with this movement, notably because of its own preoccupation with targeted treatments or interventions designed to fulfil a specific demand or address a singular health issue (Crocker et al. 2018; Regnante 2021). Unsurprisingly, therefore, in most if not all the solutions put forward by various governments to take advantage of the growth of the health life sciences sector, patient-centredness is taken for granted in the same way as the importance of research and development or the need for a qualified workforce.

V. HOW TO CREATE VALUE?

Deloitte's Global Life Sciences and Health Care Industry division publishes regular reports on the future of the sector (Deloitte 2020; Deloitte 2022). The 2020 report was drafted pre-COVID-19, and therefore has aged to a certain extent. For instance, the analysis was still postulated on a vision of ever-expandable global supply chains. This, of course, was before countries were forced to compete for vital goods on the tarmac of Chinese airports, as occurred during the second half of 2020. The 2022 edition deals with the issue. The report was also obviously unaware of the dramatic upheavals of the geopolitical order that took place since its publication, such as the Russian invasion of Ukraine.

Yet it is still a good report, for two reasons that are worth mentioning here. First, because the authors insisted on the importance of co-design and co-decision in the development and implementation of health life science sector policies throughout: consultation is not enough. When one looks at the strategies developed in comparable OECD countries, it appears obvious that direct engagement of the sector in drafting the policies — and further, in their actual implementation — brings with it such qualities as comprehensiveness, relevance and accuracy, instead of the usual high-level rhetoric. The second reason Deloitte's report is worth more than just a glance is that it gave the "patient" a prominent place, on equal terms with government and industry. In our review, only a few countries assign a pivotal role to patients, let alone a voice in the policy process. Come to think about it, this is a strange omission in the current context of health care.

The reason patient engagement is worth mentioning is that it is the first common denominator among the different policies adopted around the world to create value in the health life sciences (Taylor et al. 2021). Other popular ideas include, as we have alluded, measures to improve access to relevant data from all sources, investment incentives and funding programs, and strategic support for basic and applied research (through subsidies for infrastructure development and maintenance, for example).

The adaptation of regulatory instruments to the needs of a global competitive environment is also a common purpose of the strategies contemplated by policy entrepreneurs. So-called "smart" regulation is all about reducing the amount of red tape and bureaucratic veto points that impede knowledge-sharing and collaboration and ultimately delay the access of patients and providers to health innovations. A well-co-ordinated sector, with clear lines of communication from the research front to the end users, including of course public regulators, can satisfy legitimate concerns for safety and value while also ensuring the swift diffusion of efficient new treatments and better medical devices.

This sort of agenda is not new (West and Bogers 2013; Curley and Salmelin 2013; Chesbrough 2015). "Open innovation" considers that it is possible to manage socially and economically valuable knowledge in a way that benefits everyone, and patients especially (Innovative Medicines Initiative 2016; Gabriel, Stanley and Saunders 2017). It encourages the sharing of scientific information to ensure multiple innovators can "compete" and pursue all possible avenues. The same approach favours early discussions with regulators, who are less likely to be intimidated or even put off by an innovation when it doesn't appear as a scientific or technological "black box" anymore, with its inner workings clearly communicated.

Expectations placed on public authorities, and notably, on national governments, are another feature of the open-innovation agenda. It is hardly surprising that governments have use of a wide range of tools that the sector itself, even with the strongest will in the world, cannot access. The first thing that comes to mind is the capacity to engage all segments of the sector, despite their differences and sometimes competing interests, and help them speak with one voice, thanks, in part, to proper incentives. This approach has been particularly successful in countries as diverse as Australia, Denmark and the United Kingdom, as we shall see. Governments are also uniquely equipped to help the health life sciences sector in each country define its particular niche or niches and champion them on the global scene through promotion and branding.

Government "picking winners" or favouring a certain technology or company to the detriment of all others, has proven to be a poor strategy to foster innovation. What can be helpful, however, is to ensure that support exist for "value chains" in their entirety, from basic research all the way to market. This can be done when public authorities develop a comprehensive understanding of the sector and its needs, an understanding that depends in return on open communication and real efforts to broaden the expertise of officials and other policy advisors. Like smart regulation, *integrated* programming is not only about priorities, targets, and outcome measures (which are essential, of course), it is first and foremost about the quality of the information received and gathered, and the manner in which it is used to address the vulnerabilities of the sector and bolster its efforts.

VI. CANADA'S NEW STRATEGY

The BLSS, Canada's own health life sciences strategy, belongs to the same recent "cohort" of policies of those we examined in the previous section. How does it compare?

As we mentioned earlier, Canada's strategy has been marked by the experience of COVID-19, with its hard lessons about shortages, supply-chain failures, and limited national capabilities — even more apparently than the Australian, French, or Danish strategies, which were also drafted during the pandemic. It may be, in part, for this reason that the BLSS is quite limited in its focus. The expectations are modest, as are the means to meet them. While the strategy was preceded by a broad stakeholder consultation shaped by years of serious work on the industry side[2], it was nonetheless a government document, with none of the "co-design" features found in other jurisdictions.[3]

Summary results of the national stakeholder consultation were released in May 2021 by Canada's Ministry of Innovation, Science and Economic Development (Health Canada and the Public Health Agency of Canada were involved in the process as well), under the title: *What We Heard: Considering the Creation of New Biomanufacturing Capacity for Canada.* This report is in and of itself a *policy* document: it summarizes the participants' concerns, suggestions, and demands according to a particular framework, which amplifies some themes and diminishes others. Perhaps unsurprisingly, pandemic preparedness is given more space than the sector's governance issues. Regardless, it is striking that some of

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[2] See Research Canada 2021.

[3] The provinces of Ontario and Quebec, which both released their own health life sciences strategies in 2022, followed a similar process and reached very similar conclusions (see Ontario 2022; and Quebec 2022). Alignment from two major provinces is a good omen for the national policy.

the most salient points in the report intersect almost exactly with features we encountered in other countries' strategic statements.

The consultation zeroed in on five essential demands coming from the stakeholders, the first of which is related to the lack of co-ordination between public authorities, industrial and/or commercial entities, and non-profit organizations. Overall, the governance of the sector is perceived as lacking. Stakeholders complained about the absence of strategic thinking and the lack of clear and measurable outcomes. They were also quite vocal about the need for a robust participatory process, leading to co-decision and partnerships. Participants issued calls for increased, predictable, and long-term investments in research and research infrastructure, in line with the sector's needs for a flow of new ideas and innovations. Because it is difficult to access the specialized workforce that is required at each step of the innovation process, from basic research to clinical applications and from testing and validation to manufacturing, hopes were high that the federal government would come with new programs intended to attract, recruit, train, or even retain the health life science sector's much-needed highly qualified personnel. Finally, the web of policies and regulations, compounded by the decentralized nature of Canada's health system, that delay or even limit patients' and providers' use of new treatments and other therapeutic innovations, is a major concern. While some of the levers are in Ottawa's hands, especially in the case of pharmaceuticals and medical devices, and could be activated at the federal level, clear and purposeful leadership at provincial levels would help as well.

At the level of principles, the government of Canada's answer was consistent with the concerns expressed by the sector. The two broad headings — *resilience* and *innovation* — allowed the strategy to address both long-standing issues hindering the performance of the sector and emerging needs arising from the globalization of biomanufacturing. Given the timing of the document's release, it should be no surprise that pandemic preparedness had a special place in the document, but it must also be acknowledged that this question is quite skilfully integrated in a wider discussion of national capacity. Not unlike the other national strategies that we have examined, the BLSS takes due note of the lessons learned during the pandemic without necessarily limiting itself to public health issues.

Incidentally, the core features of the Canadian strategy include familiar elements, such as knowledge management (but with a unique emphasis on IP), better integration of academic and industrial research, and a focus on "complete" value chains, which require the recognition and prioritization of promising areas. The BLSS also attempts to balance, albeit with mixed success, its orientation toward increased *national* capacity and the incontrovertible reality of a globalized economy. In the first case, the impulse is to do everything by ourselves, whatever the cost; in the second, the sector would rather be invited to specialize in the fields in which it is or can be competitive. It is easy to understand that these two objectives could be difficult to reconcile in practice. In fact, nowhere else in the strategy is the need for an open and collegial decision-making process more important. It is not enough to provide more investments or changes to the regulatory environment. Success necessarily entails a new approach to the sector's governance; in such a manner, difficult trade-offs will be made, based on good information and with due regard to all partners' capabilities and interests.

Specifically, the BLSS is structured around five dimensions, or "pillars." The promise of "strong and co-ordinated governance" (Pillar 1) comes first, partly for the reasons we just mentioned. Yet the strategy falls short of laying the foundations of a true partnership between government, industry, and research institutions. It is instead committed to the establishment of a dedicated structure, a single point of access to the complex federal bureaucracy and, presumably, a place where policies developed in different areas of government (health, industry, trade, etc.) will be examined and harmonized. The second pillar is concerned with the country's research capacity and aims to strengthen the existing infrastructure, while ensuring that Canada possesses the right health life sciences workforce. The third pillar is focused on current and potential "areas of strength." The proposed perspective involves new investments on the one hand, and targeted policy support on the other. The fourth pillar gives priority to the needs of public institutions engaged in life sciences research and development, to ensure they can play an active role in the sector's growth. The fifth and final pillar once again reiterates the government's commitment to adapting regulations and standards to help the sector face the constraints of a globalized trade environment.

It must be expected that a strategy evolves as it is implemented. Discretion is necessary as the context changes and difficulties arise. Yet the BLSS is very short on specifics and it is difficult to really appreciate what would be considered a success or a failure. "Doubling down on existing and emerging areas of strength" (Pillar 3) is a bold and important objective, but none of the associated sub-objectives lead to measurable outcomes. What does "ensuring world class regulation" (Pillar 5) really mean? Or more exactly, who will be the one to decide the target has been met? There are many other examples. As the next section of the report will show, the federal government has not demonstrated much program discipline. Instead of properly evaluating and, when necessary, terminating programs that are not overly convincing, new initiatives just add up over the years. Perhaps the first step to take by whomever will assume the "strong governance" (Pillar 1) of the sector is to prepare a comprehensive forensic inventory of the existing interventions and subsidies aimed at the health life sciences and to prune all that are not contributing meaningfully to growth and innovation.

SECTION TWO: THE FEDERAL PROGRAM LANDSCAPE

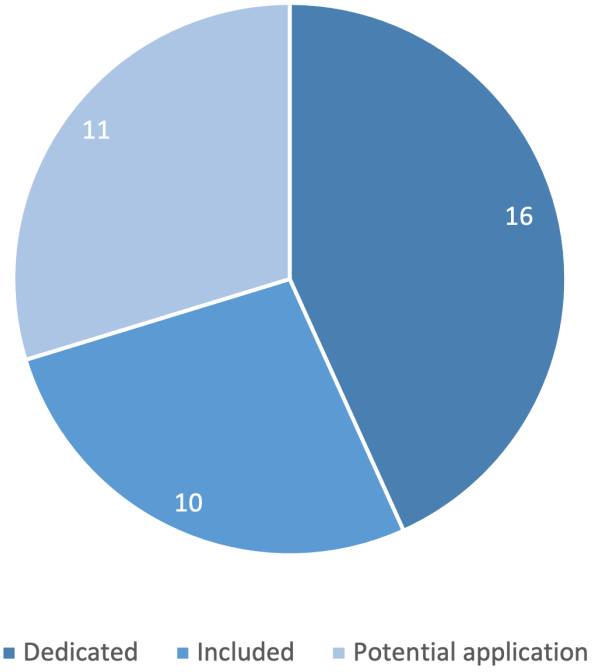
As we mentioned, the BLSS sometimes lacks clarity or direction. As such, it can be difficult to discern the priorities of government in this space, and further exploration is often needed. The existence of programs offering funding or other supports can provide clues as to the priorities of government in this space. As such, this section will provide an analysis of the landscape of supports available in the health life sciences sector. This sort of analysis is vital to peering into the federal government-erected support apparatus for the health life sciences. In the context of a successful health life sciences sector, the landscape of federally funded programs was analyzed (a full detailed methodology is provided in Appendix B). What resulted was not only a glimpse of the current landscape, which is marked by fragmentation and duplication, but also a database of programs, the first of its kind in Canada, that may be useful to innovators, researchers, or others interested in the health life sciences (portions of its contents can be seen in Appendix C and Appendix D).

I. A ROBUST LANDSCAPE

The landscape of federal funding for health life sciences programs is robust. In total, 51 programs with publicly available data offered funding at the federal level equally (in opportunity) to all provinces and territories between 2016 and 2022. These programs varied in their goals and ranged widely in their intended beneficiaries and targeted funding stage. It is imperative we note that there were 71 other programs also assessed. These other programs, such as funding agencies/umbrella agencies, geographically restricted programs, programs that offer business support programs, and support for researchers/ academics, can also be extremely supportive. These are further discussed in Appendix C.

Programs included those providing some level of funding, whether it be at the research, development/applied research, testing/ trials, or market/dissemination/uptake stage. Nearly a quarter were thought to potentially have limited impact due to tight or very specific and restricted eligibility, low funding levels, or the objectives are thought to be peripheral to the sector. Thus, of the 39 programs that housed large-scale impact, nearly half had dedicated funding for health life sciences, a quarter were programs in which health life sciences were included but funding was shared with other sectors, and just over a quarter were potentially (but not explicitly) applicable to the sector (see Figure 1). Of the total, there were two programs with various sub-programs that are not included in **Figure 1**. The full program list can be seen in Appendix D.

Figure 1. Less than half of the programs are dedicated to health life sciences funding



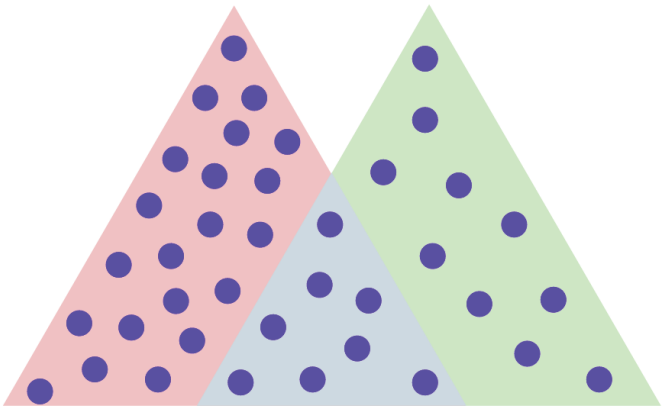
Note: Two programs are not included here due to sub-programs resulting in hybrid specificity of funding.

II. GOALS

The goals of the programs were either explicitly stated or, in most cases, deduced from the stated objectives. General themes emerged — goals were typically of one or more (of seven) categories: 1. support domestic growth; 2. improve market access; 3. increase Canadian employment; 4. strengthen research capacity; 5. attract and train highly qualified research and technical personnel; 6. generate knowledge while also generating economic and health benefits; and/or 7. support research facilities.

While research is a vital ingredient in the improvement of population health, it is not the only ingredient, despite the goals of the health life sciences sector being heavily weighted towards research. In fact, over half of the funding programs related to research, with an additional fifth housing research-related goals in conjunction with goals related to economic growth (see Figure 2). Only a quarter of the assessed programs had goals related primarily to economic growth — whether that be in the sphere of supporting domestic growth, improving market access, increasing Canadian employment, or a combination of one or more of the three (see **Figure 2**).

Figure 2. Program goals typically include some aspect of research — only a quarter of the identified programs focused solely on aspects related to economic growth



Note: Goals generally fall into one or more of seven categories that relate to research, economic growth, or both. Each circle represents a single program.

III. FUNDING STAGE

Most of the programs (and therefore funding) were directed or targeted to the supply and creation of innovation (early stages of research) and less so the market/dissemination or uptake stage (**see Figure 3**).

Figure 3. Program funding is front-loaded to the research-and-development/applied-research funding stages

Programs	Funding Stage			
	Research	Development/applied research	Testing/trials	Market/dissemination/uptake
Discovery Grants	■			
Discovery Development Grant	■			
Discovery Accelerator Supplements program (DAS)	■			
Discovery Institutes Support (DIS) grants	■			
Ideation Fund	■			
Research Support Fund	■			
Terry Fox New Frontiers Program Project Grants	■	■		
Strategic Science Fund	■	■		
Human Frontier Science Program (HFSP)	■	■		
Foundation Grant Program	■	■		
Alliance Grants	■	■		
Research Tools and Instruments (RTI) grants program	■	■		
Discovery Frontiers	■	■		
Emerging Infectious Diseases Modelling Initiative	■	■		
Alliance Missions	■	■		
Strategic Innovation Fund	■	■		
Canada Biomedical Research Fund (CBRF)	■	■		
Innovation Superclusters	■	■	■	
Scientific Research and Experimental Development (SR&ED) Tax Incentive Program	■	■	■	
Innovative Solutions Canada	■	■	■	
CDQM Quantum Leap	■	■	■	
Innovation Fund	■	■	■	
John R. Evans Leaders Fund	■	■	■	
College Fund	■	■	■	
Major Science Initiatives (MSI) Fund	■	■	■	
Biosciences Research Infrastructure Fund (BRIF)	■	■	■	
Exceptional Opportunities Fund (EOF)	■	■	■	
Societal Implications of Genomic Research	■	■	■	
Genomics in Society Interdisciplinary Research Teams	■	■	■	
Industrial Research Assistance Plan	■	■	■	
Business Development Bank of Canada Capital	■	■	■	■
Project Grant Program	■	■	■	■
College and Community Innovation Program		■		
Genomic Applications Partnership Program (GAPP)		■	■	
Precision Health Initiative — Rare Diseases: Clinical Implementation Projects		■	■	
adMARE Bioinnovations		■	■	■
Investment Matching Program				■
Business Development Bank of Canada Financing				■
Business Development Bank of Canada Venture Capital Incentivized Programs (VCIP)				■

Note: This figure does not take into account the magnitude of investment.

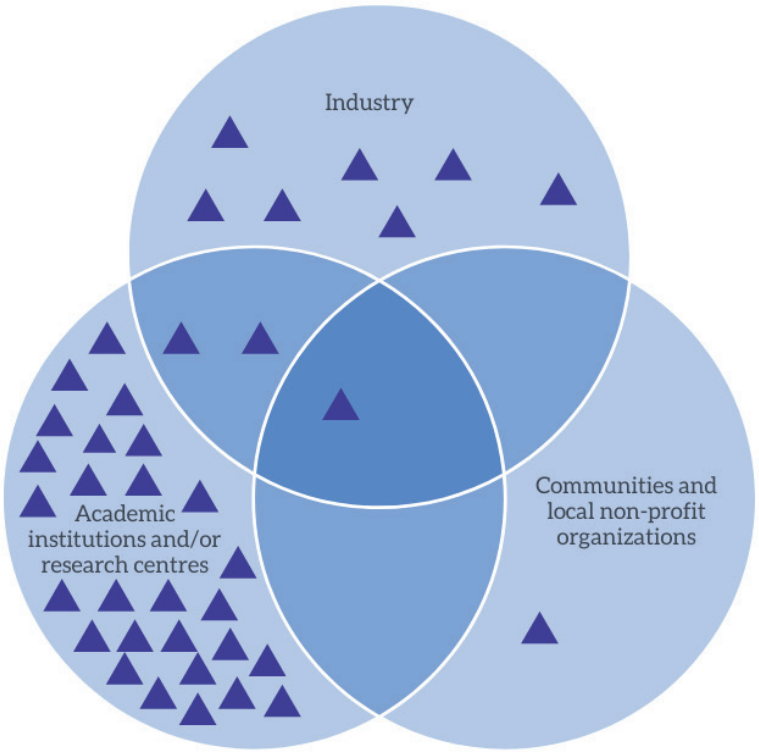
There is a noticeable absence of funding programs for market/dissemination/uptake project stages. In fact, more than 80 per cent of the programs targeted research, only 15 per cent included the market/dissemination/uptake stage and only eight per cent were dedicated solely to this stage. The priorities of the government are clear — the creation of innovation, albeit at the expense of getting these innovations to the Canadian public. This is further discussed in Section 3.2.

IV. BENEFICIARIES

The intended beneficiaries of these programs are important — they can either align with the vision put forward by the BLSS, or not. Generally speaking, there were three categories of beneficiaries visible: 1. industry; 2. academic institutions/research centres; and 3. communities and local non-profit organizations.

In line with other findings that show research to be prioritized, academic institutions or research centres were the number one group of beneficiaries of these programs. In fact, nearly 80 per cent of programs included academic institutions and/or research centres as beneficiaries (see **Figure 4**). Conversely, only two programs (five per cent) included communities and local non-profits. A single program catered to all three beneficiary categories. As programs are scattered between different agents and agencies, it is often difficult to determine strategic intent or the direction of the federal government's priorities.

Figure 4. Most programs are intended to support academic institutions and/or research institutions

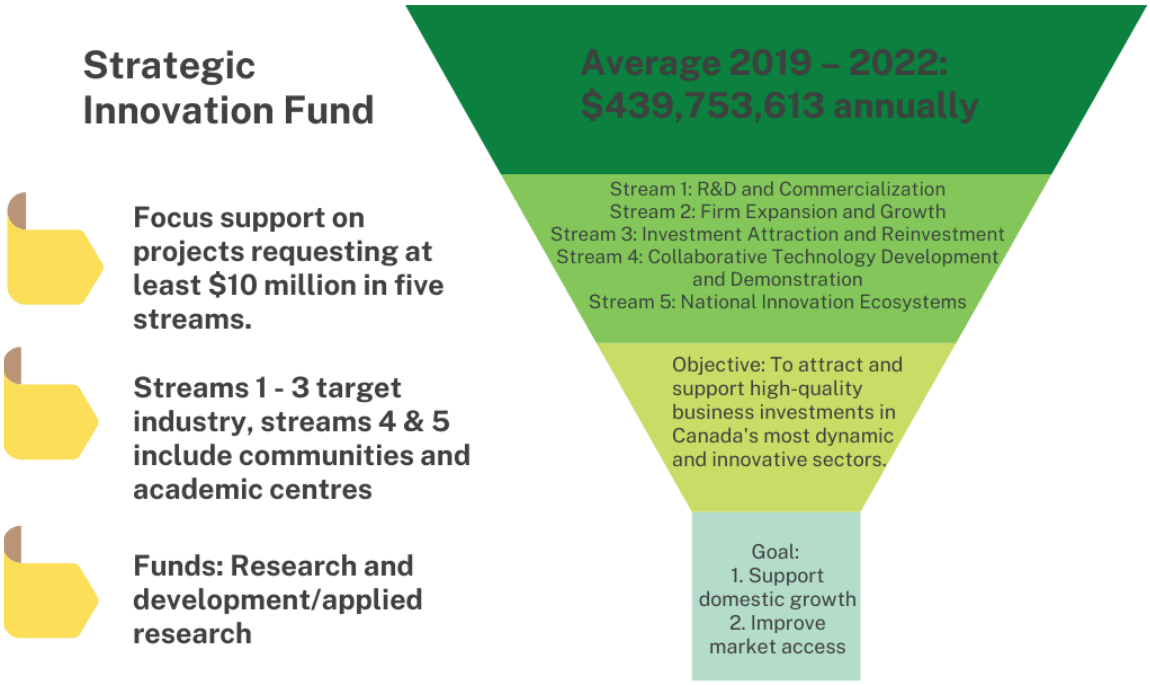


Note: Each circle represents the intended beneficiaries, and areas of overlap are programs with more than one beneficiary type or sub-programs that cater to differ program types. Each triangle represents a single program.

V. PUBLIC ACCOUNT ALLOCATION

Funding for health life sciences programs has undoubtedly increased during the COVID-19 pandemic, but for years Canada lagged peer countries (Government of Canada 2018b). To get a sense of the size of some of these programs, the federal government's Public Accounts of Canada archives were consulted to determine the contributions to programs through their respective funding ministries. The intention here was to include an additional layer of analysis to these programs to get a better sense of their situation in the health life sciences landscape. Much like the way geologists use a small portion of a formation in a core sample to provide analysis, this small sample can provide an idea of the scope of some of these programs.

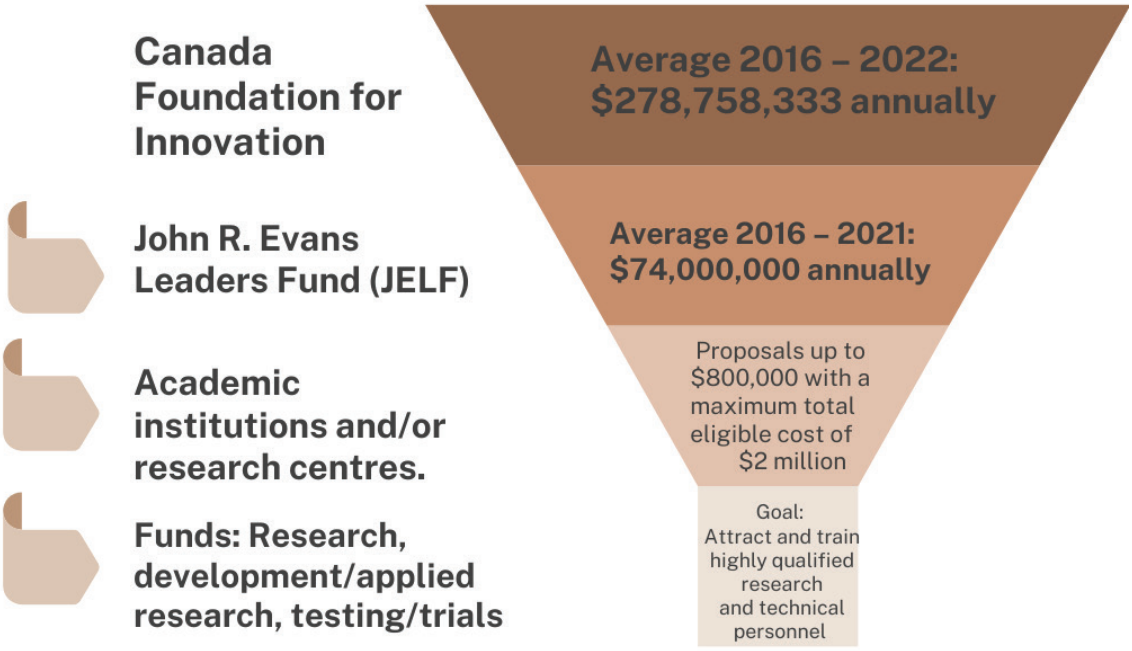
Figure 5. The Strategic Innovation Fund disburses an average of nearly $440 million annually and funds research and development/applied research



The Strategic Innovation Fund (SIF) and the John R. Evans Leaders Fund (JELF) are both programs under the mandate of Innovation, Science and Economic Development Canada and are large and complex. The SIF was introduced in Budget 2018 to focus support on business research and development projects over $10 million and consolidate two previous programs (Centres of Excellence for Commercialization and Research and the Business-Led Networks of Centres of Excellence) (Government of Canada 2018a). The aim of the SIF is to "to spur innovation for a better Canada by providing funding for large projects and national innovation ecosystems" (Government of Canada 2022a). Made up of two streams of activities, the program issued $316,748,009 in 2019–2020, $421,069,258 in 2020–2021, and $581,443,572 in 2021–2022, for an average of $439,753,613 dollars per fiscal year annually between 2018 and 2021 (see **Figure 5**) (Government of Canada 2019b; Government of Canada 2020; Government of Canada 2022b).

The JELF is a program administered by the Canada Foundation for Innovation (CFI). Between 2016 and 2022, the CFI's allocations ranged from $177,100,000 to $359,300,333 per year, for an average of $278,758,333 annually (see **Figure 6**) (Government of Canada 2016b; Government of Canada 2017b; Government of Canada 2018c; Government of Canada 2019b; Government of Canada 2020; Government of Canada 2022b). Of this, an average of $74,000,000 annually was disbursed through the JELF, which funds proposals up to $800,000 and benefits academic institutions and research centres, generally to advance research objectives (**Figure 6**) (Canada Foundation for Innovation 2017; Canada Foundation for Innovation 2018; Canada Foundation for Innovation 2019; Canada Foundation for Innovation 2020; Canada Foundation for Innovation 2021).

Figure 6. The John R. Evans Leaders Fund disburses approximately 26.5 per cent of the funds earmarked for the Canada Foundation for Innovation and supports academic institutions and/or research centres



What these two examples show is that the amount of funding provided is not minuscule. This underlines the importance of a comprehensive strategy that outlines the strategic intent of these investments.

VI. GAPS

As we have seen, of the programs concentrating on supporting health life sciences, there still aren't many that are necessarily exclusive to the sector. Funding is often shared with other sectors, and eligibility is often convoluted. In addition, the goals related to federal support programs are often overlapping, but are focused largely on research and not necessarily economic growth. What this translates to is a lack of sustainable and dedicated funding in getting health innovations to market. This prioritization of the "push" side of

the innovation process can leave industry between a rock and a hard place, resulting in a competitive disadvantage in marketing these innovations relative to peer countries, some of which have been mentioned previously.

VII. WHAT DOES THIS ALL MEAN?

This brief program analysis indicates that when it comes to health life sciences, research and front-end innovation are more highly prioritized by the Canadian federal government, and that fragmentation and duplication abound. In addition, the programs not discussed here (but included in Appendix C) include geographically restricted programs, business-support programs, and funding for researchers and academics, which all also contribute to fragmentation and, in some cases, result in duplication.

This can't be all too surprising, though, as between 2016 and 2021 (not including 2020, as there was no federal budget tabled that year), "life sciences," "bio-sciences," and "health innovation" were mentioned a total of 36 times — over 60 per cent of which were in 2021 (see **Table 2.1**). The significant increase in importance/mentions in 2021 is likely due to the emergence and persistence of the COVID-19 pandemic, thus also illustrating that federal programming and priorities in this area are reactive and have not historically been proactive.

How often a government mentions something in its budget can be an indicator of the intensity of its commitments in the area, so prior to 2021, health life sciences appear to have been a policy afterthought. While the increasing federal interest in the Canadian health life sciences sector is evident in **Table 2.1**, "life sciences," "bio-sciences," and "health innovation" are not mentioned in proportion to their importance to Canadians and the Canadian economy. For comparison, consider that in 2018 alone, "reconciliation" was mentioned 42 times, while the number of mentions related to the health life sciences sector tally to five (see **Table 2.1**).

Table 2.1. Federal government budget mentions, 2019–2021*

	Number of mentions (not including Table of Contents)		
Budget Year	**Life sciences**	**Bio-sciences**	**Health innovation**
2016	1	0	0
2017	0	6	1
2018	1	2	2
2019	0	1	0
2021	19	2	1

Source: Government of Canada 2016a; Government of Canada 2017a; Government of Canada 2018a; Government of Canada 2019a; Government of Canada 2021b.

*There was no 2020 Canadian federal budget.

Thus, while the federal program landscape shows fragmentation and overlap, it also indicates many neglected areas. Therefore, it is likely that a full and systematic program review, using the BLSS guidance as a lens, is a necessary first step on the road to success.

SECTION THREE: SEARCHING FOR SUBSTANCE AND CONSISTENCY

I. THE MOST PRESSING ISSUES

The picture that emerges from the previous section is not really surprising. The federal government has many roles — a report commissioned by the minister of health in 2019 counted no fewer than six different roles for her department alone — and it would require an iron discipline to keep them all aligned. Add to that the budgetary process, which encourages the proliferation of boutique programs, and periodic changes in the country's government, cabinet composition, and economic orientation, and it becomes highly predictable that public support for the health life sciences would be characterized by fragmentation, duplication, and overlap.

It does not imply, however, that nothing could or should be done. First, a comprehensive review would help dispose of programs that are long past their due date, too small to be effective, or just inefficient. For example, we identified a number of programs that were considered to be limited in their capacity for impact due to tight or very specific and restricted eligibility, low funding levels, or objectives that are peripheral to the sector. A forensic analysis could and would determine whether this assessment was indeed accurate, and identify others that may not have a substantive basis for impact. Second, as to the future, even if the BLSS is not very explicit about the specific measures that must be implemented, it still provides a general policy orientation that can help with program alignment. In reality, the question is: should the program review and the subsequent policy refoundation be conducted by bureaucrats alone, as it is usually done, or is this an opportunity for collegiality and partnership, as urged in the BLSS? This is a real test of the new vision. The government pledged to be more strategic and purposeful, and to be disciplined and co-ordinated. Yet the government also committed to foster collaboration, in the spirit of consultation and engagement. A program review would be a good place to start. Asking the sector what should stay and what should go; trusting the experience and expertise of stakeholders when new initiatives are designed; involving them as well in the implementation and subsequent follow-up: these would be truly aligned with the principles and directions of Canada's Biomanufacturing and Life Sciences Strategy and would put the country on par with the best international practices.

The spirit of a participative program review, as just suggested, could be extended to other domains. For example, if a proper channel of communication becomes available — thanks to the institution of a sector champion within government, like in the United Kingdom, or the establishment of a permanent consultative body, such as France's Conseil stratégique des industries de santé — the challenging issue of regulatory reform could gain real momentum, instead of being tinkered with in bits and pieces. Another area would be the policy initiatives in favour of the sector's internationalization. Look at the countries that have made successful steps in that direction, such as the Netherlands, Denmark, and Australia. All share one thing in common, which is to make use of the intelligence and experience of their national research and industrial organizations before making any decisions about targets and priorities. The lack of "collegiality" in policy development and, even more, in policy oversight, is a real weakness in the Canadian approach, especially when most competitors have found a way to harness the energy and innovative spirit of the sector to support and enhance their strategies.

Workforce issues are another domain that requires a deep understanding of the sector's needs and would benefit from more collaboration between government and stakeholders from different horizons. Life sciences is a knowledge-intensive sector, dependent on highly specialized skills that include research and clinical experience, of course, but also expertise — to quote Sweden's strategy — "in areas such as automation, lean methodology, analysis, process engineering, chemical engineering, and good manufacturing practices." Add computing, data literacy and AI to the mix, and it becomes clear a country the size of Canada, competing with the rest of the world to attract and retain the best talent, cannot hope to succeed if all the players are not engaged and ready to do their part.

Governments in the past saw the role of long-term investors as essential to their economic and social mission, which explains why they were keen at building infrastructure. In the last decades, however, the policy landscape has changed quite dramatically and global competition has forced the private sector to consider investments at an unprecedented scale, which translates into a significant lengthening of the financial commitment attached to any new project. On the other hand, politicians that are eager to show results to their electorate or are otherwise short-sighted may have less appetite for projects with uncertain and far-off benefits, not to mention the multiple veto points that must be overcome along the way.

This state of affairs is quite unhealthy. It impedes the development of a robust and competitive health life sciences sector as a few megaprojects do not constitute a system of any sort, and because a succession of short-term initiatives, even if well-inspired, cannot generate enough capacity to sustain the demands of a growing market. There is no easy way out of this situation. Yet it is clear from the experience of other countries that part of the solution, once again, resides in a closer relationship between government and the sector's major players. This is certainly one of the lessons learned during the pandemic, notably in the case of vaccine research, production, and distribution. There is no reason not to take this approach in more areas of public interest when it comes to long-term funding and investments in training, basic research, clinical trials, or even precision manufacturing.

II. THE UNIQUE ROLE OF GOVERNMENT

There are very few goods or services the private sector cannot provide, but policy leadership is on that short list. In the previous section, we described what government should now consider doing hand in hand with the Canadian health life sciences sector if the national strategy is to be successful. Let's talk now of the areas in which government must lead and be the first to take action.

Funding is the first issue that requires attention. Not because private investments are necessarily lacking, or because public funding suddenly needs a massive increase. The problem is the discrepancy between the supply of public funds — which are going primarily to discovery and research projects — and the demand for support at later stages of the process, closer to the bedside and/or the market. This is evident in the second section of this report, with the federal program landscape focusing heavily on the "push" side of the equation. It is possible that this situation was considered normal in the past, a sort of tacit "division of labour" between the public sector, which was responsible for upstream investments, and the private sector, which was there to take care of everything happening downstream. Yet the world of health research has changed dramatically with the

proliferation of startup (private) companies pursuing research at a very early stage, and with non-profit institutions, at the other end of spectrum, trying to monetize their discoveries and their IP. Public funders must adapt to this new reality and allocate funding to ensure resources are properly distributed along the value chain, with a particular focus on the pressure points that burden the new ecosystem with costs and delays, from proof of concept to market authorization.

Data should be the second policy priority. Only government, and especially in Canada, the federal government, is solid enough to withstand the multiple challenges that come with the needs of the health life sciences sector for accurate, reliable, comprehensive, and well-integrated data systems. Interoperability, for example, is still a major issue, not only between sectors, which is a common problem in other parts of the world, but among different provincial and territorial jurisdictions, which should be an object of shame in a country that likes to promote itself as a world leader in new information technologies. How can the provinces be engaged to make sure we benefit fully from the massive amount of quality data produced in our public health-care organizations, in the best interest of patients and providers? And who but the federal government has the capacity to interact and negotiate with the international giants and private providers that generate and control precious private health data, to ensure information doesn't flow in one sense only?

Part of the work that the federal government must undertake is directed primarily at its own policies, which call for serious reform and renewal. The list is daunting — it goes from competition to privacy, passing through challenges such as national security and social inclusion — but it is not impossible to achieve some real improvement. IP policies are a good example. Current approaches are framed with a "national" perspective that does not reflect the way new ideas, new processes, and new products or services are developed in a global economy. In other words, to put it facetiously, an innovative medicine might never be 100-per-cent Canadian, like maple syrup or ice wine, and still be worthy of support and protection. Our future trade relations are, in fact, dependent in part on our capacity to untangle the web of preconceived ideas we may have formed about IP and innovation, and to adapt to a globalized world.

Finally, it is also up to public authorities to decide on the type of partnerships they want to foster and sustain. The options are broad, but in the end, only a handful are consistent with the needs and expectation of the sector, not to mention the objectives of the BLSS. Knowledge networks are not exactly a new concept and their Canadian avatars, such as the 1989 Networks of Centres of Excellence, have been open to private sector and non-profit partners. This is a solid foundation on which one can build, especially if, like the 2018 Strategic Innovation Fund, there is a focus on concrete projects, from early development to market entry. The co-design and open governance approach that is now favoured by so many countries in the realm of policies and programs finds its natural counterpart in public-private partnerships and consortia at the coalface.

III. PILLARS AND PRIORITIES

Public policy is about doing more than one thing at the same time. Therefore, it is possible to start work — or to carry on, when the proposed "pillar" sits on sound foundations — in each of the five areas prioritized by the BLSS. The problem is rather to identify, as we attempt in **Table 3.1**, a few initiatives, based on good practices identified earlier in the report, that could bring concreteness to the high-level goals stated in the strategy.

Table 3.1. Pillars and priorities for the health life sciences sector

The BLSS Five Pillars		Possible Priorities
1	Strong and co-ordinated governance	Federal champion? Permanent consultative forum? Independent national agency?
2	Laying a solid foundation by strengthening research systems and the talent pipeline	Comprehensive program review? Public-private partnerships and consortia? Expedited visa programs?
3	Growing businesses by doubling down on existing and emerging areas of strength	Focus areas aligned with global context? Value chain analysis and support?
4	Building public capacity	Dedicated unit in charge of strategic intelligence and planning? Data oversight?
5	Enabling innovation by ensuring world-class regulation	Smart advocacy? "Red tape" task force?

Source: Government of Canada 2021a.

There are many solutions that can help meet the challenge of governance underlined in the discussion of the BLSS's first pillar. The strategy itself is not exactly daring on this count, with its promise of a dedicated office for the health life sciences, presumably on the model of the U.K.'s efficient Office of Life Sciences, a creature of the Department of Health and Social Care and the Department for Business, Energy and Industrial Strategy. Yet it can be argued that the British model of governance functions well because it is not limited to a single office. First, there is a much-respected national champion for the sector who lends his voice and face to the promotion of its activities and the defence of its specific interests. Second, the strategic vision itself is the product of a collegial process to which various players have contributed, notably some leading industry practitioners and experts. Canada still has a few foundational stones to lay. Another possible direction is, of course, the establishment of an arm's-length agency with equal representation of all major stakeholders, following the examples of the Netherlands and Denmark.

We have already covered much of the ground as regards the second pillar: program review; project focus; widespread use of private-public partnerships and consortia. Canada is already a destination of choice for the best international students and has been able to attract a good number of highly talented researchers, thanks to generous programs and great research facilities. A more assertive orientation toward commercialization will now highlight gaps and deficits at other stages of the value chain, in domains in which we compete with the entire world. Why not replicate for those cases what we successfully implemented when the country's priorities were basic research and discovery, and make sure that delays and bureaucratic dithering do not discourage qualified individuals from considering joining Canada's health life sciences workforce?

The right question is not: what are our areas of strength? It should be instead: in what areas can we out-compete the other countries engaged in that same race? This approach, adopted with much success by countries as different as Australia and Denmark, would serve Canada well, given our limitations. We should look at the third pillar with lucidity and candour, without ever losing sight of the global context.

This is an exercise that cannot be properly completed without the direct contribution of the sector. Its leaders know where we have a real advantage, where we still have a chance, and where the country lags more advanced competitors. Let's assume we know how to listen and act when good advice has been offered. What could be more challenging is the lack of criteria for identifying a "strong" value chain, despite the fact everybody seems to take for granted we know for sure what it looks like. The territory is not completely uncharted — there is abundance of good research and expertise. Yet the gap between theory and practice is still quite wide, which is an issue if program decisions and funding priorities are supposed to be based on that notion.

The BLSS is preoccupied with the fate of public institutions that are active in the health life sciences sector, such as the National Research Council of Canada, for example. It would be dishonest not to endorse this orientation. Strong partners are a condition for strong partnerships. Furthermore, this is a case in which history is evidence: public institutions have actively contributed to the development of the sector, whether directly, thanks to their own research capacity, or indirectly, through training, funding, or mentoring.

What could be better defined regarding their future contribution, however, is the unique role they could play in gathering intelligence about the evolution of the sector for strategic planning purposes. In matters of science, and especially of leading-edge science, decision-makers must access a type of information that is usually not available to "laypeople" and that is first acquired on the bench, within the production and processing chain, or in the depths of large data sets. (Incidentally, it would be helpful to hear more about the federal government's plans concerning the oversight of data — who will be responsible for the creation and maintenance of the national multi-sector data system, without which future progress in the health life sciences will be seriously thwarted?)

The section of the BLSS where regulation is discussed is short on details, but the general philosophy behind it is encouraging. The message is that what impedes innovation should be questioned and eventually replaced by a new approach, inspired by Health Canada's emergency measures during the pandemic. There is also a commitment to some form of consultation with the sector's principal stakeholders, aiming not only at knowing more about their direct experience, but also at making good use of their expertise in domestic and international regulatory systems. One idea that could be explored is to make sure this reform process is ongoing, emulating Australia for example, where MTPConnect, the life sciences independent public agency, is explicitly tasked with challenging regulations that hinder growth and competitiveness. Or to follow the lead of provinces that have established "red tape" reduction programs, with the same goal of making regulatory reform an open and ever-evolving process.

CONCLUSION

We insisted earlier that public policy is about doing more than one thing at the same time — a way for governments to avoid chasing one crisis after another. Strategy, on the other hand, is supposed to ensure that, like a compass, all the different policies are aimed in the same direction. The BLSS has some shortcomings, as we have seen, but on the whole it provides the health life sciences sector with an overview of the current government's priorities and, to some extent, outlines a way forward. It is not customary, especially in Canada, to get a detailed implementation plan at the same time a strategy is announced. However, given the progresses made by our direct competitors with reforms and strategic reflection, there is a certain degree of urgency in moving fast toward the realization of our ambitions.

Where to start? Without questioning the relevance of all the measures contemplated in the BLSS, or the capacity of the federal government to begin work across a broad front, three initiatives have the potential to create real momentum. First, as we have pointed out, a program review is overdue. Programs are there to serve a policy, and the continuation of those that cannot pass that test should be questioned. This project would also be a great opportunity to develop productive working relationships between the bureaucracy and the sector's stakeholders, in the spirit of "collegiality" that is called for in the strategy.

When a policy is owned by everyone, it is owned by no one. The second measure with an ability to make a huge difference would be the appointment of a federal champion for the sector. The current government has been keen on appointing "special representatives" in areas that it considers a priority. That's not to say that this health life sciences champion would duplicate the role of the Chief Science Advisor of Canada, or of any science advisor in the bureaucracy, but would instead play an essential function of convener for a very diverse sector of the economy and would help it find its voice. We suppose this individual would act as well as an advocate for the national strategy and its vision, ensuring they will not be put aside after a year or two. This is a model that has been tested in other countries, with proven results.

The third initiative relates to the complex and contentious file of a national health data system. The health life sciences sector is not the only player with an interest in this realm, and progress in this area is vital to competitiveness and growth. Federal action to ensure access, quality, safety, and interoperability of data at a national level would send a signal of leadership and political will. Only the federal government, furthermore, has the fiscal and policy tools to incentivize the provinces and territories, in addition to the capacity to convince the global information giants to co-operate.

Finally, it is not enough to provide more investments; success requires modernization of the regulatory environment. If we look to countries with more regulatory certainty, such as Australia, we can see guidance in the direction for growth. There needs to be a concerted effort and a will to move forward. We believe that the best path forward is one that incorporates the recommendations provided in the third section of this report and is proactive, rather than reactive. If the federal government does indeed intend to fortify the Canadian strategy and build the health life sciences sector into one that is more concrete, robust, and effective, a high-functioning health life sciences system should be a priority for Canada, and therefore, requires action.

REFERENCES

Bell, John. 2017. Foreword to: *Life Sciences Industrial Strategy—A Report to the Government from the Life Sciences Sector.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/650447/LifeSciencesIndustrialStrategy_acc2.pdf.

Blumenthal, David. 2003. "Academic-Industrial Relationships in the Life Sciences." *New England Journal of Medicine* 349(25): 2452-2459.

Canada Foundation for Innovation. 2017. *Research Builds our Communities: Annual report 2016-17.* https://www.innovation.ca/sites/default/files/2021-09/CFI-Annual-report-2016-2017_0.pdf.

Canada Foundation for Innovation. 2018. *Giving Young Researchers the Tools They Need to Imagine and Innovate: Annual report 2017-18.* https://www.innovation.ca/sites/default/files/2021-09/CFI-Annual-report-2017-2018.pdf.

Canada Foundation for Innovation. 2019. *I picture my research in Canada: Annual report 2018-19.* https://www.innovation.ca/sites/default/files/2021-09/CFI-Annual-report-2018-2019_0.pdf.

Canada Foundation for Innovation. 2020. *Research is my business partner: Annual report 2019-20.* https://www.innovation.ca/sites/default/files/2021-10/CFI-Annual-report-2019-2020.pdf.

Canada Foundation for Innovation. 2021. *Research at the ready during the COVID-19 pandemic: Annual report 2020-21.* https://www.innovation.ca/sites/default/files/2021-12/CFI-Annual-report-2020-2021.pdf.

Chesbrough, Henry. 2015. *From Open Science to Open Innovation*. Brussels: Science Business Publishing. https://www.fosteropenscience.eu/sites/default/files/pdf/1798.pdf.

Cooke, Philip. 2004. "Life Sciences Clusters and Regional Science Policy." *Urban Studies* 41(5-6): 1131-1131. https://doi.org/10.1080/0042098041000167581 4.

Crocker, Joanna C., Ignacio Ricci-Cabello, Adwoa Parker, Jennifer A. Hirst, Alan Chant, Sophie Petit-Zeman, David Evans, and Sian Rees. 2018. "Impact of Patient and Public Involvement on Enrolment and Retention in Clinical Trials: Systematic Review and Meta-Analysis." *BMJ (Online)* 363: k4738–k4738. https://doi.org/10.1136/bmj.k4738.

Curley, Martin, and Bror Salmelin. 2013. Open Innovation 2.0: A New Paradigm. Intel and European Commission Joint Paper. Retrieved from the EU Commission website: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=2182.

Deloitte. 2020. *2020 Global Life Sciences Outlook: Creating New Value, Building Blocks for the Future*. https://www2.deloitte.com/gr/en/pages/life-sciences-and-healthcare/articles/global-life-sciences-sector-outlook.html.

Deloitte. 2022. *2022 Global Life Sciences Outlook: Digitalization At Scale: Delivering on the Promise of Science.* https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/gx-lshc-dei-global-life-sciences-outlook-report.pdf.

Denmark Ministry of Industry, Business, and Financial Affairs. 2021. *Agreement on a Strategy for Life Science*. https://em.dk/media/14236/agreement-on-a-strategy-for-life-science.pdf.

France Conseil stratégique des industries de santé. 2021. *Innovation santé 2030: Faire de la France la 1ère nation innovante et souveraine en santé*. https://www.gouvernement.fr/sites/default/files/contenu/piece-jointe/2021/06/sante_innov30_a4_07_vdefdp.pdf.

Gabriel, Madeleine, Isaac Stanley, and Tom Saunders. 2017. *Open Innovation in Health: A Guide to Transforming Healthcare Through Collaboration.* London: Nesta. https://media.nesta.org.uk/documents/open_innovation_in_health_0.pdf.

Government of Canada. 2016a. *Growing the Middle Class: Budget 2016.* https://www.budget.gc.ca/2016/docs/plan/budget2016-en.pdf.

Government of Canada. 2016b. "Transfer payments." Last Modified 2016-11-30. https://epe.lac-bac.gc.ca/100/201/301/public_accounts_can/html/2016/recgen/cpc-pac/2016/vol2/isde-ised/pt-tp-eng.html.

Government of Canada. 2017a. *Building a Strong Middle Class: Budget 2017.* https ://www.budget.gc.ca/2017/docs/plan/budget-2017-en.pdf.

Government of Canada. 2017b. "Transfer payments." Last Modified 2017-12-27. https://epe.lac-bac.gc.ca/100/201/301/public_accounts_can/html/2017/recgen/cpc-pac/2017/vol2/isde-ised/pt-tp-eng.html.

Government of Canada. 2018a. *Equality + Growth: A Strong Middle Class: Budget 2018.* https://www.budget.gc.ca/2018/docs/plan/budget-2018-en.pdf.

Government of Canada. 2018b. "Report from Canada's Economic Strategy Tables: Health and Biosciences." Last Modified 2018-09-27. https://www.ic.gc.ca/eic/site/098.nsf/eng/00025.html.

Government of Canada. 2018c. "Transfer payments." Last Modified 2018-11-06. https://epe.lac-bac.gc.ca/100/201/301/public_accounts_can/html/2018/recgen/cpc-pac/2018/vol2/isde-ised/pt-tp-eng.html.

Government of Canada. 2019a. *Investing in the Middle Class: Budget 2019.* https://www.budget.gc.ca/2019/docs/plan/budget-2019-en.pdf.

Government of Canada. 2019b. "Transfer payments." Last Modified 2019-12-12. https://epe.lac-bac.gc.ca/100/201/301/public_accounts_can/html/2018/recgen/cpc-pac/2019/vol2/isde-ised/pt-tp-eng.html.

Government of Canada. 2020. "Transfer payments." Last Modified 2020-12-16. https://epe.lac-bac.gc.ca/100/201/301/public_accounts_can/html/2020/recgen/cpc-pac/2020/vol2/isde-ised/pt-tp-eng.html.

Government of Canada. 2021a. *Canada's Biomanufacturing and Life Science Strategy.* Ottawa: Innovation, Science and Economic Development Canada. https://ised-isde.canada.ca/site/biomanufacturing/sites/default/files/attachments/1098_01_21_Biomanufacturing_Strategy_EN_WEB.pdf.

Government of Canada. 2021b. *A Recovery Plan for Jobs, Growth, and Resilience: Budget 2021.* https://www.budget.gc.ca/2021/report-rapport/toc-tdm-en.html.

Government of Canada. 2022a. "Strategic Innovation Fund." Last Modified 2022-07-14. https://www.ic.gc.ca/eic/site/125.nsf/eng/home.

Government of Canada. 2022b. "Transfer payments." Last Modified 2022-02-15. https://epe.lac-bac.gc.ca/100/201/301/public_accounts_can/html/2021/recgen/cpc-pac/2021/vol2/isde-ised/pt-tp-eng.html.

Government of Canada. 2022c. "Business Benefits Finder." Last Modified 2022-07-27. https://innovation.ised-isde.canada.ca/s/?language=en_CA&lang=eng.

Government Offices of Sweden. 2020. *Sweden's National Life Sciences Strategy.* https://www.government.se/4abc0d/contentassets/a8cdfafc39444985973d729ecb95ed63/swedens-national-life-sciences-strategy.pdf.

Holland. 2019. *Health and Care: Knowledge and Innovation Agenda 2020-2023; Vital Functioning Citizens in a Healthy Economy.* https://www.health-holland.com/sites/default/files/downloads/HH%20KIA%20Health%20%26%20Care%202021%20ENG%20WEB_0.pdf.

Health-Holland. 2020. *International Strategy 2020-2023*. https://www.health-holland.com/sites/default/files/downloads/Strategy%20International_1.pdf.

Innovative Medicines Initiative. 2016. *The Innovative Medicines Initiative and Patients — A Partnership.* https://www.imi.europa.eu/sites/default/files/uploads/documents/news-events/events/2016/PatientBrochure2016.pdf.

Life Sciences Queensland. 2022. "Clinical Trials." Accessed July 27, 2022. https://www.lsq.com.au/human-health/clinical-trials/.

Microsoft Corporation. 2013. Retrieved from https://www.microsoft.com/en-ca/microsoft-365/excel?legRedir=true&CorrelationId=5f6b32e0-4f75-40cc-8328-94c630b9711b&rtc=1.

MTPConnect. 2019. *How Global MedTech and Pharma Corporates Engage with Australia*. https://www.mtpconnect.org.au/Category?Action=View&Category_id=203.

MTPConnect. 2020. *Medical Technology, Biotechnology and Pharmaceutical Sector Competitiveness Plan*. https://www.mtpconnect.org.au/images/2020%20MTPConnect%20Sector%20Competitiveness%20Plan.pdf.

National Research Council. Committee on Key Challenge Areas for Convergence and Health. 2014. Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond. Washington, D.C.: National Academy Press. DOI 10.17226/18722.

OECD. 2012. *Knowledge Networks and Markets in the Life Sciences.* Paris: OECD Publishing. http://dx.doi.org/10.1787/9789264168596-en.

Ontario. Ministry of Economic Development, Job Creation and Trade. 2022. *Taking Life Sciences to the Next Level; Ontario's Strategy.* https://www.ontario.ca/files/2022-04/medjct-taking-life-sciences-next-level-ontario-strategy-en-2022-04-07.pdf

Quebec. Ministère de l'Économie et de l'Innovation. 2022*. Utiliser notre ingéniosité pour faire évoluer la santé; Stratégie québécoise des sciences de la vie 2022-2025.* https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/economie/publications-adm/politique/PO_strategie_sciences_vie_2022-2025_MEI.pdf?1654528376.

Regnante, Jeanne. 2021. "Patient Voice in Clinical Trial Programs in Industry." In *Pragmatic Randomized Clinical Trials; Using Primary Data Collection and Electronic Health Records*. Edited by Cynthia Girman and Mary Ritchey. Amsterdam: Academic Press. https://doi.org/10.1016/B978-0-12-817663-4.00026-X.

Research Canada. 2021. *Invigorating the Biopharmaceutical Sector's Contribution to Canada's Health Research Innovation Ecosystem — Report of Research Canada's Expert Advisory Panel*. https://rc-rc.ca/wp-content/uploads/2021/06/Research-Canada_Expert-Advisory-Panel-Final-Report.pdf.

Taylor, Jane, Sjouke Dekker, Diny Jurg, Jon Skandsen, Maureen Grossman, Anne-Karien Marijnissen, Christoph Ladel, Ali Mobasheri, Jon Larkin, Harrie Weinans, and Irene Kanter-Schlifke. 2021. Making the patient voice heard in a research consortium: experiences from an EU project (IMI-APPROACH). *Research Involvement and Engagement* 7(24): 1-15. https://doi.org/10.1186/s40900-021-00267-0.

United Kingdom Office for Life Sciences. 2017. *Life Sciences Industrial Strategy — A Report to the Government from the Life Sciences Sector.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/650447/LifeSciencesIndustrialStrategy_acc2.pdf.

United Kingdom Office for Life Sciences. 2020. *Life Sciences Industrial Strategy Update.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/857348/Life_sciences_industrial_strategy_update.pdf.

United Kingdom Office for Life Sciences. 2021. *Life Sciences Vision.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1013597/life-sciences-vision-2021.pdf.

West, Joel, and Marcel Bogers. 2013. Leveraging External Sources of Innovation: A Review of Research on Open Innovation. *Journal of Product Innovation and Management* 31(4): 814-831. DOI: 10.1111/jpim.12125 .

APPENDIX A

The objective of **the international strategic analysis** was to identify policies comparable in scope and intent with Canada's BLSS. We have limited ourselves to OECD countries and to policies drafted or released *after* Deloitte's 2018 review (see page 4 of this report). For each policy, we went through a systematic thematic analysis to identify policy goals and related means of intervention, such as funding, regulations, governance structures, etc. Other samples of policies could have been instructive, but our objective was not to provide a comprehensive review that would duplicates Deloitte's efforts. It was instead to penetrate into the detail of each strategy to discover common perspectives, common challenges and common goals, beyond what is shaped by each country's specific industrial and scientific landscape in the health life sciences sector. Our conclusions were validated through a process of consultations with a group of experts from the sector.

APPENDIX B

The objective of **the funding program landscape analysis** was to identify health life sciences programs currently supported by the federal government. For each program, we went through an identical process to gather data and constructed a database that details federally funded health life sciences data for each year from 2016 to 2021, where available. This database is the first of its kind to our knowledge in Canada, and focuses on providing information on funding programs as well as business and academic/researcher support for health life sciences in Canada. We expand on our search strategy and program selection and database development approach in the sections that follow.

I. SEARCH STRATEGY AND PROGRAM SELECTION

Our search strategy entailed a three-pronged approach. The first prong included the use of a search-engine widget that had been developed previously in collaboration with a public policy librarian at the University of Calgary to capture grey literature and policy documents. This widget was used alongside the Google search engine and the search-engine features available on federal government agency websites to locate annual reports, funding announcements, and other electronically available documents. The second prong of the search strategy included content analysis on federal budgets from the years 2016, 2017, 2018, 2019, and 2021. We searched for relevant information pertaining to innovation investments, health investments, health innovation investments, life sciences, and bio-sciences. In addition, as the number of times something is mentioned can give insight into a government's priorities, a word-count analysis was undertaken of the keywords "life sciences," "bio-sciences," and "health innovation." The third and final prong of the approach was the federal government's Business Benefits Finder (Government of Canada 2022c) to locate funding streams or programs that may have been missed otherwise.

In addition to the above, for the SIF and JELF programs, the federal government's Public Accounts of Canada archives were consulted to determine the contributions to programs through their respective funding ministries. The intention here was to include an additional layer of analysis to these programs. Much like the way geologists use a small portion of a formation in a core sample to provide analysis, this will present a small sample of the size and scope of some of these programs.

Defining a health life science funding program is challenging for a number of reasons. First, the federal government does not offer a definition of health life sciences, leading researchers to adopt the most robust and applicable definition offered on page 4 of this report. Second, and stemming from the lack of definition, the federal government does not explicitly differentiate between "health life sciences" and "life sciences." To be included in this assessment, a program was required to offer funding at the federal level, have been active in the time frame 2016–2022, provide equal opportunity to all provinces and territories (i.e., not be geographically restricted), and be listed publicly/have publicly available information. If a program met most, but not all, inclusion criteria, it was set aside for further analysis.

We compiled all the collected data and information for each program into a single Excel 2013 spreadsheet (Microsoft Corp. 2013). Repeating this process for each program resulted in the creation of our database.

II. DATA COLLECTION AND DATABASE DEVELOPMENT

A grid was developed in a three-stage process. First, the research team determined a primary list of salient program-specific data. Then, this preliminary grid was piloted with the sponsor, at which point it was both expanded and refined. Finally, at the stakeholder-validation stage, which will be detailed further below, a number of additional categories were added. The following data were determined to be important and extracted from programs that met the inclusion criteria:

- Name of the program and sub-programs, if applicable.
- Funder/funding body.
- The overarching goal(s) of each program, classified as: 1. support domestic growth, 2. improve market access, 3. increase Canadian employment, 4. strengthen research capacity, 5. attract and train highly qualified research and technical personnel, 6. generate knowledge while also generating economic and health benefits, 7. support research facilities.
- The explicitly stated objective(s) of the program.
- The funding life-cycle stage supported, classified as: 1. research, 2. development/applied research, 3. testing/ trials, 4. market/dissemination/uptake.
- The specificity of the funding, classified as: 1. dedicated, 2. included, 3. potential application.
- The total amount of funding available, per application.
- Eligibility considerations.
- Program considerations of equity, diversion, and inclusion principles or acknowledgement of underrepresented categories of applicants (e.g., Indigenous, immigrants, minorities, women, etc.).
- The intended beneficiaries of the program, categorized as: 1. industry, 2. academic institutions and/or research centres, 3. communities and local non-profit organizations.
- Timeline for the program/funding receipt.
- Applicant guide.
- Data source.
- Whether or not the program eligibility stipulates a partnership requirement.

Data collection occurred largely between January 9, 2022 and April 29, 2022, with spot checks and minor modifications to single entries occurring, where needed, through to May 30, 2022.

III. DATABASE

Our database includes the fields indicated above, as well as additional or expanded information in/as comments to specific Excel cells, where applicable, to aid in the interpretation of the data and clarify any nuances. The final database is hosted by Life Sciences Ontario, but portions of its contents can be seen in Appendix B and Appendix C.

IV. VALIDATION

As previously mentioned, this database is thought to be the first of its kind in Canada. Therefore, finding established data sets to compare with for validation purposes proved to be difficult. Thus, to enhance robustness and utility, a validation of the program list, extraction categories, and database was conducted on April 29, 2022 through a round-table discussion with a group of six stakeholders and the research team. This consisted of a presentation of the methodology and database, and facilitated discussion regarding the search strategy and extraction. This round-table validation discussion was conducted on Zoom and was recorded, and lasted approximately two hours. An additional two stakeholders were provided the presentation deck, database, and recorded round table. Stakeholders (eight in total) were asked for feedback and were given until May 6, 2022 to provide it to the research team.

APPENDIX C

As mentioned, there were 122 programs assessed for extraction, 51 of which were programs that satisfied the inclusion criteria completely and are therefore included in the database. Programs that satisfied most of the criteria, but not all, were not exhaustively extracted, but were still categorized and described. This included funding agencies/umbrella agencies, geographically restricted programs, programs that offer business support programs, and support for researchers/academics. These are further discussed below.

I. FUNDING AGENCY/UMBRELLA AGENCY

We discovered nine different funding agencies or "umbrella agencies" that distribute funding and/or operate as granting agencies. These include Canada Foundation for Innovation (CFI), Business Development Bank of Canada (BDC), Tri-Agency/Tri-Council, Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council (NSERC), National Research Council (NRC), Genome Canada, Export Development Canada (EDC), and Trade Commissioner Services (TCS). While the Canada Revenue Agency (CRA) offered the Scientific Research and Experimental Development Tax Incentive Program (SR&ED Program), this program is accessed via tax filing and not application. Therefore, the CRA was not considered to be a funding agency for the purposes of the database (see **Table C.1**).

Table C.1. The funding agencies and funders identified

Funding Agencies	
Agency	**Funder**
Canada Foundation for Innovation (CFI)	Innovation, Science and Economic Development (ISED) portfolio
Business Development Bank of Canada (BDC)	ISED Portfolio
Tri-Agency or Tri-Council	Jointly administered by the Canadian Institutes of Health Research (CIHR), the Social Sciences and Humanities Research Council (SSHRC), and the Natural Sciences and Engineering Research Council of Canada (NSERC)
Canadian Institutes of Health Research (CIHR)	Health portfolio
Natural Sciences and Engineering Research Council (NSERC)	ISED portfolio
National Research Council	ISED portfolio
Genome Canada	Innovation, Science and Economic Development portfolio
Export Development Canada (EDC)	Global Affairs Canada (GAC)
Trade Commissioner Service	GAC

II. GEOGRAPHICALLY RESTRICTED PROGRAMS

Thirty-four geographically restricted programs were discovered. These programs are offered largely through the seven regional development agencies (RDAs) to foster regional growth and innovation. The seven RDAs include the Atlantic Canada Opportunities Agency (ACOA), Canada Economic Development for Quebec Regions (CED), Canadian Northern Economic Development Agency (CanNor), Federal Economic Development Agency for Southern Ontario (FedDev Ontario), Federal Economic Development Agency for Northern Ontario (FedNor), Prairies Economic Development Canada (PrairiesCan), and Pacific Economic Development Canada (PacifiCan). PacifiCan and PrairiesCan were formerly a single agency, Western Economic Diversification Canada. The programs are generally the same (or similar) in multiple RDAs. For example, there is the Regional Economic Growth Through Innovation program, which is a national funding program, but is delivered by CED in Quebec and ACOA in the Atlantic region (see **Table C.2**).

Table C.2. Programs that were funded federally but geographically restricted

Geographically Restricted Programs	
Name	**Funder**
Business Development Program	Innovation, Science and Economic Development (ISED): Atlantic Canada Opportunities Agency (ACOA)
Regional Economic Growth through Innovation (REGI)	ISED: ACOA
The Innovative Communities Fund	ISED: ACOA
Atlantic Innovation Fund	ISED: ACOA
Community Futures	ISED: ACOA
Economic Development Initiative (EDI)	ISED: ACOA
Economic Development Initiative (EDI)	ISED: Canadian Northern Economic Development Agency (CanNor)
Northern Aboriginal Economic Opportunities Program (NAEOP): Community Readiness and Opportunities Planning (CROP)	ISED: CanNor
NAEOP: Entrepreneurship and Business Development (EBD)	ISED: CanNor
Inclusive Diversification and Economic Advancement in the North (IDEANorth)	ISED: CanNor
Jobs and Growth Fund	ISED: CanNor
Regional Economic Growth through Innovation (REGI)	ISED: Canada Economic Development for Quebec Regions (CED)
Quebec Economic Development Program (QEDP)	ISED: CED
Community Futures Program (CFP)	ISED: CED
Jobs and Growth Fund	ISED: Federal Economic Development Agency for Southern Ontario (FedDev Ontario)
Regional Economic Growth through Innovation (REGI)	ISED: FedDev Ontario
Northern Ontario Development Program (NODP)	ISED: FedDev Ontario
Community Futures Program	ISED: FedDev Ontario
Economic Development Initiative (EDI)	ISED: FedDev Ontario

Geographically Restricted Programs	
Name	**Funder**
Business Scale-Up and Productivity (BSP)	ISED: Prairies Economic Development Canada (PrairiesCan)
Economic Development Initiative (EDI)	ISED: PrairiesCan
Regional Innovation Ecosystem	ISED: PrairiesCan
Community Economic Development and Diversification	ISED: PrairiesCan
Strategic Partnerships Initiative	ISED: PrairiesCan
Business Scale-Up and Productivity (BSP)	Pacific Economic Development Canada (PacifiCan)
Economic Development Initiative (EDI)	PacifiCan
Regional Innovation Ecosystem	PacifiCan
Community Economic Development and Diversification	PacifiCan
Strategic Partnerships Initiative	PacifiCan

III. BUSINESS SUPPORT PROGRAMS

There were 14 business support programs identified that offer supports other than funding. For example, the Community Futures Network of Canada (CFCN) provides direct support to local communities through business financing, business support services, community economic development, and strategic planning. Although these programs are not funding programs, they offer valuable support to entrepreneurs (see **Table C.3**).

Table C.3. Programs that offered non-financial supports for business

Support for Business	
Name	**Funder**
Accelerated Growth Service (AGS)	Funded by ISED, delivered by NRC-IRAP, EDC, BDC, GAC: TCS, and the RDAs
BDC Advisory Services	ISED: BDC
Community Futures Network of Canada (CFNC)	Funded by ISED, administered by RDAs
Coordinated Accessible National (CAN) Health Network	ISED
Black Entrepreneurship Program	ISED, administered by the Federation of African Canadian Economics (FACE)
Canadian Technology Accelerators	TCS
MEDTEQ Accelerator	NRC
Digital Technologies Research Centre	NRC
Human Health Therapeutics Research Centre	NRC
Medical Devices Research Centre	NRC
Nanotechnology Research Centre	NRC
The NRC and the University of Toronto Collaborative Centre for Research and Applications in Fluidic Technologies (CRAFT)	NRC
Disruptive Technology Solutions for Cell and Gene Therapy Challenge program	NRC
Pandemic Response Challenge program	NRC

IV. ACADEMIC, RESEARCHER, AND STUDENT SUPPORT

There were 23 programs identified that directly supported academics, researchers, and students. These programs aim to grow Canada's research capacity and promote high-quality research by providing opportunity to graduate students to develop research skills and enhanced training (see **Table C.4**).

Table C.4. Federal government support for academics and researchers directly

Academics and Researchers	
Program	**Source**
Stem Cell Network	https://stemcellnetwork.ca/research/research-funding-opportunities/
Brain Canada Foundation	https://braincanada.ca/
Terry Fox New Investigator Award	https://www.tfri.ca/funding-opportunities/funding-programs/program/new-investigator-program
Vaccine and Infectious Disease Organization — master's, doctoral, and postdoctoral opportunities	https://www.vido.org/careers/training
CIHR Health Research Training Platform	https://cihr-irsc.gc.ca/e/52278.html
CIHR Health Research Training Awards Program — master's, doctoral, and postdoctoral opportunities	https://cihr-irsc.gc.ca/e/50513.html
Tri-Agency Vanier Canada Graduate Scholarships	https://vanier.gc.ca/en/home-accueil.html
Tri-Agency Banning Postdoctoral Fellowship	https://banting.fellowships-bourses.gc.ca/en/home-accueil.html
NSERC Discovery Grants	https://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/DGIGP-PSIGP_eng.asp
NSERC Undergraduate Student Research Awards	https://www.nserc-crsng.gc.ca/Students-Etudiants/UG-PC/USRA-BRPC_eng.asp
NSERC Collaborative Research and Training Experience program	https://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/CREATE-FONCER_eng.asp
Tri-Agency Canada Graduate Scholarships — master's program	https://www.nserc-crsng.gc.ca/Students-Etudiants/PG-CS/CGSM-BESCM_eng.asp
Tri-Agency Canada Graduate Scholarships — doctoral program	https://www.nserc-crsng.gc.ca/Students-Etudiants/PG-CS/CGSD-BESCD_eng.asp
Tri-Agency Vanier Canada Graduate Scholarships Program	https://www.nserc-crsng.gc.ca/Students-Etudiants/PG-CS/VanierCGS-VanierBESC_eng.asp
NSERC Collaborative Research and Training Experience program	https://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/CREATE-FONCER_eng.asp
Tri-Agency Human Frontier Science Program Postdoctoral Fellowship	https://www.hfsp.org/funding/hfsp-funding/postdoctoral-fellowships
NSERC Alliance International Catalyst grants	https://www.nserc-crsng.gc.ca/Innovate-Innover/AllianceInternational-AllianceInternational/index_eng.asp
NSERC Alliance International Collaboration grants	https://www.nserc-crsng.gc.ca/Innovate-Innover/AllianceInternational-AllianceInternational/index_eng.asp
Terry Fox Cancer Research Training Program	https://www.tfri.ca/funding-opportunities/funding-programs/program/cancer-research-training-program

Academics and Researchers	
Program	**Source**
Mitacs Accelerate	https://www.mitacs.ca/en/programs/accelerate
Mitacs Elevate	https://www.mitacs.ca/en/programs/elevate
Mitacs Globalink	https://www.mitacs.ca/en/programs/globalink
Mitacs Step	https://www.mitacs.ca/en/programs/step

APPENDIX D

Table D.1. Full program list of those that met the inclusion criteria and are therefore contained in the database.

Federally funded health life science programs	
Name	**Funder**
Business Development Bank of Canada Financing	Innovation, Science and Economic Development (ISED)
Business Development Bank of Canada Capital	ISED
Business Development Bank of Canada Venture Capital Incentivized Programs (VCIP)	ISED
Innovation Fund	ISED
John R. Evans Leaders Fund	ISED
College Fund	ISED
Major Science Initiatives (MSI) Fund	ISED
Biosciences Research Infrastructure Fund (BRIF)	ISED
Exceptional Opportunities Fund (EOF)	ISED
Genomic Applications Partnership Program (GAPP)	ISED
Precision Health Initiative — Rare Diseases: Clinical Implementation Projects	ISED
Societal Implications of Genomic Research	ISED
Genomics in Society Interdisciplinary Research Teams	ISED
Industrial Research Assistance Plan	ISED
Canada Biomedical Research Fund (CBRF)	Tri-Agency
Strategic Innovation Fund	ISED
adMARE Bioinnovations	ISED
Innovation Superclusters	ISED
Scientific Research and Experimental Development (SR&ED) Tax Incentive Program	Canada Revenue Agency (CRA)
Innovative Solutions Canada	ISED
Project Grant Program	Canadian Institutes of Health Research (CIHR)
Discovery Grants	Natural Sciences and Engineering Research Council (NSERC)
Discovery Development Grant	NSERC
Discovery Accelerator Supplements program (DAS)	NSERC
Discovery Institutes Support (DIS) grants	NSERC
Research Tools and Instruments (RTI) grants program	NSERC
Discovery Frontiers	NSERC
Emerging Infectious Diseases Modelling Initiative	NSERC
Human Frontier Science Program (HFSP)	Tri-Agency
Foundation Grant Program	CIHR

Alliance Grants	NSERC
Alliance Missions	NSERC
College and Community Innovation Program	Tri-Agency
Ideation Fund	National Research Council (NRC)
CDQM Quantum Leap	CIHR
Terry Fox New Frontiers Program Project Grants	CIHR, ISED
Strategic Science Fund	ISED
Investment Matching Program	Export Development Canada (EDC)
Research Support Fund	Tri-Agency

Table D.2. The list of programs that met the inclusion criteria, although were thought to be of limited impact due to tight or very specific and restricted eligibility, low funding levels, or the objectives are thought to be peripheral to the sector

Programs with Limited Impact	
Name	**Funder**
CanExport Community Investments	Global Affairs Canada (GAC): Trade Commissioner Service (TCS)
CanExport SMEs	GAC: TCS
CanExport Associations	GAC: TCS
CanExport Community Investments	GAC: TCS
Canadian International Innovation Program (CIIP) — Partnership Development Activities	GAC: TCS
CIIP Collaborative Research and Development Projects	National Research Council's Industrial Research Assistant Program (NRC IRAP)
Futurpreneur	Innovation, Science and Economic Development (ISED)
Canadian Immunization Research Network	CIHR and Public Health Agency of Canada (PHAC)
Black Entrepreneurship Program	ISED
Women Entrepreneurship Strategy — Women Entrepreneurship Loan Fund	ISED
Women Entrepreneurship Strategy — WES Ecosystem Fund	ISED
College and Community Innovation Program — College and Community Innovation Fund	Tri-Agency

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