UNLOCKING INNOVATION TO DRIVE SCALE AND GROWTH

ADVISORY COUNCIL ON ECONOMIC GROWTH
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Introduction

In an era of uncertainty, change, and unprecedented technological shifts, the imperative for innovation will rise. Innovation is crucial to addressing the core challenge of maintaining living standards and growing our economic output as the population ages and labour-force growth slows. Through innovation, Canadian firms can improve their productivity—such as by finding smarter, better ways to use capital and labour so that they can produce more output for the same level of input. Moreover, innovation can broaden the benefits of growth to more Canadians in the middle class, even as automation fundamentally changes today's jobs, by making Canadian firms global leaders in the jobs of tomorrow.

Fortunately, as a leading open economy with a world-class yet affordable education system, a diverse workforce, and assets ranging from natural resources to the country's reputation for tolerance and fairness, Canada has the tools to ride this next wave of global change, and to help lead it. Canadian students' science, math, and reading scores consistently rank in the top five among OECD nations. Our strong safety net ensures that Canadians are able to share in the country's good fortune, while making Canada a highly attractive choice for top students and talent from around the world. These attributes will help us excel in the sectors and technologies that promise to drive inclusive growth—if our execution matches our ambition. Now is the time to think strategically about our assets, our gaps and how our country can think creatively to further catalyze, and sustain, a nationwide ecosystem that fosters and supports innovation—and creates wealth for all Canadians.

The traditional engines of Canadian economic growth are slowing. As the past few years have shown, Canada cannot rely exclusively on commodities. Nor can it rely on a steadily increasing workforce: employment growth is expected to fall to an annual rate of 0.3 percent from 2014 to 2064, compared with 2 percent increase per year from 1964 to 2014. Meanwhile, the boost that Canada derived from trade liberalization in the past three decades has effectively flat lined since 2000, although there is still great opportunity to improve trade.

Innovation can play a major role in delivering the GDP growth needed to meet Canada's ambitious objectives of increasing productivity, driving inclusive growth, and helping to create conditions for entrepreneurial companies to scale up and become global champions. As the world moves briskly towards digitization and automation, Canada must adapt. We must exploit our advantages to drive the innovative thinking that creates high-value, specialized jobs that are more resilient to technological change and that allow middle-class families to enjoy prosperous livelihoods. At the same time, we must ensure Canadians have the skills and training to seize these new opportunities. For this reason, the Council believes the following innovation-specific recommendations must be complemented by initiatives to improve skills training and workforce participation, as discussed in our other recommendations.[1]

A Mutually Reinforcing Suite of Initiatives

We believe that the following five interventions can help boost Canada's innovation agenda:

1. Catalyze the formation of business-led "innovation marketplaces" in sectors and technologies where Canada has momentum and where market participants need new solutions.

2. Create additional pools of growth capital to ensure promising companies have sufficient capital to scale up and access to investors who can provide advice and other value-added support.

3. Modify our government procurement policy to incorporate strategic procurement and innovation as a key objective. A shift from a requirements-focused to a value-based procurement system will facilitate the government and other public-sector players becoming important first customers, to test and validate Canadian innovative solutions.

4. Review and rationalize government innovation programs, then scale up those that have proven impact. Review regulatory barriers and remove or re-tool those that would impede development of priority sectors and innovation marketplaces.

5. Expedite entry for top talent through immigration policy that helps reduce a talent shortfall for high-growth companies, and invigorate the talent pool through a focused innovation talent strategy and the FutureSkills Canada program.[2]

The Case for Change: Canada's Innovation Opportunity

Why innovation?

"Innovation" is a broad term that includes categories like product, process, marketing, and organization.[3] It has a clear and positive impact on the productivity of firms.[4] Innovative economies are "more productive, more resilient, more adaptable to change, and better able to support higher living standards".[5] Innovation is the "secret sauce" driving productivity across the economy, and is often the foundation of job-creating clusters and Canadian champions.

Commercial innovation creates value and high-quality jobs across the economy. Innovation-focused jobs tend to be high paying and drive job growth for the middle class. These jobs have a very high "multiplier effect"—meaning they create more indirect jobs across all income groups, such as lawyers, doctors, retail workers, etc.[6] High-skilled, higher-wage jobs are also at a lower risk of being negatively affected by automation.[7] "Moving up the value chain" through innovation has the potential to create more specialized jobs in areas facing automation, thereby creating opportunities for displaced workers.[8] Innovation, however, is by no means a guarantee of inclusive growth. Technological disruption can lead to job displacement and short- and medium-term gains tend to favour those with higher skills. Nevertheless, the Council strongly believes that Canada should aim to make a step change improvement in its innovation performance, in order to drive more resilience and productivity growth within its economy. In addition, Canada should seek to equip workers with the skills they will need to thrive in this innovative economy and encourage labour force participation among underrepresented groups in the population. The Council has developed specific recommendations to this effect.[9]

Canada's opportunity

The time is now for Canada to raise its innovation capacity if it is to become more globally competitive and drive economic growth.

Canada has many ingredients of a successful innovation ecosystem. This includes good universities and recognized research strengths, a history of entrepreneurship, significant support and infrastructure for start-ups, and some emerging clusters that could become globally competitive. These are important ingredients for fostering successful innovation.

However, the "recipe" for innovation is elusive. The innovation ecosystem is complex and this Council has not identified any silver-bullet solution. That said, three specific bottlenecks in the ecosystem do appear to be contributing to the country's underperformance in this area:

- a gap between invention and revenue-generating commercialization
- a struggle to scale up successful start-ups and small and medium-sized enterprises (SMEs)
- no burning platform for corporate adoption of innovation

A gap between invention and revenue-generating commercialization

The country does not benefit as much as it should from the intellectual property that it generates. Neither government, business, nor academia has completely solved this conundrum and none will be able to solve it on its own. Several indicators suggest that these groups are not interacting as much as they could. For example, in 2012, Canadian higher-education institutions created approximately 16 licences per institution compared with about 35 in the United States. Furthermore, Canada's ranking on business-university R&D collaboration declined to 19th place in 2015.[10] The reasons for this are complex and interrelated, including a lack of local R&D-intensive corporations to develop and adopt inventions, a lack of qualified staff within universities and companies to build relationships and broker collaboration, and insufficient funding to support early and risky commercialization activities.

Several programs have attempted to bridge this innovation gap. However, our persistent lack of improvement on this dimension calls for a new approach.

Canada is good at starting companies but struggles to scale them up

One of the fundamental problems with Canadian innovation is that even though our entrepreneurs are good at launching companies, very few companies achieve significant scale. Starting a business in Canada is relatively easy: in fact, according to rankings by the World Economic Forum, Canada ranks second in ease of establishing a new firm. The problem is that many companies do not grow after a certain point. The reasons are complex and include a small and fragmented local market, shortages of experienced business talent, a lack of at-scale sources of growth capital, and an aversion to risk on the part of some of Canada's established companies.

As a result, company growth is often stunted. Small firms account for about half of business sector employment in Canada versus just over one-third in the United States.[11] This lack of scale accounts for

20 percent of the labour productivity gap between Canada's business sector and that of the United States.[12] Canada's start-ups also have smaller exits and face a longer path to exit than their American counterparts. For example, a survey of exit events in Canada and the United States since 2000 found that only 1 percent of Canadian exits occurred with a valuation of more than $500 million, compared with 10 percent of exits in the United States.[13] This lack of scaling has started to take a toll on Canadian competitiveness: the nation had 18 global industry leaders in 1990, while in 2015 it had just five.[14]

No burning platform for corporate adoption of innovation

Canada's corporations, on average, do not innovate nor adopt innovation as quickly as those in other developed economies. Canadian business R&D spending is persistently half the US rate, with a large variance among sectors and geographies.[15] Furthermore, Canada's ranking in the OECD Business Expenditure on Research and Development index fell from 12th place in 2001 to 22nd in 2015.[16] R&D investment varies by sector and size of company: sectors that are most exposed to competition through international trade tend to invest more in R&D than those that are not.[17] Though R&D expenditure metrics are admittedly imperfect, they do represent an indicative proxy of the level of corporate adoption of innovation. A recent survey found that only 30 percent of Canadian firms consider any form of innovation to be extremely or very important, and just 15 per cent would assume significant financial risks in the pursuit of innovation.[18]

Part of the reason business R&D investment has not been a priority is that many Canadian firms have been able to prosper in their chosen niches and have settled into a low-innovation equilibrium.[19] Several factors could explain such complacency, including regulatory protections, the depreciation of the Canadian dollar, trade with the United States, strong demand for Canada's natural resources, and low competitive intensity in some sectors.

Multinationals active in Canada could also contribute further to increasing Canada's R&D intensity, which is necessary to counter current trends.

Canada needs to fortify its innovation ecosystem

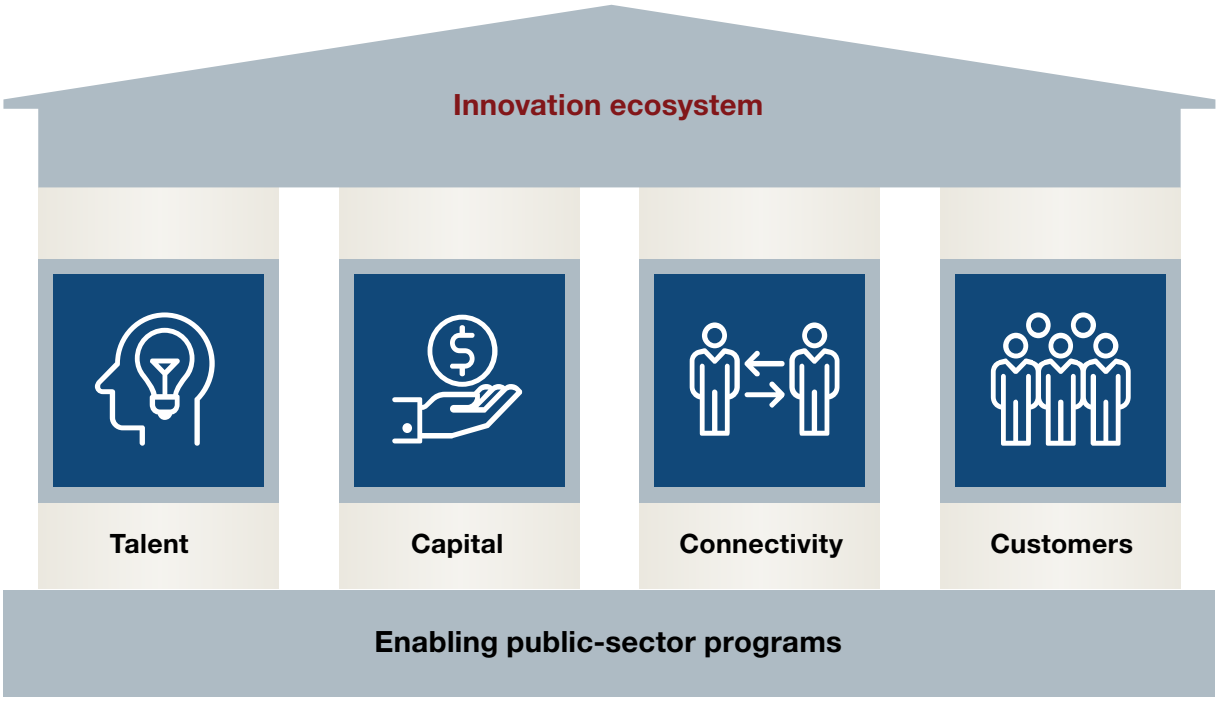
None of these bottlenecks has an obvious solution. In fact, the Council believes that an ecosystem lens is required to improve the country's innovation outcomes.

Furthermore, as Exhibit 1 illustrates, we believe that there are five critical elements in the innovation ecosystem that enable companies to grow into industry leaders: access to talent, capital, connectivity, customers, and enabling public-sector programs.

The Council has identified opportunities for improvement in each of these areas in Canada:

- Finding *experienced* talent: More than half of technology company founders (53 percent) say the biggest obstacle to growth is finding and hiring experienced business talent. They are particularly hard pressed to find senior managers in areas such as business development, sales, and marketing, particularly those with global experience.[20] This is another result of the scale problem: Canada has relatively few companies

Exhibit 1 **Framework for a functioning innovation ecosystem**



that have scaled through all stages of growth nor large companies to train this type of talent. At the same time, immigration processes make it difficult for companies to quickly hire managerial talent from abroad, although this has begun to change.[21]

- Limited access to value-added capital: There is evidence that young Canadian firms would benefit from bigger injections of expansion capital. In a survey, more than twice as many fast-growing companies in Canada cited insufficient access to risk capital as their greatest concern in comparison with high-growth firms in the United States.[22] The average later-stage venture deal (B or C rounds) is 41 percent smaller than such deals south of the border.[23] Moreover, only a few Canadian venture funds specialize in capital-intensive sectors such as healthcare and clean technology ("cleantech"), where funding gaps persist across the lifecycle. Even more important than capital is the value-added support that world-class venture investors can bring. Although strong value-adding investors exist in Canada, this network is also subscale and fragmented. In addition to funding, top-tier professional investors bring relevant experience and connections, including badly needed operational expertise and relationships with customers and top industry talent—all of which can be critical to accelerating growth.

- Low connectivity: Fast-growing companies, particularly tech companies, thrive in an atmosphere where there is a critical mass of talent and knowledge—where companies can connect with customers, partners, start-ups, investors, universities, and vice versa. The few anchor companies that we do have are not

well connected to these clusters or to the broader innovation ecosystem and could benefit from these productivity-enhancing relationships. Universities benefit from connectivity through commercializing their inventions and in finding jobs for their graduates.

- Lack of local customers: Young companies need access to customers—commercial and government—to grow quickly. In general, Canadian corporations are relatively slow to adopt new technology and seem reluctant to buy from young or smaller firms. Large corporations can accelerate small-company growth not only by acting as first customers, but also by referring small companies to other potential customers in their supply chains. Currently, the average large Canadian company purchases around C $728 million in goods and services from SMEs, compared with C $2.7 billion for similar-size US companies.[24] Government can also support fast-growing businesses by using strategic procurement policies to be a first customer, particularly in regulated sectors such as healthcare and energy.

- Poorly coordinated public-sector programs and regulations: There are dozens of different programs relating to innovation in Canada, but the overall effort is diffused, which limits effectiveness. There is an opportunity to use evidence-based evaluation and a rigorous metrics-driven approach to better allocate resources. At present we offer a range of programs created by various governments at different times with limited data on effectiveness. As the nation's performance on innovation continues to lag, it appears these programs are not making the difference they intended.

In addition, the Council received considerable input on promoting and encouraging more of an "innovation culture" in Canada, including greater ambition and higher tolerance for risk and failure. We believe a mindset shift could be promoted through initiatives that celebrate innovation, such as the Governor General's Innovation Awards and events like National Innovation Week.

Recommendations

In this paper, the Council presents a series of five interlocking recommendations to address the issues outlined above, accelerate innovation, and help more Canadian start-ups and SMEs achieve scale. These recommendations have been crafted with five principles in mind: place more emphasis on demand pull over supply-push programs; scale up what is working; focus programs and resources where Canada can win; be bold yet ready to fail and use metrics to turn around quickly; and act with a sense of urgency. Together, these initiatives would help Canada raise its global competitiveness, achieve inclusive growth goals, and create a more resilient economy and labour force.

- Recommendation 1: Create innovation marketplaces to foster commercialization and technology adoption.

- Recommendation 2: Build a value added growth capital strategy focused on Canada's fastest-growing firms.

- Recommendation 3: Implement a strategic public procurement program allowing the government to act as a first customer for innovative Canadian companies.

- Recommendation 4: Review and rationalize government business innovation programming.

- A fifth recommendation, on simplifying the attraction and retention process for top global talent, was published in October 2016.[25]

Recommendation 1: Innovation marketplaces

The opportunity

Canada has developed key aspects of a successful innovation ecosystem, but its efforts are subscale and uncoordinated. Specifically, while Canada has a strong base of talent, large firms, high-growth SMEs, and research infrastructure, these stakeholders are not collaborating sufficiently. The Council believes that three problems must be tackled: insufficient corporate and government adoption of innovation from start-ups, SMEs, universities, and government research; a lack of translation of inventions into commercial innovation; and a lack of local customers for start-ups and SMEs, which hinders their ability to reach scale.

Rapid change and wholesale disruption are markers of the world we live in. Canada has the opportunity to evolve its innovation programs to keep up with this change. Current systems do not allow for the speed required to compete nor the connectivity among universities, SMEs and start-ups, corporates, and government required to reach our full potential. We need a more dynamic system of continual iteration and adjustment, to amplify innovations that are working and squelch those that are not. We also do not have the size and scale to simply let “1,000 flowers bloom”. The time has come for new ways of working, to set a new course for Canada’s innovation economy, create innovation at scale and set a course for becoming an innovation powerhouse.

Catalyzing “innovation marketplaces” and helping them reach scale

More selection, focus, coordination, curation, and scale are required in our innovation ecosystem. The Council recommends the government focus on catalyzing “innovation marketplaces” with the goal of achieving national and globally significant scale in key sectors and technologies. Marketplaces are centers of technology and industry activity that are developed and driven by the private sector.

An innovation marketplace brings together researchers and entrepreneurs with public and private customers around a common business challenge. These marketplaces match innovation demand from corporations and governments with innovation supply from researchers and entrepreneurs. This matchmaking strengthens supply-chain relationships and the flow of information, thereby fueling further innovation.

In our view, innovation marketplaces would benefit all concerned. Companies that come up with world-class ideas could find new customers on their doorstep, develop their talent, and connect with new sources of capital. Established companies could enjoy faster growth, better access to new products and markets, and, perhaps, global competitive advantage. Both kinds of companies, incumbents and new entrants, could come together to identify the business problems that need solving. And Canada’s workers and communities could flourish as new jobs open up and local economies are revitalized. Moreover, an increased emphasis on innovation and creativity could lead to a more diversified and inclusive economy, as more members of

underrepresented groups such as women, youth, older Canadians, Aboriginal Canadians and other minorities are encouraged to bring their creativity and crucial perspectives to the table—and are supported once they do.

More specifically, the Council believes that marketplaces could spur corporations to adopt innovation and buy from young innovative firms by improving connectivity and sharing investment risk. By connecting firms, start-ups, SMEs, and research institutes (including university and government labs), well-functioning marketplaces could set in motion network effects and eventually reach national and then global scale. By spreading risks, marketplace participants would be better placed to invest in game-changing technologies.

At the same time, the government should not take undue risk when selecting marketplaces to scale up. We recommend a "test and validate" approach to catalyzing marketplaces, which would begin by funding a larger number of proposals (e.g., 10–15), and scaling up those that demonstrate success (resulting in 3–5 larger marketplaces).

Box 1

Why innovation marketplaces?

The Council applauds the Ministry of Innovation, Science and Economic Development's ambition to revitalize Canada's innovation landscape, including his proposal to form a series of "Superclusters", funded at scale, in areas where Canada has already developed a competitive edge.

As we are facing an era of rapid and unprecedented technological change, the Council has been considering new approaches to mobilize our full innovation capacity (from research to early scaling firms to our high-performing corporations) on market-relevant growth challenges and opportunities. We have taken learnings from leading models around the world, and adapted those to our geographic and business context. We believe a new approach is required, including:

- Significant private-sector leadership, investment, and involvement
- A data-driven and results-oriented selection and monitoring process
- Lean, agile, and accountable governance
- Capacity to support new technologies and market opportunities as they emerge
- Stage-gated funding approach
- Scaling what works—backing our winners

The Council's recommendation for "innovation marketplaces" attempts to provide guideposts to gaining advantage through such a new approach. This proposal was designed to complement our suite of innovation recommendations, as well as the Council's broader portfolio of ideas, especially our Driving Growth Through Sectoral Strategies proposal. We believe marketplaces would provide the foundation for a dynamic and ambitious innovation economy.

The concept builds on global best practices from Germany, the United Kingdom, and the United States, among others. The US manufacturing sector has formed (with catalytic government support) nine regional hubs to solve advanced manufacturing challenges under the rubric "Manufacturing USA." Another American marketplace focused on energy, ARPA-E, is a particularly relevant model with several aspects worth considering for the creation of future Canadian innovation programs. (See the Appendix for this and other case studies.)

We have adapted these global examples to Canada's unique geography and diverse regional economies in an effort to build on our national strengths. Marketplaces are already forming in Canada—for example, the oil and gas sector has formed a network (Canada's Oil Sands Innovation Alliance, or COSIA) to solve the water, air, and greenhouse gas-emission challenges it faces. This consortium was formed so that oil sands companies could share intellectual property (IP) related to environmental issues. Although the industry did not have a culture of cooperation, COSIA now allows companies to access and share billions of dollars-worth of intellectual property. It has also expanded to a much broader range of collaborative activities, including developing its own IP and a competition for technologies that transform carbon into marketable end products.

In this recommendation, we outline our vision for innovation marketplaces: their guiding principles; the "how-to" of making them work, including sharply defined roles for private sector and government; their selection approach; and their governance.

Core principles

Innovation marketplaces should reflect certain core principles and characteristics as follows:

- Originate through market pull—To qualify for investment, marketplaces must address real business needs articulated by private-sector stakeholders who demonstrate leadership and commitment by putting financial "skin in the game," as well as committing people and other resources.

- Include a risk-sharing objective—Marketplaces would co-fund projects for which the risk and cost of innovation would be difficult for a single actor to bear. The private sector would provide 50 percent of the capital required at a minimum.

- Demonstrate the potential for national then global scale—Marketplaces should have a bold vision, show the potential for significant impact on both the domestic economy and exports, in target sectors or technologies where Canada already has strong momentum and some form of competitive advantage.

- Include multiple partners—Marketplaces would involve a partnership among several companies, technology-driven start-ups and SMEs, university researchers, and, in their role as buyers of goods and services, public-sector agencies—such as governments, hospitals, the National Research Council (NRC), and so on. Marketplaces would engage all relevant players in a single ecosystem, and connect with programs sponsored by provinces, municipalities, and research institutions to maximize the "spillover" of innovation in the community.

Box 2

What could an innovation marketplace look like?

Innovation marketplaces could emerge around a number of different technologies or sectors. For example, Canada has built momentum in "platform technologies" like artificial intelligence, genomics, and energy storage, as well as in core sectors like energy and renewables, agriculture, and financial services. Innovation marketplaces could also be leveraged to tackle a number of inclusive growth challenges, such as social innovation and public service delivery.

Clean technology

Canada has invested steadily in clean technology ("cleantech") for the past decade. Combined with a strong entrepreneurial ecosystem, we have a maturing cleantech sector with a healthy number of market-ready companies poised to compete globally and deliver strong export revenues in large overseas markets. However, the industry has unique barriers to scale: it is capital intensive and includes systemic adoption constraints.

A cleantech related marketplace could drive innovation and growth in two ways:

- Bring forward customers: Have private-sector firms commit to acting as first customers and public entities commit to buying through strategic procurement in a specific clean technology, e.g. in green buildings/infrastructure or energy storage. By taking a focused approach to leveraging our cleantech assets, Canada could spark collaboration between industry and government, reward early adopters and outcomes, and attract the private capital necessary to implement projects at scale.

- Accelerate adoption by modernizing regulation: A responsive and enabling regulatory framework would help propel cleantech innovation while attracting and retaining global-leading companies. Specific modernizations could include ideas like expedited permitting timelines for cleantech companies.

Artificial intelligence

Canada has a strong history of innovation in artificial intelligence (AI). Some of the earliest AI developments came from Canadian researchers, and major Canadian research institutions have moved to entrench their early advantage. This will have far-reaching impact on almost all sectors of our economy. However, the commercialization of AI research has been slowed by a few factors, including a lack of coordination between research institutes and slow adoption by corporate and government customers.

An AI marketplace could strengthen Canada's AI advantage in two ways:

- Bring together research capacity: Facilitate coordination between research and innovators at Canadian institutes in Toronto-Waterloo, Montreal, and Vancouver, while providing a common "brand" to attract innovators from abroad.

- Foster connections and promote early adoption: Bring AI innovators together with corporate and government customers to identify and solve real commercial challenges. This would provide a "springboard" for AI technology to export globally, while enabling Canadian companies in a range of sectors to stay ahead of the technology curve.

- Focus on leading-edge innovation—The purpose of innovation marketplaces would be to drive competitiveness and exports through commercialization and adoption of leading-edge innovation (technologies and processes), not to support product or process improvements that should be the normal course of business.

- Include success metrics—The performance of the marketplace program would be relentlessly assessed with data and against target outcomes. The program would be benchmarked against international peers at the outset and at regular intervals thereafter, to track performance and incorporate global best practices.

- Play matchmaker for talent—Innovation is fuelled by talented people. Marketplace management teams would actively connect the brightest and best people in their domains, forging links between critical experts in established and emerging firms, young talent and relevant stakeholders in the ecosystem, local and international supply chain partners, regulators, and so on. The marketplace for talent would serve as a resource for participants beyond the boundaries of a given project, and thus spawn further collaboration and new avenues for growth.

Forming innovation marketplaces

Both the private and public sectors have a role to play in the formation of marketplaces. The Council envisions marketplace formation being led by the private sector with support from government agencies and departments, in particular the Department of Innovation, Science and Economic Development (ISED). We expect that marketplaces will be an important component of sector strategies, as recommended by the Council.

Role of the private sector

- Assemble consortia of like-minded companies interested in investing in a technology platform, collaborating to solve a shared problem, or strengthening sector capacity in a manner that could significantly increase productivity and global competitiveness in their industries.

- Develop bold plans outlining their ambition and commitment to the marketplace. The plans would outline proposed collaboration models and priorities, commitments for direct funding, in-kind support including personnel, and key performance indicators (KPIs) that measure impact and scale on a national and global basis. The plan would likely call for phased development, with key milestones to demonstrate progress against larger goals as prerequisites for further investment. The program would recognize that plans may change as the marketplaces learn and optimize.

- Establish a leadership and operating model, as well as a governance structure for each marketplace, reflecting the roles and contributions of the partners. Marketplaces should build on available capacity and use relevant expertise to keep momentum.

Role of the government

The government could provide substantial convening and informational support to marketplace formation. As we've seen, Canadian researchers and companies do not interact as closely as they could.
The government could also provide financial and operational support to mitigate risk and stimulate private-sector investment.

The government's initial role would include soliciting bids, such as by:

- Promoting the innovation marketplace program to companies and stakeholders that could be interested by the idea

- Encouraging private-sector-led consortia to come together. An open call would be necessary and would need to be on-going so as to promote the best marketplaces as they emerge. Some preliminary work may be required to cultivate the formation of ambitious consortia.

Once launched, the government should support marketplaces that are making appropriate progress, by:

- Co-funding part of each marketplace's overhead and projects that benefit multiple industry players and where corporate sponsors commit to providing at least 50 percent of the capital needed to de-risk the project. This capital could be allocated in stages based on project milestones.

- Providing regulatory support including a fast-track process for high-priority marketplaces to help them navigate their regulatory environment and modernize regulations where warranted.

- Acting as a "first customer," where appropriate, through targeted strategic procurement programs. For instance, procurement programs can create competitive marketplaces when used within the supply chain of major prime contractors to the government.

- Connecting marketplaces to government programs and resources where needed. For example, the NRC or other institutes could become important sources of people and equipment for marketplace-sponsored projects.

- Featuring marketplaces in international marketing of Canada's innovation assets and efforts to attract greater trade, foreign direct investment, risk capital and talent, as well as infrastructure investments, to generate a "flywheel" effect.

Marketplace selection and management

The Council wishes to emphasize the importance of a shift to an agile, expert, and metrics-driven selection approach. The Council feels strongly that rapid advances in technology and shifting market dynamics will demand a disciplined selection approach coupled with ongoing results-focused program management. The Minister of Innovation, Science and Economic Development should appoint an independent oversight organization to select the marketplaces, continually monitor their performance, and make regular recommendations for future support. The Minister should ensure that the group has the independence, expertise, flexibility, and authority required to carry out this new agile oversight model, such as:

- Deep technology and sectoral expertise with the ability to marshal critical external resources when required. Marketplace proposals are expected in a broad range of technologies and sectors. It would be impractical for a committee to possess every necessary expertise. However, committee members should find the right expertise to support their work.

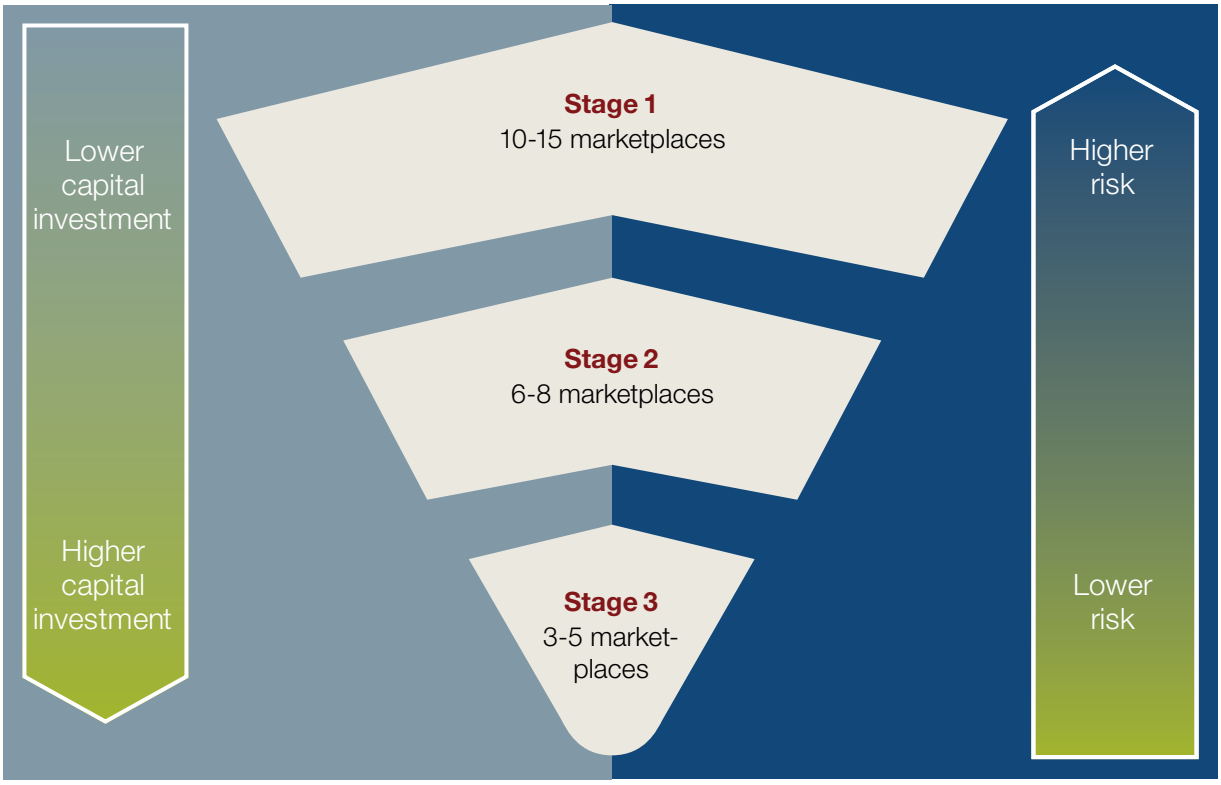
- Milestone approach based on progress and results. Initial selection and the level of follow-on investment decisions should be based on the merits of the marketplace, as evidenced in adherence to core principles and progress on KPIs.

- Ability to execute in an iterative and agile manner. We live in a world of rapid change, and while many of the proposed elements of government's role may seem familiar, the pace of change demands a more agile and iterative way of working with partners to drive outcomes. The Council wishes to emphasize the importance of an agile model where marketplaces are continually validated and funding is channelled to those demonstrating success.

The oversight organization should follow a three-stage approach (Exhibit 2).

Stage 1: Proposed marketplaces are evaluated on core principles outlined above in an ongoing, open-door evaluative process. All selected marketplaces should have potential to reach scale, but risk at these early stages is high. We expect that up to 10 or 15 marketplaces would be eligible for stage 1 funding, and each should be given enough support to reach critical milestones for stage 2.

Exhibit 2 **Process of selecting innovation marketplaces**



Stage 2: Periodic check-ins (e.g. quarterly) are held with marketplace leaders (akin to meetings of a board of directors). The oversight body could assist the marketplace in achieving its goals. It would evaluate funding needs after an appropriate timeframe depending on the sector. Those marketplaces that reach their key performance indicators (KPIs) could receive more funding.

Stage 3: Remaining marketplaces are evaluated after a further period appropriate for the sector. Those marketplaces that reach their KPIs would receive more funding.

The marketplace selection and funding process should be ongoing such that new marketplaces could be funded at any time. The selection process should be agile, dynamic and evergreen.

Governance model

The Council believes that marketplace selection, governance, and progress-tracking would benefit from an entirely new governance model. To support the iterative approach outlined above, the Council suggests creating an oversight organization where these principles are embedded. While the organization could take a few forms (for example, a new body or a division within ISED), it should be as independent as possible, given the difficulty in implementing this type of approach within government.

Once validated, this new iterative approach could be applied to other programs as applicable following the completion of an Innovation Program Review.[26] Over time, the government could shape a fast-moving, metrics-driven, agile agency, with multiple programs at scale, fit for purpose in the fast-moving 21st century.

Connecting to sectors, and getting to scale

The Council recommends that the government map the sectors and opportunities in Canada's key economic sectors. If such a map were developed for Canada's largest economic sectors, it would illuminate the global growth opportunity over the next decade—starting with our strengths, what is working, what is emerging internationally, and identifying clearly where Canada can win and what needs to be done to win. As outlined in the Council's Sector recommendation, these strategies should be led by the private sector in collaboration with relevant public and academic bodies. New collaborations might emerge, as well as a robust, data-driven, and ambitious national strategy. Likewise, new marketplace partnerships could take shape. Beyond that direct impact, these plans could serve to benchmark the impact of selected marketplaces on moving the economic needle to reach our full innovation potential.

APPENDIX: CASE STUDIES

ARPA-E

The American ARPA-E program is noteworthy for its cutting-edge research and iterative governance model. The Council believes that this rigorous but competitive approach could provide a useful template for the innovation marketplace governance model.

ARPA-E was designed in 2005 to help the United States tackle pressing energy challenges. On the selection front, ARPA-E mixes calls for proposals on specific technical barriers alongside open calls for proposals for any energy-related technology. This combination approach draws on the ARPA-E leaders' expertise while

still letting the market bring forward interesting ideas. ARPA-E projects typically require some level of cost sharing with the recipient, although the exact amount depends on the technology.

The program resides in the Department of Energy but employs an independent and highly skilled team to handle project selection and management. The management team decides if projects have the technical merit to be considered an innovative platform technology as well as the potential to make an impact on the market. ARPA-E is explicitly designed to start projects quickly, monitor their success, and quickly terminate projects that do not reach their milestones. ARPA-E professionals have a limited five-year mandate within the organization, after which they return to their home organization, bringing with them their ARPA-E experience.

The program had a budget of US $280 million in 2015.

Manufacturing USA

Manufacturing USA is a US federal government initiative designed to foster innovation and excellence in the manufacturing sector. It consists of a network of 15 public-private regional institutes designed to serve as hubs of manufacturing excellence, in which federal funding (up to US $70 million) is matched or exceeded by private industry and other non-government sources. Over time, the institutes are expected to become financially independent, either through separate project funding or corporate memberships for shared IP schemes.

The program is overseen by an interagency office housed in the Department of Commerce and includes a team of public servants and manufacturing fellows dedicated to managing the program.

Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft is a German applied research organization operating through 67 institutes and research units spread throughout Germany. Only 30 percent of the core funding comes from governments. Corporations or groups of corporations typically approach specialized institutes with a specific challenge and galvanize research programs with major investments. The institutes also contract with a wide range of other private and public-sector customers in their zones of applied research expertise. Total Fraunhofer-Gesellschaft staff is 24,000, with an annual research budget exceeding €2.1 billion; €1.8 billion of this comes from contract research, the majority of which is from private-sector customers.

Recommendation 2: Scaling our high-potential businesses through growth capital

The opportunity: accelerate growth with value-add support and investment

From start-ups to third-generation family enterprises, there are 1.2 million small and medium- sized enterprises in Canada. These businesses drive more than half of Canada's GDP and account for 63 percent of private-sector employment.[27] Canada has an SME and start-up ecosystem that is healthy in many respects: we rank second globally in ease of starting a business and we have strong universities that generate significant knowledge and skills which can be commercialized.

Where Canada falls short, however, is in scaling its high potential businesses. Larger businesses are a key driver of productivity and employment needed for inclusive growth. Small firms account for about half of business sector employment in Canada versus just over one-third in the United States.[28]

Two groups of businesses warrant particular attention, and are collectively referred to herein as "high-potential SMEs":

- Early- and expansion-stage SMEs are high-growth firms that develop and commercialize new technologies, some of them game-changers. These firms typically grow at over 40 percent a year in revenues and some have the potential to become anchor companies.

- Established high-impact SMEs are found across all sectors and all regions of the economy, and are responsible for a disproportionate amount of Canada's economic and job growth. These firms are defined as growing at over 20 percent per year in revenues, have at least C $10 million in revenue, have the potential to export, and are led by dynamic and risk-tolerant entrepreneurs.[29]

It is worth noting that the majority of these firms are not backed by venture capital. While venture capital-backed firms are important, focusing solely on these firms would likely exclude many high potential firms that are not within VC focus sectors, as well as more established firms that have a lower risk-return profile.

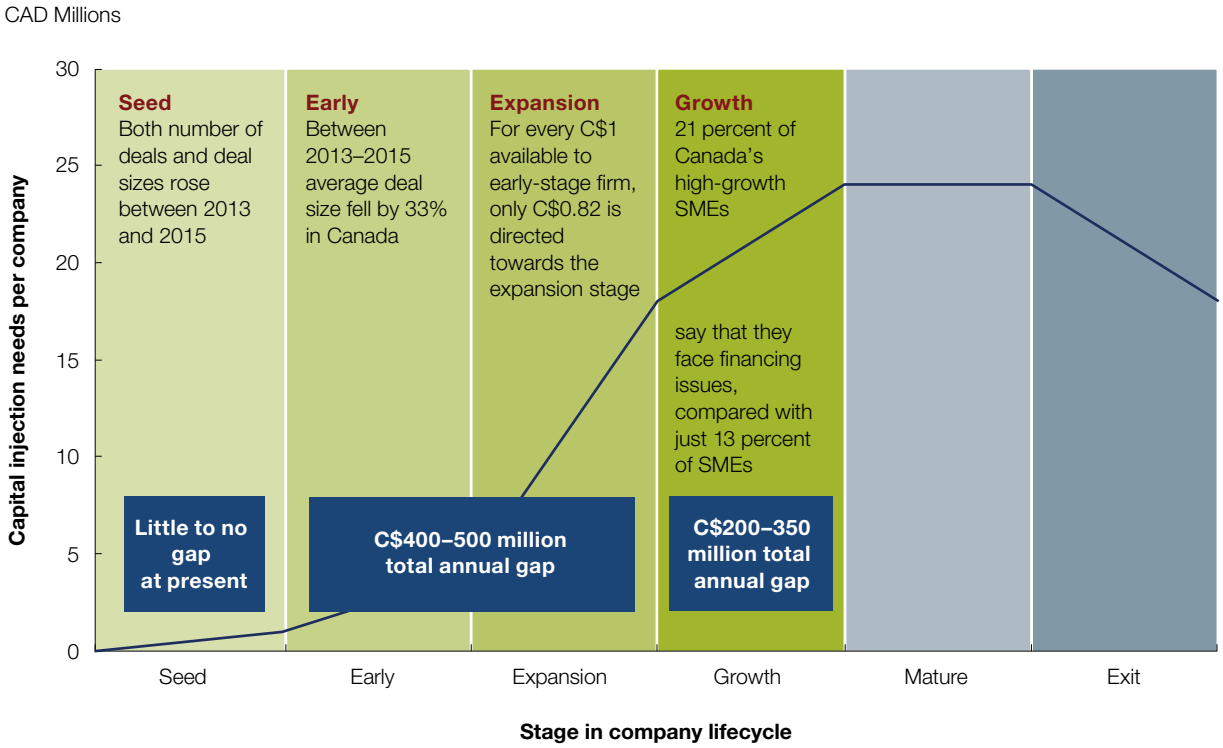
High-potential SMEs face important barriers to scaling and reaching their full potential:

- A lack of business talent and value-added support for high-impact entrepreneurs. In a survey of high-impact SMEs, seven of the top ten barriers to growth related to a scarcity of experienced management talent and advice.[30]

- Shortfalls in deal sizes for Canadian early-, expansion-, and growth-stage SMEs. Exhibit 3 lays out the challenges.

Exhibit 3 **Capital injection needs by stage in company lifecycle**

ILLUSTRATIVE



A healthy innovation ecosystem supports firm development at each stage of the company life cycle. Canadian firms appear to have sufficient access to capital at the seed stage but face increasing unmet capital needs as they scale up.

- For seed financing, i.e. the initial capital needed to start a business, typically up to C $0.5 or $1.0 million depending on the sector, there appears to be adequate financing in Canada at present. The number of deals went from 107 in 2013 to 178 in 2015, and deals sizes rose by 10 percent.[31] The government should continue to monitor this space and consider incentives to investors if this becomes necessary.

- For early-stage companies, the total amount of capital has increased in recent years. But Canadian investors have provided smaller amounts of equity to more companies—in other words, we are spreading this capital too thinly. In 2013, the average early-stage deal in the United States and Canada was the same size. By 2015, the average early-stage deal in the United States was 53 percent larger than in Canada.[32]

- The expansion capital supply in particular is more restricted: for every $1 available to Canadian early-stage firms, only $0.82 is directed towards expansion-stage firms, compared with $1.92 in the United States.[33] Furthermore, the size of expansion-stage deals appears to be too small. Whereas early-stage deals have

increased in size (though still lower than the United States), later-stage deals have fallen 35 percent in size from their 2013 levels. Moreover, later-stage deals in the United States are 71 percent larger than comparable deals in Canada, an indication that Canadian firms may be underfunded in later stages.[34] Though difficult to define precisely, we estimate that the gap for these early- and expansion-stage firms (here defined as firms that have received at least series A venture funding) is between C $300 and C $400 million annually.

- In terms of growth capital for established high-impact SMEs, there is evidence of a lack of risk capital and of a lack of more diverse set of financial products to sustain their growth (see Exhibit 3 on page 18):
  - 21 percent of Canada's high-growth SMEs say that they face financing issues, compared with just 13 percent of SMEs.[35]
  - Established high-growth SMEs need more innovative financing options for growth projects: 29 percent of "high-impact firms" would find financial guarantees to help bid on large contracts very valuable, and 25 percent would like access to loans for risk-sharing agreements.[36]
  - Despite efforts by the Business Development Bank of Canada (BDC) to address this issue, Canada still has room to develop its growth capital market (i.e. growth equity and mezzanine/subordinate debt). Between 2013 and 2015, the US growth capital market grew by 3 percent, whereas Canada's fell by 40 percent.[37]
  - The funding gap for these high-impact SMEs is estimated to be between C $200 million and C $350 million annually.

Stimulating large private-sector investments and value-added support

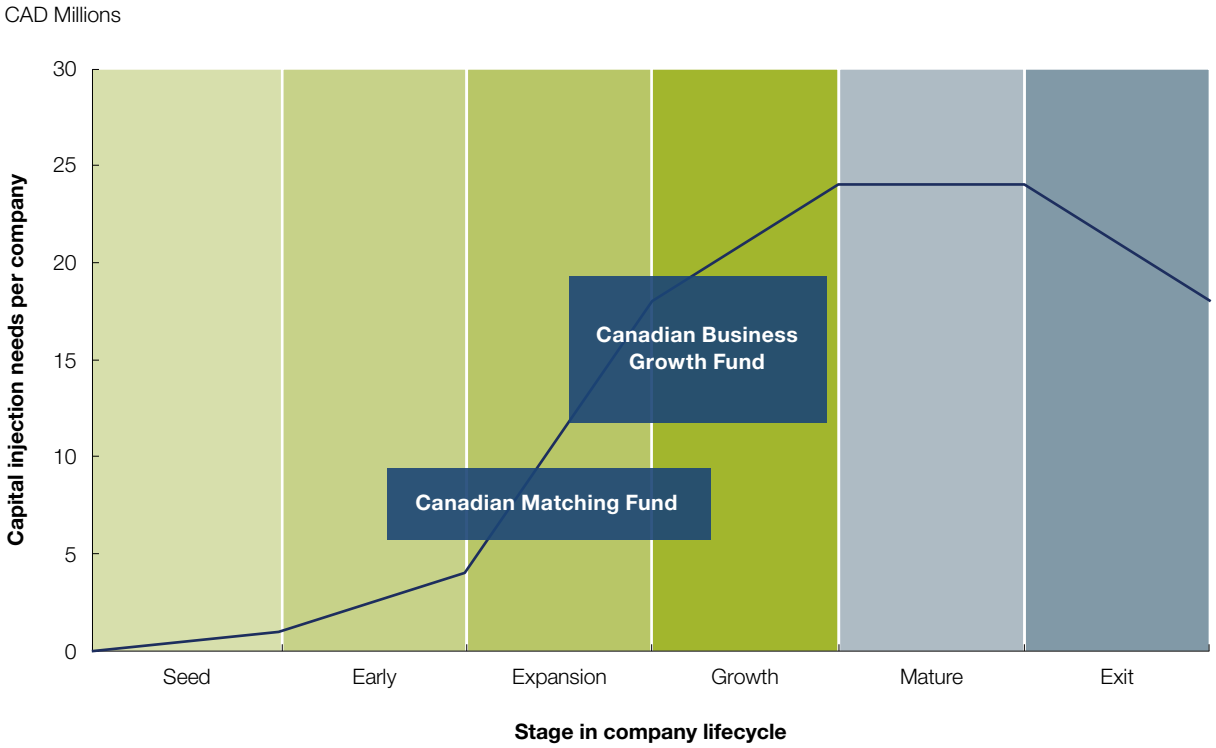
We believe that the government can play a role in scaling Canada's high-performing SMEs by better targeting its support programs and using its spending and regulatory powers to nudge private players to support the scaling of SMEs along their entire lifecycle (Exhibit 4).

Specifically, the government could:

- Create a Canadian Matching Fund to stimulate larger capital raising—both early- and expansion-stage companies need to raise larger sums in a single round, in a way that minimizes investment management fees and the time required to deploy the capital, while also giving high-value-adding investors an incentive to invest. This solution would serve higher-risk companies looking for a cash injection of C $5 million to C $15 million, with a "sweet spot" of C $7 million to C $10 million.

- Support the creation of a private sector led growth fund for minority equity stakes to address the gap in growth financing for established high-impact firms, through the purchase of minority stakes or unsecured debt for growth and expansion projects. This business growth fund should serve companies looking for between C $7.5 million and C $25 million in capital, with a sweet spot between C $10 million and C $20 million or above. **The Council is particularly enthusiastic by this idea, which it views as a high-impact program that could be led and financed by the private sector.**

Exhibit 4 **Capital injection needs by stage in company lifecycle** ILLUSTRATIVE



Initiative 1—A canadian matching fund for high-potential firms

Overview

The Council recommends creating a government-financed Canadian Matching Fund, which would provide high potential SMEs that raise private capital from an arm's length source with matching government funds in the form of unsecured debt or minority equity, at a rate of $1 of matching fund money for each $2 of qualified private capital.

Rationale for creating a Matching Fund

A Matching Fund:

- Leverages private capital to stretch the return on taxpayer dollars
- Puts power in the hands of the entrepreneur rather than the fund/investor because funding would go directly into companies
- Is a source of "patient" capital, with a long-term repayment expectation (ten years or more)

- Ensures "smart capital" by including a minimum private-capital injection of C $3 million and up to C $10 million from an investor selected by the entrepreneur for their ability to add value. The total capital injection in a company would therefore be between C $4.5 million and $15 million at $1 of public capital for every $2 of private capital. This ticket size could grow larger depending on the market reaction to the concept.

- Minimizes fees and administrative oversight required

Qualifying criteria

Companies that qualify for the matching funds should to meet the following conditions:

Criterion	Description	Rationale
Have raised "arm's-length" equity from private sources	Must have previously raised a minimum of C $3 million in private capital that does not come from related parties or affiliates.	The Matching Fund should only put taxpayer dollars at risk when following arm's length private investors.
Demonstrate high growth	Growing by at least 20 percent or more annually for three years and outperforming their sector.	ISED found that high-growth firms are responsible for 1 million of the 1.8 million net job creations over a 15-year period.[38]
Exhibit high ambition	High level of ambition (and risk appetite) determined by the company's business plan and growth objectives.	A comprehensive survey found that highly ambitious entrepreneurs have 10 percent greater revenue growth, 9 percent more international sales, and invested 5 percent more in innovation than moderately ambitious entrepreneurs.[39]
Show the potential to export	Operating in an export sector, or one with potential to export.	Companies that export have higher sales, pre-tax profit margins, and returns on assets, on average, than companies that do not export. They also spend more on R&D, increasing the innovation spillovers for the Canadian economy.
Have a source of value-added support	This could include funding from an engaged investor, having an advisory board or being supported by other external advisors.	A lack of value added support, experience and capabilities are the most important barriers to scale for high potential SMEs – more important than capital alone.

Co-funding

The Matching Fund should offer co-funding through a wide range of potential instruments including common equity, preferred equity, or unsecured debt, based on the entrepreneur's needs:

- Equity can be offered on a pari passu basis, with a call option for other equity investors to be able to buy out the matching fund's stake at some required multiple of capital. This would provide both upside on government funds, as well as an attractive structure for the entrepreneur. The government should purchase its equity position at the same initial valuation as the private investor. If the company moves its headquarters outside of Canada, the government should also consider including a put option to sell its shares based upon some pre-determined valuation formula.[40]

- Alternatively, debt could be offered where appropriate at an attractive yield with a ten-year term to be repaid at maturity, at exit, or upon headquarters leaving the country. However, it is important to note that future rounds of financing should be considered when debt is used as this could discourage follow-on equity funding.

In both cases, the Matching Fund should match private investments on a 1:2 basis (1 part matching funding, 2 parts private-sector funding) for total funding of between C $4.5 million and C $15 million. The public contribution would therefore be between C $1.5 million and C $5 million per deal.

Value-added support

The fund would provide value-added support in four ways:

- Attract leading investment firms (either venture capital or growth equity firms) that can offer their Canadian portfolio companies access to their talent and networks

- Include a commitment to advising as a criterion for selecting investors to ensure that entrepreneurs are receiving the managerial support they need

- Build a virtual network of "operator mentors"— former executives who volunteer to work with firms that have been selected into the fund

- Allow the government to identify clients for the BDC Growth Driver Program and the Accelerated Growth Service (AGS) that coordinate different agencies to help Canada's high-impact firms

Fund size

To bridge the gap of C $300 million to C $400 million faced by early- and expansion-stage companies, a matching fund could invest C $100 million to C $130 million per year which would match C $200 million to C $270 million of private investment.

Benefit for Canadians

Even with low returns and the risk of losses, tax payers will have a better return from the Matching Fund than from a pure subsidy. Furthermore, its economic benefit would also be felt through the revenue, salaries, and tax contributions that recipient firms would generate. While an average small firm (0–99 employees) generates roughly C $500,000 in GDP contribution annually, an average medium-size firm (100–499 employees) generates roughly C $15 million.[41] Scaling just 30 of the 75 to 100 firms that the matching fund invests in every year from small to medium size would therefore generate about C $435 million in additional annual GDP.

Risks to mitigate

The program should mitigate three risks:

- Crowding out private capital. The intention of the matching fund is fundamentally to increase deal sizes and "dry powder" available to our high-performing entrepreneurs. If the Matching Fund replaces either debt or equity capital that would otherwise have invested in these same businesses, that is a negative outcome. In the specific design of the program, the government would need to create an attractive structure for other investors, which does not create a disincentive for the entrepreneur to seek other sources of financing when needed.

- "Gaming" the structure. The administrators for this fund would need to monitor the transactions it supports to identify those cases where investors may be looking to unduly profit from this funding structure without the overarching goal of growing the underlying businesses.

- Failing to attract "smart" capital. The requirement for value-added support for companies to qualify for matching is a qualitative criterion, yet it needs to be applied rigorously for this fund to have the desired impact.

Governance

The Matching Fund should be governed by an existing public agency with deep networks of entrepreneurs and mentors, such as the Business Development Bank of Canada. An independent funding committee within the agency should be established and charged with providing funding quickly and with the least administrative burden. The funding committee should be staffed by experienced investors and focus on an objective evaluation of the business plans of companies that meet the qualifying criteria.

Funding

Rather than devote new funding to these initiatives, the Council recommends re-allocating funding from existing programs where possible. The Innovation Program Review proposed in Recommendation 4 provides a process for identifying potential funding sources.

Initiative 2—A canadian business growth fund

The idea

The government should encourage the private sector to establish one or more Business Growth Funds to provide patient capital for high-growth businesses in the form of minority equity or loans for SMEs. The fund or funds (hereafter the "fund") should consist of pre-committed capital from Canada's leading banks and financial institutions, which would benefit from appropriate capital treatment under the current Office of the Superintendent of Financial Institutions (OSFI) regulations. The Council is particularly enthusiastic about the potential of this idea, given that it is private sector-led and would not place any additional burden on Canadian taxpayers. Though this fund could theoretically be formed without any intervention, we believe that government can play an important role in (a) highlighting the potential capital need; (b) convening and coordinating the different sources of capital, and (c) clarifying the capital treatment for investments in this fund.

Rationale for creating a growth fund

The government should encourage the formation of a business growth fund as it fills a clear capital need, provides a fully private-sector solution and diversifies funding options for SMEs.

- Capital need: The Business Growth Fund could serve firms looking for deals between C $7.5 million and $25 million in capital, with a "sweet spot" between C $10 million and $20 million. It could focus on established, revenue-generating firms looking to finance their next phase of growth.

- Private-sector solution: The cardinal advantage of Business Growth Fund is that it reduces the need for public-sector funding and promotes rational capital allocation. The United Kingdom's Business Growth Fund only required regulators to lighten capital requirements on the committed funds. OSFI capital rules are not a barrier to creating the type of investments proposed in the Business Growth Fund as they provide for similar capital treatment to those in the United Kingdom.[42]

- Diversifying funding options: Observers have expressed concern that the gradual disappearance of small securities firms—over one quarter of independent broker-dealers have disappeared in the past two years—has reduced the options for SMEs seeking financing on public markets.[43] This is a separate issue that the government may want to address, but in the meantime, the Business Growth Fund could provide a solution for companies looking for funding opportunities without having to subject themselves to public-reporting requirements before they are ready.

The Business Growth Fund would allow financial institutions to invest together because of favourable capital treatment for this type of growth capital.

- The key ingredient is a critical mass of private-sector investors that jointly agree to launch this fund—they could include banks, pension funds, insurance companies, and other institutional investors that believe the risk-return profile of these investments is attractive.

- For banks, OSFI rules assign a lower risk weight to equity investments that are deemed to be non-substantial in the Bank Act.[44]

- There are a number of proposals in circulation on how to create a growth fund in Canada. The Council fully supports the creation of such a fund given the market need. It is not contemplated that the fund would require any government financing.

- More than one Business Growth Fund may be needed. However, funds should have sufficient scale to attract the investing talent required to manage the fund and enough Limited Partners (LPs) so that no single LP exceeds the ownership threshold put forward in the current OSFI rules.[45]

Fund size

For established high-impact SMEs, our estimates indicate that there is a C $200 million to C $350 million total annual gap in financing for high-growth firms with at least C $10 million in revenue.[46] The Council believes that it is critical not to create an oversupply of capital in the market. To avoid this, we suggest launching a business growth fund with a total size of approximately C $1 billion, which would address the conservative C $200 million estimate of the expansion-stage capital gap over five years. We believe this could make a significant improvement in the identified gap while mitigating any risk of crowding out other sources of capital.

In addition, the fund could be built using a milestone-based approach, whereby only a fraction of the capital is disbursed initially. Follow-on disbursements would only be made if the fund successfully deploys capital into targeted companies.

Recommendation 3: Supporting innovation through strategic procurement

Governments across Canada spend approximately C $100 billion per year to procure equipment and supplies to provide public services—everything from asphalt to patch roads to hi-tech intelligence equipment—at the municipal, provincial and federal levels. Today, most procurement in Canada is requirements based, meaning that a federal agency, province, or local government issues a request for proposal (RFP) for goods or services and selects a vendor based predominantly on price and quality. In strategic procurement, the government uses its leverage in the purchase of goods and services to pursue indirect benefits such as promoting growth, encouraging employment for certain groups of workers, helping commercialize new products, or scaling up companies. In Canada, we recommend adopting a clear policy to incorporate strategic procurement as a way to support technology adoption and accelerate growth of innovative companies.

The opportunity

The Council believes that strategic procurement could be used in Canada to support innovation and help small companies scale up and gain the credibility to become integrated in global supply chains. With government acting as a first customer, companies can test and validate products and services before introducing them into commercial markets. This is particularly beneficial to mid-sized and smaller companies, which may have more challenges accessing new customers and linking into global supply chains. Strategic procurement would also help deliver inclusive growth by creating opportunities to build on existing success stories linked to businesses owned by underrepresented groups, such as Aboriginal-identified

small businesses. Done well, strategic procurement also offers the opportunity of better servicing all Canadians, and of improving the efficiency of government by applying new technology and approaches to longstanding problems.

The Council recommends that Canada redesign the procurement process to support innovation and manage this effort using clearly defined internal metrics and benchmarking against other countries. Several reports have outlined this problem: the critical challenge will be implementing this approach across governments to achieve results at a meaningful level.[47] The Council strongly recommends that the Government of Canada takes this step now, and actively builds partnerships with other governments and public sector partners to expand the opportunities for Canadian innovators.

Federal procurement in Canada is approximately C $18 billion per year, including goods, services, and construction. This includes roughly $6 billion for defence procurement. Provincial/territorial governments procure approximately C $20 billion per year.[48] However, only a small portion of government spending has been used strategically, even though the federal contracting policy calls for government to take into account "overall benefits to the Crown and the Canadian people" when making purchases. The federal government currently does procurement on behalf of indigenous communities and northern territories but this procurement is currently not strategic and could be better used to promote economic development in these communities. Current procurement practices are designed to avoid risks, contain costs, and focus narrowly on selecting goods and services, rather than achieving social or economic goals such as accelerating innovation or promoting inclusive growth. Overall, the process lacks transparency and does not foster communication between innovators and purchasing agencies, limiting the possibilities for what can be purchased and depriving small companies of an opportunity to validate their products.

Adopting strategic procurement to drive innovation and growth

There are four basic approaches to strategic procurement that are used by other countries, which could guide the formulation of a strategic procurement plan in Canada.

- Solution-based procurement specifies outcomes desired, rather than specifying equipment or service to be purchased.
- Supply-push procurement opens the procurement process to unsolicited offers, exposing the government to innovative ideas and options that officials may not know exist.
- Set-asides reserve a share of government spending for certain types of suppliers, such as small businesses.
- Demand-pull programs where agencies intentionally create demand for nascent technologies.

The solution-based and supply-push procurement approaches have both led to improved outcomes for local companies and industrial growth. Other countries have used innovation set-asides, which allocate a share of procurement to small businesses, and have used demand-pull programs, in which the government defines needs and incents departments to use procurement to stimulate innovation. The US Small Business Innovation Research (SBIR) program is considered a global model for best practice in demand-pull programs.

The program offers research grants for innovative start-ups to develop products and services that are then purchased by the government (for more on global best practices see Box 3, “How other countries do it” on page 29).

Canada should also explore domestic programs at the provincial and municipal levels, which could be emulated and scaled up. Some provinces are considering solution-based procurement programs in healthcare. Such programs would challenge suppliers to come up with solutions to healthcare needs rather than submitting existing technology in response to detailed equipment specifications. Solution-based contracting would encourage innovation and provide an opening for small players.

The Building in Canada Innovation Program (BCIP) is a small supply-push program, under which the government has set aside C $40 million a year to test unsolicited new products. The program is managed by Public Service Procurement Canada (PSPC), which screens suppliers and helps to match them with federal departments, which participate voluntarily. The program is focused on pre-commercial innovation. Informal feedback on the program suggests the program is on the right track, though it was undersubscribed in its early years. It was also suggested that the program should be simplified, and that start-ups should be given more assistance to find internal customers. We support the intent of this program, and see potential to use feedback to improve awareness, effectiveness and scale.

Another strategic procurement program in Canada is the Industrial and Technological Benefits (ITB) program, which requires defence contractors to undertake business activities in Canada that are equal to the value of the contract. Formerly known as the Industrial Regional Benefits program, ITB has recently been revamped to include a “value proposition” to Canada equal to 10 per cent of the overall bid score. As a result, a robust offset plan that supports innovation now can make the difference between winning and losing a contract. The government has flexibility in determining the best value to Canada and can steer investment to priorities such as Canadian firm participation, encouraging Canadian R&D and intellectual property development, SME growth, and increasing export potential. Similar principles can be applied to non-military procurement.

Five actions to drive strategic procurement

We recommend the government specify that support for innovation is an objective of government procurement policy, and commit to being a first customer of new technology, services, and products. As the government develops its approaches to strategic procurement, it is critical to share best practices and collect data across all parts of government on the potential for strategic purchasing and its results. Strategic procurement can be used to stimulate innovation in priority areas and could be aligned with innovation marketplaces, infrastructure programs, and sector strategies, which the Council also recommends. Strategic procurement also provides opportunities for cooperation between the federal government, provincial, and municipal governments.

We recommend that the federal government implement the following five actions to drive adoption of strategic procurement.

1. Use solution-oriented calls for proposals instead of specifying preselected technology. This would help innovative companies (both small and large) compete, and would align different actors in the innovation ecosystem, incent collaboration, and expand supply chains. The process could allow for investment in

early-stage technologies, de-risk purchases of emerging technologies, and help accelerate the commercial readiness of new technologies. Bidding could also favour indirect benefits to Canada such as job creation and firm growth. We also recommend that government agencies conduct more pilot programs to test solutions, such as by sponsoring "grand challenges".

2. Expand the Build in Canada Innovation Program (BCIP). BCIP stands as an important early step in expanding innovation-focused procurement in Canada and we support efforts to market and support more businesses applying to participate and to pitch their innovative solutions to potential government customers.

3. Leverage set-asides. We recommend set-asides for procurement of innovative products and services by the PSPC and other government departments. The set-aside would start at 1 per cent of federal procurement spend and rise to 5 percent by 2025. This program would be mandatory across all federal departments and include purchasing commitments for technologies developed through the program.

Box 3

Case studies from other countries

United States

The United States promotes commercial innovation and small business scale-up through four procurement-related programs:

The Small Business Innovation and Research program (SBIR), requires federal agencies that spend more than US $100 million annually in external R&D to allocate 2.8 percent of these funds to validate the commercialization potential of domestic small business innovation through a highly competitive selection process.

The Small Business Technology Transfer (STTR) program requires agencies that have research budgets of more than US $1 billion to set aside 0.3 percent to fund small business R&D partnerships with academic institutions.

Military spending is earmarked for innovation under a number of programs, the largest of which is the Defense Advanced Research Projects Agency (DARPA) with a US $3 billion annual budget. DARPA invests in new defence technologies and is the center of a robust innovation ecosystem that includes academic, corporate, and government players.

The Advanced Research Projects Agency-Energy (ARPA-E) is an agency within the Department of Energy, which now sponsors research to enhance energy security and advance US energy technology. ARPA-E had a 2015 budget of US $280 million and provides grants to companies to perform R&D-related activities.

Australia

The Australian Defence Force revamped its procurement strategy to bring SMEs into its global supply chains. Outside of defence, the Priority Industry Capabilities (PIC) program funds research for innovations that promote Australian industry. The research is usually a partnership with an academic institution.

United Kingdom

In Britain, the government established an SBIR-like program called the Small Business Research Initiative (SBRI) and made departmental participation mandatory. The program supports both innovative SMEs and large firms based in the United Kingdom and more than 70 government organizations have awarded 2,200 SBRI contracts valued at more than £270 million (C $450 million) since April 2009.

4. Implement a Canadian SBIR-type program. We recommend designing a "demand pull" procurement program modeled after SBIR in the United States. The program should require specific government agencies to earmark part of their budgets (e.g., 3–5 percent over the short to medium term) to fund early-stage R&D by Canadian SMEs. Participating agencies would identify problems they'd like to solve and challenge SMEs to come forward with innovative solutions.

5. Maintain the Industrial and Technological Benefits (ITB) policy. On the defence side, we recommend maintaining the ITB Policy and aligning the value component with priority areas for growth and innovation. Also, the impact on R&D and innovation from recent changes in the program should be monitored.

It should be recognized that implementing these new procurement approaches successfully will require a cultural shift led by leaders in government. This shift will require a risk tolerance that is uncharacteristic of past approaches to government procurement, and an acknowledgement that some ideas will succeed and some will fail.

■ ■ ■

Recommendation 4. Review and rationalize government business innovation programs

Canada needs a focused and effective innovation system that can deliver tangible results against clear economic growth objectives. Therefore, the Council strongly recommends reviewing and retooling Canada's innovation programs to support Canada's 21st century inclusive growth ambitions. This would involve examining current programs, eliminating ones that are not effective, redirecting resources, and adopting the analytical frameworks to create effective innovation programs and manage them using data. To help Canada compete globally, Canada must fund innovation programs that are relevant in a changing context and that support a coherent, agile, and data-driven innovation system.

The purpose of this initiative is to improve the outcomes of innovation programs, not reduce the size of innovation funding. The Council recognizes the challenge of overhauling such a broad suite of important programs while the economy is in transition. We also acknowledge the difficulty of closing programs that have been in existence for decades. However, the world is changing rapidly and Canada's innovation performance is lagging. Doing more of the same is not going to create a successful Canadian innovation ecosystem.

The opportunity

To meet its goals of inclusive growth and increased global competiveness, Canada needs a well-functioning innovation engine. The federal government currently provides critical funding support for accelerating innovation, enabling commercialization, scaling firms, and strengthening exports. In total, these innovation programs cost more than C$5 billion per year across federal departments (see Exhibit 5).

Given the pace of change, we must ensure that these programs are optimized. Over decades, new innovation programs have been added across federal departments, without comprehensive and consistent evaluation and without a unifying vision or objective to guide program design. The federal suite of programs serving businesses needs to be reviewed and retooled to respond to global pressures and to better promote economic growth.

Exhibit 5 Federal programs and agencies across the innovation continuum[49]

NON EXHAUSTIVE

Pipeline for business support: Federal agencies and programs

	1 Start-up	2 Traction	3 Growth	4 Maturity
Access to capital	▪ BDC; FCC Ventures; AAFC financing; VCAP; Futurepreneur Canada; CIC Start-up Visa Program	▪ BDC; FCC; AAFC financing; CSBFP; VCAP; RDAs	▪ EDC; BDC; FCC; AAFC financing; CSBFP; VCAP; RDAs	▪ EDC; BDC; FCC; AAFC financing; CSBFP; RDAs
Product/ service develop-ment	▪ BDC; CICP; Granting council collaborative programs; SD Tech Fund; VCAP; NRC-IRAP; EIP; SR&ED	▪ BDC; Granting council collaborative programs; NRC; NRC-IRAP; SADI; TDP; AIF; ASIP; VCAP; AAFC (AgriInnovation); RDAs; EIP; SD Tech Fund; GGI; IFIT; EMOP; SR&ED	▪ BDC; Granting council collaborative programs; NRC; NRC-IRAP; SADI; TDP; AIF; ASIP; AAFC (AgriInnovation); VCAP; RDAs; EIP; SD Tech Fund; IFIT; EMOP; SR&ED	▪ BDC; Granting council collaborative programs, NRC; NRC-IRAP; SADI; TDP; AIF; ASIP; AIP; AAFC (AgriInnovation); RDAs; EIP; SD Tech Fund; IFIT; EMOP; SR&ED
Business support services	▪ BDC; Futurepreneur Canada; CBN; VCAP; NRC- IRAP	▪ BDC; CBN; NRC-IRAP; TCS; VCAP; RDAs; CanExport; CTAI	▪ EDC; BDC; CBN; NCR-IRAP; TCS; VCAP; RDAs; GOA	▪ EDC; BDC; CBN; NRC-IRAP; TCS; RDAs

The current portfolio of programs delivers funding through a wide range of activities, from support for academic and industrial research to demonstration projects that lead to commercialization and from local sales to export assistance. These programs fall into five main categories (See Box 4 “The five main types of federal innovation support” on page 31).

Despite the range of innovation support programs and size of government investment, Canada continues to lag on key innovation measures, including business investment in R&D and productivity.[50] Programs are sometimes duplicative, and can be challenging for businesses to navigate. Moreover, it is unclear whether the program portfolio delivers the right balance between “supply push” versus “demand pull” or between direct versus indirect R&D support to foster commercialization and productivity enhancement. Canada relies far more heavily on indirect methods to fund industrial R&D and innovation than peer nations.[51] It is also important to explore whether current programs are aligned with priority sectors and regions. Finally, Canada lacks the data about program effectiveness to make evidence-based policy choices about how to allocate funding.

Box 4

The five main types of federal support

Financing for growth and expansion. Innovative companies can receive financial support from the Business Development Bank of Canada and regional development agencies. The Canada Small Business Financing Program offers loan guarantees to private-sector financial institutions. The small business tax rate provides indirect support through lower marginal tax rates.

Innovation support. Funding for innovation is available through the Industrial Research Assistance Program and the Venture Capital Action Plan that invests in young innovative firms. In addition, there are various sector-specific funding programs in such industries as automotive, aerospace, forestry, agriculture, and fisheries. There are testing support programs from the NRC and Transport Canada in the aerospace sector. The Build in Canada Innovation Program uses strategic procurement to support innovation through government purchasing. The Scientific Research and Experimental Development (SR&ED) tax incentive program provides indirect support to commercial research and development efforts for both large and small firms and is the single largest spending category at over C $3 billion per year. There are various programs to encourage the commercialization of university R&D.

Improving access to foreign markets. Export Development Canada provides financing and bonding for exporters. The CanExport Program is designed to help SMEs explore new export opportunities. The Trade Commissioner Service operates offices in 161 cities to encourage exports.

Building entrepreneurial and management capacity. The Business Development Bank of Canada provides (partially subsidized) consulting services. The Canada Accelerator and Incubator Program offers management advisory services including intensive mentoring.

Increasing access to skilled labour. Canadian universities generate a skilled workforce. The Canada Job Grant Program and the Youth Employment Strategy both provide worker training.

Reviewing and rationalizing innovation programs

We propose a structured approach to create a well-defined, relevant suite of federal innovation programs and assets. The goal is to bring efficiency, coherence, and data-driven decision making to the management of Canada's government-sponsored innovation-support programs.

In rationalizing innovation programs, we would aim to make clear connections between innovation goals and innovation programs. The review would identify programs that are no longer a priority, or have not demonstrated effectiveness, and develop a strategy to reallocate resources to higher priorities, identified gaps, or more effective programs. Additionally, the effort would connect to innovation activity across the federal government in programs for skills and talent, immigration, growth capital, trade, and social inclusion. Finally, we would explore opportunities for the federal government to partner with provinces to create a more cohesive and effective national innovation system—one that not only elevates the Canadian business community, but through its effectiveness also encourages greater participation in the economy by women and other underrepresented groups.

There have been a number of previous efforts to review programs, including the 2011 Jenkins Panel. The Council advises the government to draw from this and other research on program rationalization in Canada.

The program suite. A suite of innovation programs that would help Canada compete globally and reach its growth goals would:

- Allocate an appropriate level of resources to address key needs and potential market failures at each stage of the innovation continuum
  - Provide support appropriate to the level of technology and development stage of firms
  - Be responsive to the priorities and unique needs of different sectors (accounting for variation in development timelines, capital needs, and geographic distribution of businesses)
- Focus resources on driving firm growth and scaling up firms
  - Enable firms of all sizes to pull and commercialize research from relevant university and government research labs
  - Use proven approaches to accelerate growth of high-performing firms
  - Focus on building linkages for SMEs to multinational supply chains and commercialization efforts
  - Be accessible for business, with simple interfaces and processes
- Reflect new realities and use new approaches to:
  - Take into account the growing complexity of the intellectual property landscape, the convergence of technologies and sectors (such as digital health), and the opportunities and threats posed by exponential technologies
  - Use challenge-based or outcomes-based funding models to foster cross-sector collaboration and reward results
  - Use more agile regulatory and procurement processes to help local innovators and position Canada as an attractive destination for global innovators

Performance management tools. To understand how innovation programs are performing and to keep them relevant and effective over the long term, Canada needs to have powerful measurement tools and capabilities that are still business friendly, i.e. simple, focused and not too onerous. Canada can:

- Aim to become the leading global user of data to make evidence-based innovation policy decisions and engage with top international practitioners and implement best practices

- Establish consistent and advanced evaluation metrics
- Use data-collection and evaluation methods to assess program effectiveness that are adapted to different program contexts
- Use data to allocate funding to high-performing programs and retool programs as required
- Work with provinces to develop data collection and data-sharing frameworks and standards across all innovation programs with the goal of sharing best practices and improve performance everywhere
- Build a robust database of fast-growing firms across all sectors

Structuring the review process

We propose a four-step program to design and implement the new suite of innovation programs and create an ongoing program-management capability:

- Appoint a review board chaired by an external expert, consisting of external advisors charged with developing recommendations to government, who would be responsible for implementation.
- Define the scope of the review and create a program and evaluation framework for long-term success, to be used in the review as well as ongoing evaluations to ensure continued results.
- Complete a systematic review of all business-facing innovation programs to establish relevance, and measure outcomes and alignment with national priorities to ensure impact on Canada's innovation performance.
- Establish a mechanism to connect the science and innovation activities of government, building on the Fundamental Science Review and the program review proposed here, and govern them in an integrated manner. This would help government set priorities and monitor performance of both science and innovation programs, and ensure alignment between them.

An external expert would be selected to head a review board, which would be responsible for the recommendations to government, and may have an ongoing role in monitoring the impact of the review. The government, in turn, would be accountable for the implementation and impact of the program review. The review board would consist of experienced arms-length experts from business, academia, and other relevant stakeholder groups, and would ideally include international members, to provide independent perspectives and knowledge of best practices.

Reviews would include explicit considerations of future oversight options to streamline program monitoring and develop a framework for ongoing program review. Future oversight of research and innovation and the coordination of these investments could be facilitated by a single advisory body with external representatives covering the domains of both research and innovation. The Council's proposal in this regard is aligned with recommendations in the report forthcoming from the Fundamental Science Review panel, which will provide more detail.

Meeting the needs of cleantech and life sciences

Though this Council has not made a recommendation specific to the funding gaps faced by Canada's cleantech and life sciences companies, we recognize the need for further examination of these issues and the development of sector-specific solutions to solve them.

Indeed, cleantech and life sciences companies are often passed over for Information and Communications Technology (ICT) companies, which receive a disproportionate share of venture capital flows. Between 2009 and 2015, venture capital investments grew by 180 percent in Canada, from just under C $1 billion to C $2.7 billion, but nearly three-quarters of the increase went to ICT firms, compared with 16 percent for life sciences and 10 percent for cleantech.[1]

Cleantech is much more capital intensive than the traditional information technology sector and companies in this emerging industry require more patient capital, especially in energy and manufacturing. Many leading cleantech firms in Canada face severe constraints in constructing their first commercial-scale projects due to perceived financial risks, even when they have customers in hand. Private markets do not typically provide debt financing for newer technologies, preferring the lower risk profile of incumbent (tried-and-true) technologies. Life sciences companies may be less capital intensive, but face steeper regulatory and compliance barriers. Drug makers, for example, must fund lengthy clinical trials before bringing a product to market, which means investors wait longer for returns than they do for investments in IT firms.

The Council would recommend further exploring the specific capital needs of these sectors.

[i] BDC Venture Capital Overview, 2016

Expected impact

The effort to rationalize government innovation support programs is expected to yield results in five areas:

- Tangible improvements in program alignment, impact, and value delivered
- Significant reduction of the number of programs and increased program efficiency
- Improved access for business and efficient uptake by business clients
- Reduction of policy gaps as the innovation landscape changes
- A transparent structure and tools that allow for data-driven decisions to adjust programs

We believe that a multipronged effort to fuel innovation could significantly increase Canadian productivity, improve competitiveness, and drive inclusive growth for all Canadians. The Council's five interlocking recommendations provide a suite of initiatives to attract talent, provide value added capital, catalyze adoption, and better use government programs and resources. Taken together, these recommendations will help Canada build more global-leading companies and ultimately create high-quality jobs and opportunities for all Canadians. ■

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[1] See the Council's recommendations on *Building a skilled and resilient workforce with a "FutureSkills" Lab and Tapping economic potential through broader workforce participation*, released today.
[2] See "Attracting the Talent Canada Needs Through Immigration," Advisory Council on Economic Growth, October 2016, and "FutureSkills Canada," Advisory Council on Economic Growth, January 2017.
[3] *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being*, OECD, 2015.
[4] Bronwyn H. Hall, "Innovation and productivity," *Nordic Economic Policy Review*, Number 2, 2011.
[5] *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being*, OECD, 2015.
[6] *Technology Works: High-Tech Employment and Wages in the United States*, Bay Area Council Economic Institute Report, December 2012.
[7] Carl Benedikt Frey and Michael A. Osborne, *The future of employment: how susceptible are jobs to computerisation?*, Oxford University Programme on the Impacts of Future Technology, September 2013.
[8] Philippe Aghion et al, *Innovation and Top Income Inequality*, June, 2015.
[9] See "Attracting the Talent Canada Needs Through Immigration," Advisory Council on Economic Growth, October 2016, and "FutureSkills Canada," Advisory Council on Economic Growth, January 2017.
[10] World Economic Forum, *Global Competitiveness Report 2014–15*, p. 147.
[11] John R. Baldwin, Danny Leung, and Luke Rispoli, *Canada-United States Labour Productivity Gap Across Firm Size Classes*, Statistics Canada, January 2014.
[12] Ibid.
[13] *Canada's Technology Investment Gap: Unlocking the sector's key growth opportunity*, Yaletown Partners, 2016.
[14] Capital IQ, WMM.
[15] Variance between sectors shows that Canadian ICT and financial services firms spend about the same on R&D (as a percentage of total revenue) as their American peers, but Canadian automotive and pharmaceutical companies spend significantly less than US firms (Capital IQ, Press Search, Council of Canadian Academies "Why Canada Falls Short" study).
[16] OECD Science, Technology and Industry Scoreboard 2015.
[17] Council of Canadian Academies, "Innovation and business strategy: Why Canada falls short," 2009, p. 109.
[18] Statistics Canada, "Survey of Innovation and Business Strategy." Survey limited to companies with over 20 people and over $250 million in revenue across 14 sectors.
[19] Council of Canadian Academies, "Paradox Lost: Explaining Canada's Research Strengths and Innovation Weaknesses", 2013, p.7.
[20] *Scaling Success: Tackling the Management Gap in Canada's Technology Sector*, Lazaridis Institute for the Management of Technology Enterprises, Wilfred Laurier University, 2016.
[21] See recent announcements on immigration reform in relation to a Global Skills strategy with a fast-track visa process for top talent (October 2016).
[22] *High-impact Firms: Accelerating Canadian Competitiveness*, Business Development Bank of Canada, 2015.
[23] "The Venture Capital Funnel: Your Chances Of Raising Follow-Ons, Exiting, And Becoming A Unicorn," BDC Venture Capital Overview, 2016, CBInsights, "The Venture Capital Funnel," 2015.
[24] Adjusted for differences in company size: in 2010 the average US large business was 1.6x bigger than the average Canadian large business as measured by average GDP contribution (using 2010 USD-CAD exchange rates). Sources: Statistics Canada, US Small Business Administration, and Statistics of US Businesses, Centre for Digital Entrepreneurship and Economic Performance (DEEP Centre).
[25] See "Attracting the Talent Canada Needs Through Immigration," Advisory Council on Economic Growth, October 2016, and "FutureSkills Canada," Advisory Council on Economic Growth, January 2017.
[26] Detailed in Recommendation 4.
[27] Statistics Canada, share of business sector employment by firm size, 2014 (CANSIM 527-0006).
[28] John R. Baldwin, Danny Leung, and Luke Rispoli, *Canada-United States Labour Productivity Gap Across Firm Size Classes*, Statistics Canada, January 2014.

[29] Adapted from BDC definition of "high-impact firm."
[30] BDC Competitiveness Survey, 2014.
[31] *Canada's Technology Investment Gap: Unlocking the sector's key growth opportunity*, Yaletown Partners, 2016.
[32] BDC, Venture Capital Overview, 2015.
[33] BDC Overview of Venture Capital, 2016.
[34] BDC Overview of Venture Capital, 2016 and CBInsights, "The Venture Capital Funnel," December 2015.
[35] BDC Overview of Growth Capital, 2016.
[36] BDC Competitiveness Survey, 2014.
[37] "Growth & Expansion," total capital invested by country, 2016, accessed through Pitchbook.
[38] Industry Canada, *Profile of Growth Firms: A Summary of Industry Canada Research*, 2008.
[39] BDC High Impact Firm report, 2015.
[40] The exact structure of this would require further consultation and analysis.
[41] Based on 2008 GDP shares by firm size. Calculations assume that the total loss and gain to GDP from firms changing size is equal to the average firm output multiplied by the number of firms either leaving or entering the firm class size. GDP is real business sector GDP (2007 chained C $) and omits utilities, educational services, and public administration. Enterprise data is obtained from CANSIM Table 527-0002.
[42] Expert interviews.
[43] Toronto Stock Exchange.
[44] Investments that are deemed non-substantial in the Bank Act are those that represent less than 10 percent ownership on a look-through basis.
[45] This threshold would be 10 percent per limited partner in a single company assuming that the fund invests no more than 49 percent in any given company.
[46] For the purposes of this calculation, qualifying firms are defined as firms looking for a cash injection of $10 million or more.
[47] *Innovation Canada: A Call to Action – Special Report on Procurement*, Jenkins Expert Panel, 2011; Don Drummond, Evan Capeluck, and Matthew Calver, *The Key Challenge for Canadian Public Policy: Generating Inclusive and Sustainable Economic Growth*, 2015.
[48] Department of Public Services and Procurement Canada, "Overview of the Department," https://www.tpsgc-pwgsc.gc.ca/apropos-about/cdi-mbb/1/survol-overview-eng.html
[49] Accronyms in alphabetical order — AAFC: Agriculture and Agrifood; AIF: Atlantic Innovation Fund; ASIP: Automotive Supplier Innovation Program; BDC: Business Development Canada; CBN: Canada Business Network; CIC: Citizenship and Immigration Canada; CICP: Canadian Innovation Commercialization Program; CSBFP: Canadian Small Business Financing Program; CTA: Canadian Technology Accelerators; EDC: Export Development Canada; EIP: Energy Innovation Program; EMOP: Expanding Market Opportunities Canada; FCC: Farm Credit Canada; GGI: Going Global Innovation; GOA: Global Opportunities for Associations; IFIT: Investment in Forest Industry Transformation; IRAP: Industrial Research Assistance Program; NRC: National Research Council; RDA: Regional Development Agency; SADI: Strategic Aerospace and Defence Initiative; SD: Sustainable Development; SR&ED: Scientific Research and Experimental Development tax incentive; TCS: Trade Commissioner Service; TDP: Technology Demonstration Program; VCAP: Venture Capital Action Plan.
[50] Finance Canada (2009); OECD (2011) for the rankings for BERD intensity (BERD as a percentage of GDP) in 2008; OECD Science, Technology and Industry Scoreboard 2015 for the rankings for BERD intensity (BERD as a percentage of GDP) in 2013.
[51] Conference Board of Canada: Business Enterprise R&D, 2015, www.conferenceboard.ca.