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# TOWARDS AN INCLUSIVE INNOVATIVE CANADA

Volume 1 - February 2017

## **ACKNOWLEDGEMENTS**

First, we need to thank the Canada 2020 team for their hard work in organizing the innovation project and the roundtables across the country where we collected our data. This would not have been possible without Tom Pittfield, Tim Barber, Susan Smith, Melanie Coulson, Alex Paterson, Emilie Montour and Sydney Maxwell. Tim, Melanie and Alex joined Mike Moffatt on the road to participate in our roundtables and this discussion paper, the website, and our Big Ideas are stronger for it. As well, we need to thank the hundreds of participants at our roundtables across the country, who took time out of their very busy schedules to give us their insights on where we might find the bottlenecks to innovation in their industries.

Secondly, we must thank the copyediting, translation and design team who spend hours working on the Innovation Project. This includes Le Collectif Design, Phil Lizotte (Layout), Janet Hunter and Heather Blumenthal (Copy), Nancy Massé, Magali Lemay and Elizabeth Lemay (Translation).

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# ABOUT THE CANADA 2020 INNOVATION PROJECT

We know that to be competitive, Canada must innovate more — or risk being left behind. With this in mind, Canada 2020 launched its Innovation Project, devoted to studying and discussing Canada's innovation agenda — the risks, the opportunities, and key factors involved in making Canada a more innovative nation.

We launched Phase 1 of this project in June 2016, with our 'Being Innovative' event. We also convened a large team of Canadian policy makers, business and community leaders and innovators to examine how to make Canada a global leader in innovation.

From these events, we developed an outline for the Canada 2020 Innovation Project: a plan to define and promote innovation in Canada through research, roundtable discussions, surveys, measurement and public engagement. We decided the project should be inclusive, collaborative and, above all, innovative.

To ensure the Innovation Project is itself innovative, the consultative process has been designed to be agile, organic, and ever-changing. Canada 2020 doesn't believe the discussion around innovation in Canada can conclude in a set amount of time — it is a conversation that continues, and builds on itself. This discussion paper is a part of the ongoing conversation.

Since the project's launch, Canada 2020 has hosted three major conferences, each designed to explore important topics affecting Canada's innovation agenda. We traveled to Silicon Valley to hear from innovative Canadian entrepreneurs, investors and thought leaders there. Over the summer of 2016, Canada 2020 also travelled to eight Canadian cities to speak with key stakeholders in sectors ripe for innovation. While the sectors themselves were very different, common themes emerged: talent and immigration, availability of venture capital and Canadians' aversion to risk. You can read more about those discussions at [www.innovationproject.ca](http://www.innovationproject.ca)

While these conversations were invaluable, they are just the starting point of an important discourse around innovation in Canada. Not all of these discussions will be hosted by Canada 2020 and we look forward to learning from the many conversations and reports being generated by other think tanks, academic institutions and governments.

Phase 2 of Canada 2020's Innovation Project documented the findings of the project to date; the 3rd Annual Canada 2020 Conference in November 2016 marked the start of this more public discourse around innovation in Canada, what it means and where our country needs to go.

To stimulate this conversation, we presented a series of 10 “Big Ideas” to help grow and support innovation in Canada. We hope that some of these ideas, together with our ongoing conferences and roundtable discussions, will lead to the kind of passionate and informed debates that Canada 2020 was mandated to facilitate.

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## EDITOR'S NOTE

As part of the Canada 2020 Innovation Project, we asked Mike Moffatt, Senior Associate at Canada 2020 and Director at the Lawrence Centre at Western University's Ivey Business School, and Hannah Rasmussen, Director at Projection North and Professor at Western University's Brescia College, to consider how to foster innovative growth in Canada. We asked David B. Watters of Global Advantage Consulting to consider how to measure innovation in Canada.

Volume One of Canada 2020’s Innovation Project eloquently captures Canada’s need to innovate and how to measure innovation, while also highlighting important goals we should keep in mind. Specifically, Moffatt and Rasmussen focus on the importance of economically inclusive and autonomy-enhancing innovation.

Moffatt and Rasmussen argue that focusing on who benefits from innovation is critically important and that greater individual choice, with inclusive economic growth for everyone, must be a primary consideration for any innovation strategy. Volume One also looks at the importance of measuring innovation in Canada, and what an innovation agenda should accomplish.

Chapter Five of Volume One offers Moffatt and Rasmussen’s 10 Big Ideas to Drive Innovation in Canada, with detailed concepts that include a Canada 150 Prize, a national numeracy program, a ‘sandbox’ for fintech innovation, and many more. These unique and creative ideas, they are well described and detailed in how they would be executed.

Volume One is the first in a series of reports Canada 2020 will publish around innovation in Canada and we hope you’ll share your opinions on this and future publications through social media, or online at [www.innovationproject.ca](http://www.innovationproject.ca)

# EXECUTIVE SUMMARY

The word “innovation” is ubiquitous. The Canadian government has declared for itself an “Innovation Agenda,” and we know that to be more competitive, Canada must innovate more—or risk being left behind. In June 2016, Canada 2020 launched a multi-phased project on innovation. As part of that initiative, we produced this report, which provides recommendations centred around 10 Big Ideas to improve Canada’s innovation performance.

To develop our set of 10 Big Ideas, we needed to determine what being more innovative is meant to accomplish. In Chapter 1, Mike Moffatt and Hannah Rasmussen describe the two goals that Canada’s innovation agenda should achieve. First, a focus on who benefits from innovation is critically important. We would consider this project a failure if the benefits of innovation simply went to a global elite, the so-called “one per cent.” Canada needs to ensure that our innovation is economically inclusive:

**Economically inclusive innovation** is any innovation that, through market forces, leads to a combination of increased access to high-quality goods and services, higher wages or expanded job market opportunities for both the middle-class and the poor.

However, in our view economic inclusion is not enough, and solutions that simply redistribute the gains from innovation may be counterproductive. The lessons of Brexit and ketchup patriotism are that automation and globalization have not only economic consequences, they also arouse a yearning for a sense of control in those left behind. In our view, Canada’s innovation agenda must be not only economically inclusive, it also must be autonomy enhancing:

**Autonomy-enhancing innovation** is any innovation that translates into greater choice and more opportunities for individuals, families and/or local communities to develop and follow their economic and social goals and that creates or strengthens the causal links between the choices made and the outcomes achieved by those actors.

We then needed to consider how these ideas and the overall benefits of innovation can be communicated to the broader public. For too many Canadians, the word “innovation” means the automation that saw their job replaced by a robot, or the supply-chain innovations that cost them their job to a plant in China or Mexico.

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Next, we needed to consider how we would know if our big ideas to drive innovation forward actually worked. How do we measure innovation? Where are we starting from? What does success look like? In Chapter 3, Dave Watters addresses those questions and notes the significant data gaps that make it difficult to fully know how well Canada's innovation programs are working. He concludes by noting that Canada has focused on measuring innovation inputs, rather than innovation outputs. The focus on inputs is problematic as "innovation does not occur until you have 'sales' of a new product or service in global markets. Any activity before the sale is not innovation. It can, however, reflect a "capability" to innovate. And this is Canada's challenge. We have evolved an innovation ecosystem that has a significant capacity to innovate – but it just can't do it very well."

We then set out to collect the information and data we needed to begin to generate the ideas. Because of the importance of knowledge spillovers, innovation is often the product of industry clusters, so clusters were a logical place to conduct our research. Mike Moffatt and the Canada 2020 team held a series of cluster roundtables across the country, from Halifax's arts and digital creative cluster to Vancouver's cleantech community. At each of our roundtables, we asked our private- and public-sector participants what they saw as the bottlenecks to innovation in their industry. In Chapter 3, Moffatt and Hannah Rasmussen discuss what these conversations taught us, and the common themes that emerged.

Canada has a long history of developing policies to enhance our innovation performance, most of which has had limited success. In Chapter 4, Moffatt takes lessons from past innovation agendas and finds that policies are most likely to be successful when they are actionable, they identify a party responsible for undertaking the reforms and they treat the root causes of poor innovation performance rather than simply the symptoms. To ensure that the big ideas treat the causes of innovation bottlenecks, Moffatt develops a taxonomy of market and regulatory failures that can cause poor innovation performance. He also considers the issues of risk aversion and inequality of opportunity, which can further amplify those market and regulatory failures.

In Chapter 5, Rasmussen and Moffatt present the 10 Big Ideas designed to accelerate innovation in Canada. They take a firm-centric view of innovation and do not limit their recommendations to reforms that can be carried about by the federal government, as they "believe all levels of government, along with firms, institutions of higher education institutions and Canadians all have a role to play to make Canada more innovative."

Finally, in Chapter 6, Rasmussen gives concluding thoughts on Canada's need to continually assess and reassess our innovation ecosystems. It calls for the report to be the beginning of a conversation on innovation, as the authors of the report recognize that no one has a monopoly on the ideas and information needed to make the country more innovative.



# - INNOVATION INTRODUCTION

**BY MIKE MOFFATT**

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**AND HANNAH RASMUSSEN**

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# MISSION STATEMENT

Our mission is increase innovation in Canada by creating a set of Big Ideas, which, if enacted, would have measurable results, whose benefits would be well understood, and that would increase the economic well-being and personal autonomy of the middle class and those working hard to join it.

The focus on who benefits from innovation is critically important. For us to consider innovation successful, the benefits must be widely distributed across Canadian society. In addition, we believe that looking at these benefits in purely economic terms is not enough, but rather the innovation must include finding ways to put more control back into the lives of the middle class, who have seen it eroded through a combination of globalization and automation.

## 1.2 OUR FOCUS: ECONOMICALLY INCLUSIVE AND AUTONOMY-ENHANCING INNOVATION

### 1.2.1 ECONOMICALLY INCLUSIVE INNOVATION

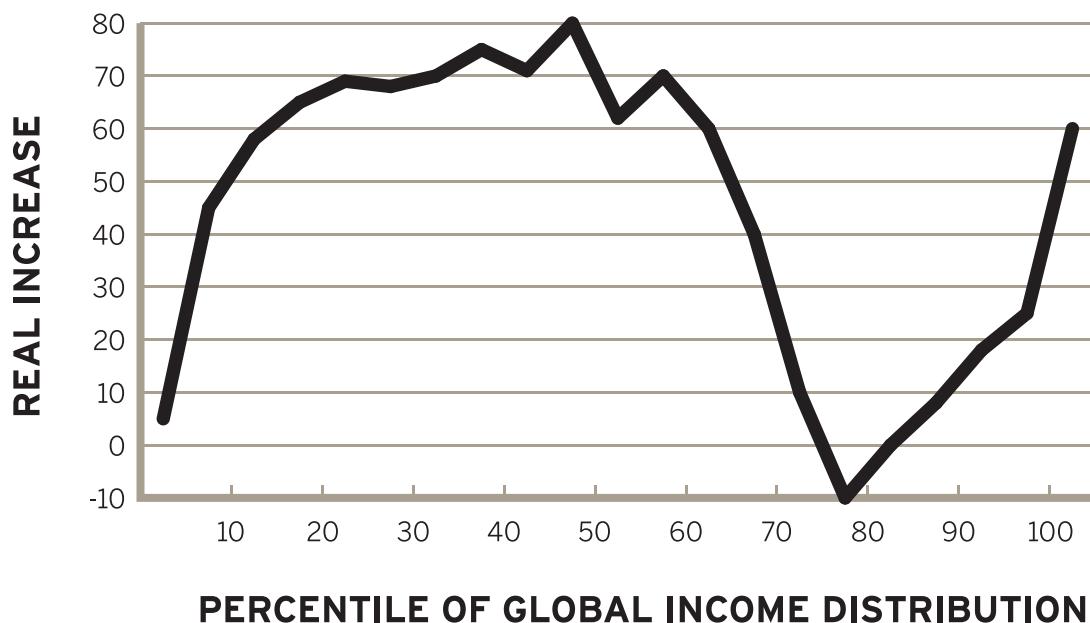
For too many Canadians, the word “innovation” means the automation that saw their job replaced by a robot, or the supply-chain innovations that sent their job to a plant in China or Mexico.<sup>1</sup>

The way innovation is communicated to the broader public colours a significant portion of the negative connotations the word holds for many. There is, however, an important economic component, famously illustrated by Branko Milanovic's elephant graph:<sup>2</sup>

<sup>1</sup> Earlier versions of this discussion appear in M.P. Moffatt, “Halting trade won’t solve globalization’s problems,” TVO website (2016) and M.P. Moffatt, “The small but significant Brexit-like backlashes in Canada,” TVO website, M.P.Moffatt (2016).

<sup>2</sup> Branco Milanovic, “The greatest reshuffle of individual incomes since the Industrial Revolution,” VOX CEPR’s Policy Portal (2016a).

## CHANGE IN REAL INCOME BETWEEN 1998 AND 2008 AT VARIOUS PERCENTILES OF GLOBAL INCOME DISTRIBUTION (CALCULATED IN 2005 INTERNATIONAL DOLLARS)



Note: The vertical axis shows the percentage change in real income, measured in constant international dollars. The horizontal axis shows the percentile position in the global income distribution.

As Milanovic explains in his book *Global Inequality: A New Approach for the Age of Globalization*<sup>3</sup>, the gains of 30 years of globalization and automation have gone to two distinct groups. The first are the people around the global median in income, nine-tenths of whom are from Asian countries, mostly India and China, which are represented by the body of the elephant. The second group is the global one per cent, which appears as the trunk of the elephant. The group centred around the 80<sup>th</sup> percentile of the global income distribution have received no real income gains since the 1980s. This group is disproportionately made up of low- and middle-income earners from fully developed countries like Canada. While middle-income earners in Canada have fared better than most, this was thanks in large part to a quintupling of world oil prices between 2002 and 2008, a trend we are unlikely to see again.

<sup>3</sup> Branco Milanovic, *Global Inequality: A New Approach for the Age of Globalization*, Harvard University Press, Cambridge, 2016b.

If the gains from innovation are not economically inclusive, there are likely to be unintended consequences. In an address to the Parliament of Canada, U.S. President Barack Obama warned of the dangers when the benefits of automation and globalization are not broadly shared.<sup>4</sup>

The world is more prosperous than ever before. But alongside globalization and technological wonders, we also see a rise in inequality and wage stagnation across the advanced economies, leaving too many workers and communities fearful of diminishing prospects not just for themselves but, more importantly, for their children.

And in the face of such rising uncertainty, it is not enough to look at aggregate growth rates or stock prices or the pace of digital innovation. If the benefits of globalization accrue only to those at the very top, if our democracies seem incapable of assuring broad-based growth and opportunity for everyone, then people will push back out of anger or out of fear.

We agree with the president: increasing innovation, by itself, is not enough. The goal must include fostering economically inclusive innovation.

While economic well-being is a necessary condition for creating support for an innovation agenda, it is not a sufficient one.

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## 1.2.2 AUTONOMY-ENHANCING INNOVATION

One potential solution to the benefits of innovation not being broadly shared would simply be to redistribute from the economic winners to those left behind. However, as economist Will Davies wrote in a thought-provoking piece on Brexit,<sup>5</sup> defining inclusion in solely economic terms misses the larger picture:

Labour's solution [to the economic crises of the 1970s] was to spread wealth in their direction using fiscal policy: public sector back-office jobs were strategically relocated to South Wales and the North East to alleviate deindustrialisation, while tax credits made low productivity service work more socially viable. This effectively created a shadow welfare state that was never publicly spoken of, and co-existed with a political culture which heaped scorn on dependency.

<sup>4</sup> Barack Obama, "Speech to the House of Commons," *Maclean's*, 2016.

<sup>5</sup> Will Davies, "Thoughts on the sociology of Brexit," Political Economy Research Centre website (2016).

This cultural contradiction wasn't sustainable and nor was the geographic one. Not only was the "spatial fix" a relatively short-term one, seeing as it depended on rising tax receipts from the South East and a centre-left government willing to spread money quite lavishly (albeit, discreetly), it also failed to deliver what many Brexit voters perhaps crave the most: **the dignity of being self-sufficient, not necessarily in a neoliberal sense, but certainly in a communal, familial and fraternal sense.**

Although these forces do not yet appear to have Brexit-sized political implications in Canada, we believe they exist and are growing here, as shown by *ketchup patriotism*.

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### 1.2.3 LEARNING FROM LEAMINGTON

In 2014, Heinz, the flagship company in Leamington, Ont., for more than 100 years, closed its tomato processing facility, costing the small community 750 jobs. The plant was reopened with a reduced workforce, by Highbury Canco, to manufacture tomato paste. The fortunes of the plant were boosted when French's announced in early 2015 that it would be sourcing from Leamington to produce its ketchup. In early 2016, in a Facebook post, Oakville, Ont., native Brian Fernandez encouraged Canadians to "support Canadian workers and tomato farmers" and purchase French's, not Heinz. The post quickly went viral, and ketchup patriotism was born.

Some commentators dismissed the Buy French's campaign as mindless patriotism. Others scoffed and pointed out that part of the production process took place in the United States, and French's parent company was based in Britain. These commentators missed the point.

Southwestern Ontarians felt helpless as the twin forces of automation and globalization, along with a petro-fuelled Canadian dollar, saw the closing of not just Heinz in Leamington, but Navistar in Chatham, Ford in Talbotville and Electro-Motive Diesel in London, to name just a few. Citizens felt powerless as local manufacturing icons closed down, based on decisions made in faraway board-rooms. Yes, buying a four-dollar bottle of ketchup was not going to solve all of the region's problems, but it was at least something an ordinary Canadian could do to try to regain manufacturing in an area that had suffered so badly.

## 1.2.4 AUTONOMY AND THE DESIRE TO REDISCOVER CONTROL

The linkages between globalization and a loss of opportunities (or control) go beyond ketchup patriotism and are a common theme in post-Brexit writing from the U.K. In a piece for the *Financial Times*, former British prime minister Gordon Brown argued for a “programme that shows how an open global economy can maximise the opportunities and minimise the insecurities of the unskilled, the poorly educated and those currently losing out.”<sup>6</sup> Like Will Davies, writing on Brexit, we would take the issue further than economic insecurities and frame the issue around autonomy:

In this context, the slogan “take back control” was a piece of political genius. It worked on every level between the macroeconomic and the psychoanalytic. Think of what it means on an individual level to rediscover control. To be a person without control (for instance to suffer incontinence or a facial tick) is to be the butt of cruel jokes, to be potentially embarrassed in public. It potentially reduces one’s independence. What was so clever about the language of the Leave campaign was that it spoke directly to this feeling of inadequacy and embarrassment, then promised to eradicate it. The promise had nothing to do with economics or policy, but everything to do with the **psychological allure of autonomy and self-respect**. [UK Independence Party leader Nigel] Farage’s political strategy was to take seriously communities who’d otherwise been taken for granted for much of the past 50 years.

A body of evidence is emerging that suggests personal autonomy, not money, is the key to individual happiness in developed countries, which Ronald Fischer and Diana Boer describe in their meta-analysis in the *Journal of Personality and Social Psychology*:

What is more important: to provide citizens with more money or with more autonomy for their subjective well-being? In the current meta-analysis, the authors examined national levels of well-being on the basis of lack of psychological health, anxiety and stress measures ... The authors found that individualism was a consistently better predictor than wealth ... The overall pattern strongly suggests that greater individualism is consistently associated with more well-being. Wealth may influence well-being only via its effect on individualism.<sup>7</sup>

Ultimately, if we are going to improve the lives of the middle-class and the poor, we must focus on increasing their autonomy, their ability to make choices that positively affect the lives of their families and communities. Increasing their wealth is one way of doing this (as Fischer and Boer note), but Brexit teaches us that simply providing financial compensation for globalization- and automation-based economic decline is not enough.

<sup>6</sup> Gordon Brown, “Leaders must make the case for globalisation,” *Financial Times Opinion* (2016).

<sup>7</sup> Ronald Fischer and Diana Boer, “What Is More Important for National Well-Being: Money or Autonomy?” *Journal of Personality and Social Psychology*, pp. 164-184. (2011).

## 1.2.5 TOWARDS A HUMAN-CENTRED INNOVATION

The goal of innovation should be to make humanity better off. In a thought-provoking essay, Lewis J. Perelman has argued that too often innovation has been about anything but improving humanity:

Innovation traditionally was viewed as a linear process: from basic research to technology development and on to test/evaluation, demonstration, deployment, commercialization, and ultimately, market penetration. And perhaps, if successful, market saturation, obsolescence, and finally replacement. Human (and social) factors — needs, desires, demands, behaviour — were considered either not at all or intuitively, anecdotally, coincidentally, mechanically, and often reactively.<sup>8</sup>

We wholeheartedly agree with Perelman's call for human-centred innovation. Past innovation, while creating economic growth, led to increased automation and globalization, which led many to feel "left behind." How can Canada ensure that future innovation, a necessary ingredient for further economic growth, does not lead to increased feelings of a loss of control among the "middle class and those working hard to join them?" Addressing these tensions and promoting economically inclusive and autonomy-enhancing innovation policies will be at the core of our 10 Big Ideas.

<sup>8</sup> Lewis J. Perelman, "Toward Human-Centered Innovation," Innovation's Vital Signs Workshop, 2007.





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# WHAT IS INNOVATION AND HOW DO YOU MEASURE IT?

**BY DAVID B. WATTERS**  
PRESIDENT AND CEO, GLOBAL ADVANTAGE GROUP

## 2.1 WHAT IS INNOVATION?

The most widespread and accepted definition of innovation, which has been adopted by the 34 countries of the Organisation for Economic Development (OECD), is based on the Oslo Manual<sup>1</sup> and defines innovation as follows:

**“An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.”**

This definition contains four distinct kinds of innovation, which are further defined by the OECD as follows:

**Product Innovation:** This involves a good or service that is new or significantly improved.

This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics (e.g. a new iPhone, a better mousetrap, a 3-D printer, etc.).

**Process Innovation:** This involves a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software (e.g. just-in-time inventory, customer-relations management (CRM), etc.).

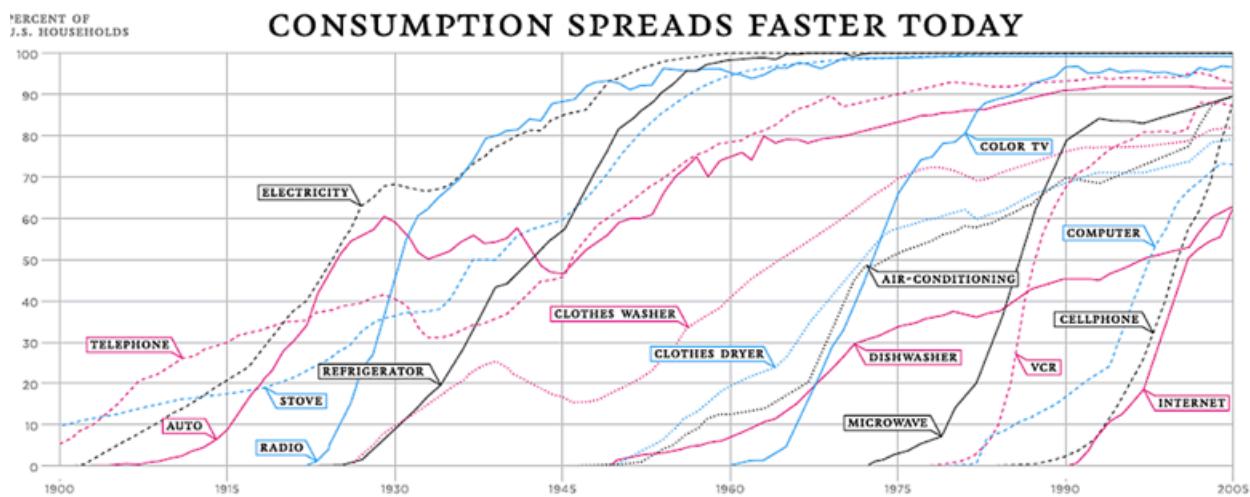
**Marketing Innovation:** This involves a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing (e.g. Amazon, Shopify, Netflix, etc.).

**Organizational Innovation:** This involves introducing a new organizational method in a firm's business practices, workplace organization or external relations (e.g. Uber, Airbnb, crowdfunding, etc.).

<sup>1</sup> Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd. edition (OECD, 2005).

From this definition of the scope of innovation activity, several important observations should be noted:

1. First, most Canadian research and innovation support programs tend to focus on the first kind of innovation, product innovation, and not the other three kinds, process, marketing and organizational innovation. And, in fact, the focus is even narrower within the category of product innovation because the focus of government research and innovation support tends to be on the development of a “good” as opposed to a “service.” However, given the fact that between 72 and 75 per cent of Canada’s economy produces services and not goods (the manufacture of goods comprises only about 11 per cent of economic activity), a rebalancing of government innovation support programs would be appropriate. Unfortunately, much of our thinking about both innovation and programs to support innovation is still driven by a focus on developing new devices or tools. While an innovative manufacturing sector is an important component of economic activity, **it is now surrounded by the much larger service economy** – and this service economy now requires a deeper understanding on our part. How can governments best support innovation in service industries (e.g. finance, engineering, design, etc.) in order to strengthen their global competitiveness?
2. Second, it should also be noted from the OECD definition that innovation activity requires **“implementation”** in order to be complete. In other words, innovation requires **the sale and use** of the new good or service in a market. If the new good or service is not sold and used, it is not an innovation. In this context it is important to note that the diffusion of new technology throughout a society requires “social licence” from that society. From the innovator, moreover, it requires an understanding of the culture, values and needs of that society such that what is designed and developed will be broadly accepted and used. In this regard, note that changes in the rate of technology adoption are increasing, as illustrated below. This suggests that there will be mounting competitive pressure to increase the speed of innovation processes and to increase the efficiency of national innovation ecosystems.



**Also note that as a technology is adopted widely, it can begin to transform other parts of a society.** Take, for example, the automobile. The wide adoption of the automobile facilitated the growth of suburbs, permitted access to jobs, supported the growth of new industries, such as auto repair, filling stations, insurance, etc., made leisure travel and entertainment more accessible and facilitated interstate commerce, among other things. **In summary, as technologies are introduced into an economy, these broader societal implications and likely changes in public- and private-sector and customer behaviour need to be anticipated and understood.**

3. Finally, it should be noted that innovation activity is not something that is new. Innovation activity can arguably be seen simply as the history of the progress of civilization. For example, consider these two displays in the Turkish Museum of Anatolian Civilizations in Ankara, Turkey.

The first, from 10,000 years ago (8000 BC), shows a simple tool in the middle of the display case that illustrates the essence of innovation, the “combining” of separate things in a new way, to create something new of value – in this case the combining of 1) a stick with 2) a sharp rock bound by 3) animal hide, to form a new tool – an axe.



Ankara Museum of Anatolian Civilizations  
Lower Paleolithic period (before 8000 BC) - A Hand Axe



Assyrian - Hittite (about 1800 BC) - Hand Held Tablet

The second, from about 4,000 years ago (1800 BC), shows a tablet in the middle of the display case that contains a trade treaty between two tribes in Mesopotamia written in cuneiform script. What is interesting is that it is hand-held and exactly the size and shape of an iPhone. However, unlike an iPhone, it could certainly be argued that it is more innovative in design because it has **two** sides on which to display information (front and back). Finally, also note that it is wireless!

In summary, innovation may be a deeply rooted instinct to find solutions to enduring human needs.

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## 2.2 WHAT IS AN INNOVATION ECOSYSTEM?

An innovation ecosystem is the network of all stakeholder organizations in both the public and private sectors whose activities and interactions:

1. create and disseminate new knowledge or technology, and
- 2 support how businesses<sup>2</sup> incorporate that knowledge or technology into both existing and new products (either goods or services) for sale in domestic and global markets.

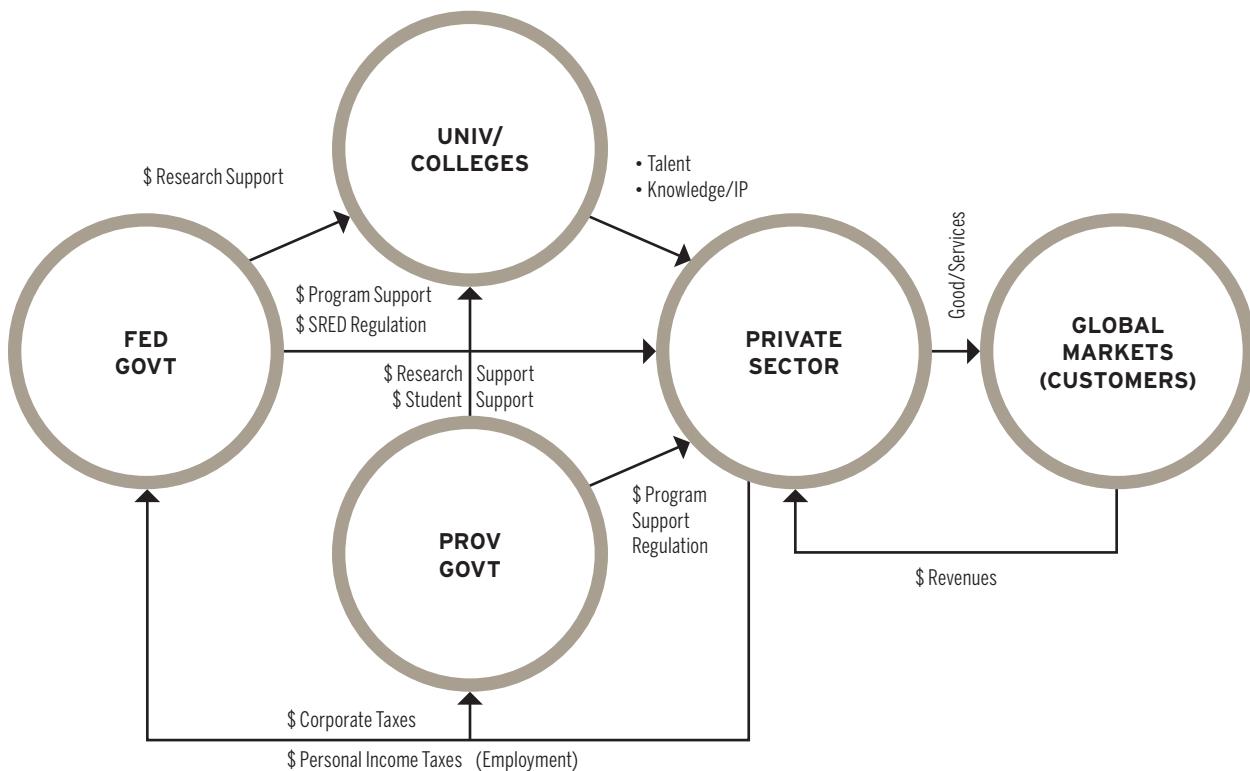
There are five key institutions and groups that combine to support an effective innovation ecosystem in Canada. They are:

1. The federal government
2. The provincial, territorial and municipal governments
3. Universities and colleges
4. The private sector
5. Global markets

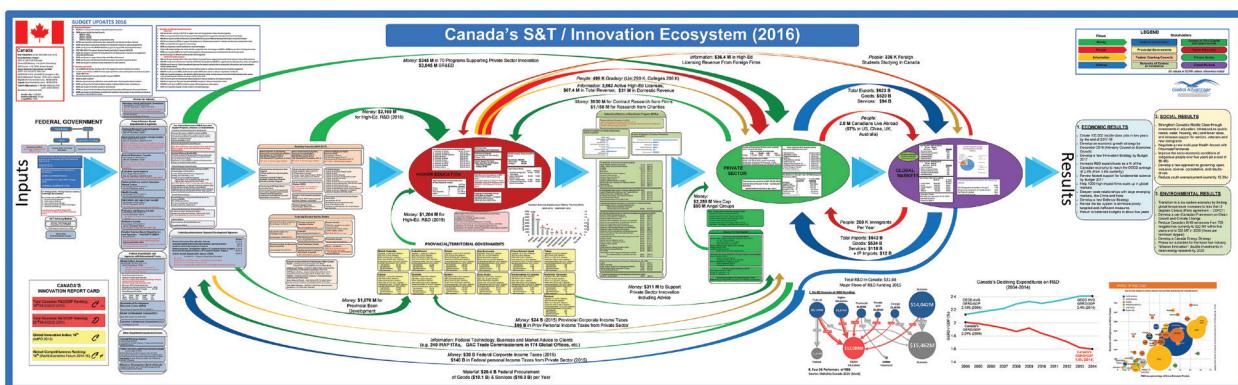
The five key stakeholder groups are noted in figure 1 below and their key outputs are identified. For example, the most important outputs of the universities and colleges are talented graduates and new research-based knowledge.

<sup>2</sup> Note that innovation activity can, of course, also be examined in relation to other activities, such as social- or public-sector innovation. Unfortunately, these sectors of "non-market innovation" have not been examined nearly as much as has business innovation. In the interim, and quite correctly, the federal government's Innovation Agenda centres on business innovation in order to respond to the challenges of low economic growth, poor productivity performance and the need to grow Canada's middle class.

## WHO ARE THE FIVE (5) KEY STAKEHOLDERS IN CANADA'S INNOVATION ECOSYSTEM:



To identify these roles further, the state of Canada's 2016 innovation ecosystem is shown here and online at <http://globaladvantageconsulting.com/2016-science-technology-innovation-ecosystem-map/>



The input-output structure of the 2016 Innovation Ecosystem Map permits a clearer identification of the key role of each innovation stakeholder group and the key linkages between them. For example:

- A. Governments** (federal, provincial, municipal) create the overall macroeconomic and regulatory environment within which each group operates, and provide the programs and services through spending, tax incentives, regulations and procurement that support the higher education, not-for-profit and private sectors within the performance of the entire ecosystem.
- B. The higher education sector** conducts more than 40 per cent of all Canadian research (basic and applied) that has the possibility of being commercialized while also training the highly qualified employees that companies and public institutions are in need of. (These employees are drawn from the almost 500,000 students that graduate from Canada's universities and colleges every year.).
- C. The private sector** conducts about 50 per cent of all Canadian research and employs talented graduates (students and new professionals, known as Highly Qualified Personnel or HQP) to commercialize research and its own new ideas, operate businesses and enter new markets (domestic and international) with innovative goods and services.
- D. Global markets** represent both customers and competition for innovative products and services created by Canada's private sector.
- E. Results** are produced in the innovation ecosystem when Canadian firms sell their innovative products and services to customers in the domestic and global marketplace. As these products and services are purchased, they generate the revenues that flow back to Canada's private sector and permit firms to create new middle-class jobs, train and invest in new information and communications and clean technologies, invest in further innovation activity and pay federal and provincial taxes to sustain government programs and services.

## 2.3 WHY IS INNOVATION IMPORTANT?

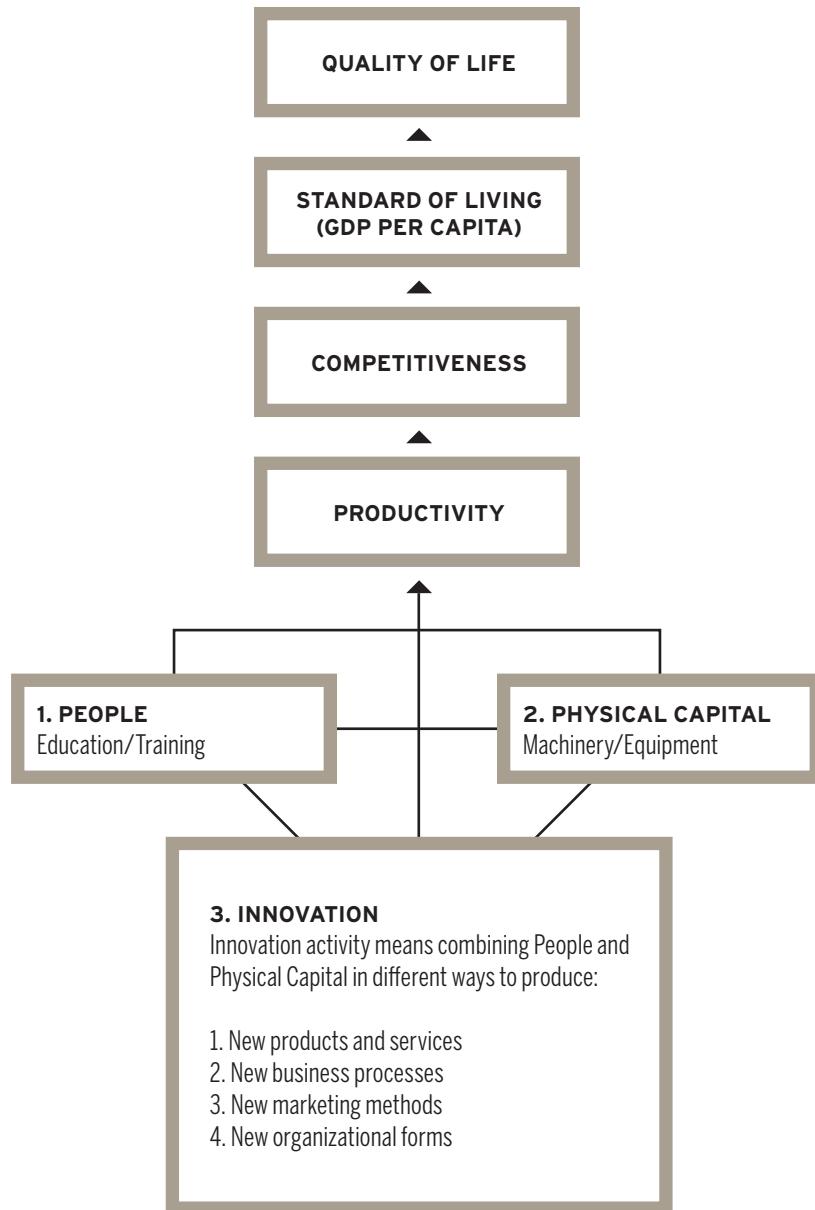
The Federal Economic Logic Chart in figure 2 is a useful way to explore the role of innovation in the economy. The following explanation summarizes its structure.

Governments are mandated to improve the quality of life of their citizens. Improving the quality of life of a population requires investments whose sustained affordability depends on a country's standard of living (as measured by GDP per capita). The standard of living of a country is dependent upon how competitive its economy is in producing goods and services for global markets. The long-term competitiveness of an economy depends in turn upon the productivity<sup>3</sup> of its workforce. And the growth in its productivity depends upon three activities:

1. Public and private investments in people (education/training/participation rate),
2. Public and private investments in physical capital (the volume and quality of the latest machinery and equipment), and
3. Public and private investments in innovation (experimenting and managing different combinations of people and physical capital to create new goods, services, business processes and business and marketing structures).

As a result, these three categories of investment in productivity are the primary source of a country's competitiveness, standard of living and quality of life.

<sup>3</sup> Productivity or Total Factor Productivity are defined here as the efficiency with which people and capital are combined in the output of the economy. Productivity gains lead to improvements in the standard of living, because as labour, capital, etc. produce more, they can generate greater income.

**Figure 2: Federal Economic Logic Chart**

From this logic chart, it is interesting to note that innovation activity is a “managed” activity. It involves the discipline of the integration of people and physical capital in new ways to produce new value for customers.

As a result, it requires a deep understanding of: customer needs in global markets that have different cultures, norms and business practices; how to access these markets through complex global distribution channels and value chains; how to develop the partnerships and alliances to permit this access; and how to manage a network of capital, talent and component suppliers to produce the firm's innovative goods or services that are then capable of meeting the specific needs of customers in each of these global markets (e.g. China as differentiated from India).

This complexity is why designing an effective national innovation ecosystem requires a systems approach.

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## 2.4 HOW INNOVATIVE IS CANADA TODAY?

**How does Canada's innovation performance compare with that of other countries?  
Is this performance adequate or does it need improvement?**

The most comprehensive and sophisticated assessment of innovation performance is conducted annually by Cornell University, INSEAD and the World Intellectual Property Organization. Called the Global Innovation Index, it ranks 128 countries on 82 measures of innovation.

Canada's performance continues to be mediocre among developed economies. In 2016, our rank was 15<sup>th</sup>, an overall decline from our eighth-place rank when the index was developed in 2007. However, Canada's innovation efficiency ratio, a ratio of innovation output to innovation inputs, was extraordinarily poor, and ranked us 57<sup>th</sup> in the world in 2016. Moreover, Canada has been ranked as low as 74<sup>th</sup> in the past several years.

This means that Canada has good innovation capacity and inputs (such as institutions, human capital, research, regulations and infrastructure) but we are poor at producing innovation outputs such as new technology, creative goods and services and related exports.

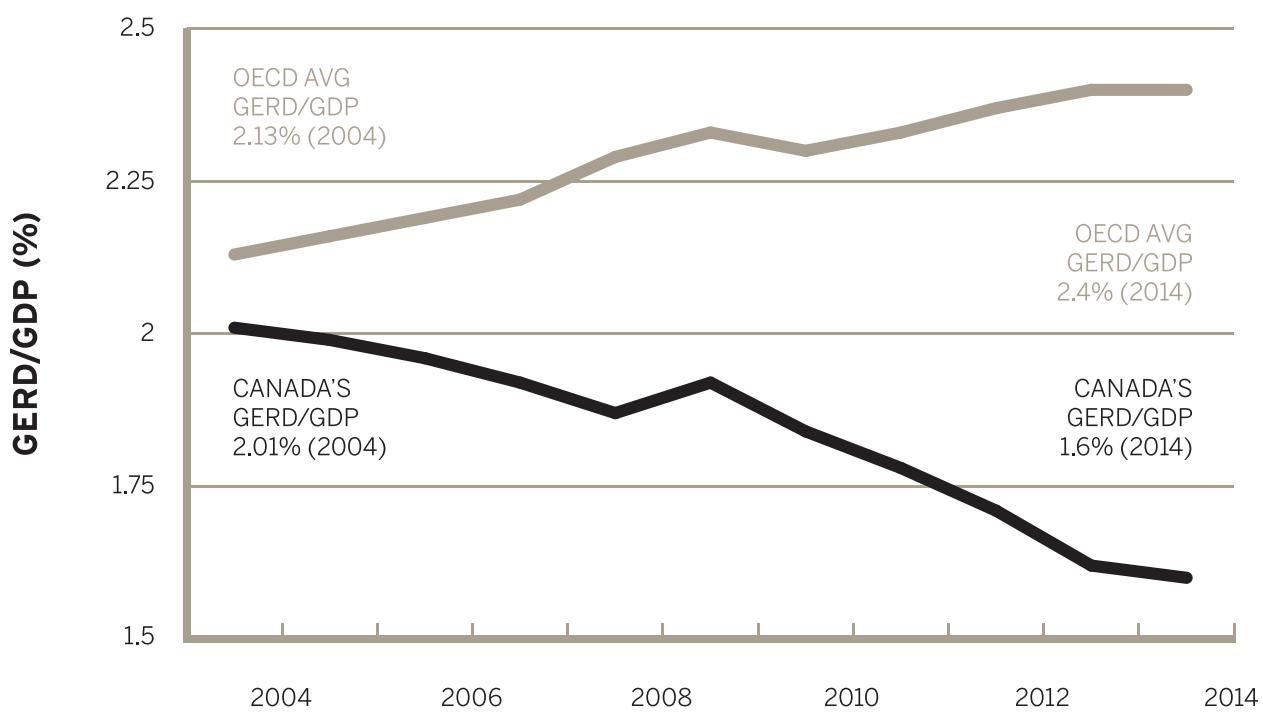
This suggests structural problems in the way Canada's innovation ecosystem has been designed. A second standard way of examining a nation's innovation performance is to look at its gross expenditures on research and development (GERD). This approach is used by the OECD and other institutions as a significant way to compare the innovation performance of all 34 OECD countries as well as key emerging market economies.

Using this system, Canada ranks 19<sup>th</sup> out of 34 OECD countries in the percentage of its economic activity spent on supporting research and development (Canada spends 1.6 per cent of its GDP on R&D). This compares with the OECD average country expenditure spent on R&D of 2.4 per cent of economic activity. Canada's performance has been in steady decline over the past 10 years "a decade of darkness" (see chart, Canada's Declining Expenditures on R&D, below) and is now a third below the OECD average. The performance gap is so extensive that if Canada decided that it wanted to close the gap over a five-year period – to just become an average OECD performer – then it would cost an incremental investment of \$78 billion from governments, institutions of higher education and the private sector.

Combining the performance results of these two measurement systems can give the cynic a spark of satisfaction and good news: Canada is at least underfunding an ineffective innovation system.

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## CANADA'S DECLINING EXPENDITURES ON R&D (2004-2014)



An examination of these two ways of comparing Canada's lacklustre innovation performance suggests that we need to consider both a redesign of our innovation ecosystem to improve its productivity and a significant refunding to expand its critical mass in order to be capable of competing globally.

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## **2.5. HOW WILL WE KNOW IF NEW FEDERAL POLICIES WILL INCREASE INNOVATION? WHAT WILL WE MEASURE? WHAT BEHAVIOURAL CHANGES DO WE WANT TO SEE FROM INNOVATION INVESTMENTS?**

The issue of what innovation activity to measure can be deconstructed into two major components, similar to the approach taken by the Global Innovation Index measuring:

1. Innovation Inputs
2. Innovation Outputs

However, of the two categories of measures, I would argue that the measurement and performance of innovation outputs is the most important. If a country has the best innovation inputs in the world, but no innovation outputs, then the performance of its innovation ecosystem must be unacceptable. To make an analogy, if a nation presents the largest number of competitors of any country in the Summer Olympics, and they are the best resourced, trained and coached, but it produces no medals, then its system to support Olympic athletes is a failure. Similarly, if you have the best research and innovation funding, institutions, education, researchers, innovation infrastructure and supportive mentoring, but do not actually innovate, then your innovation ecosystem is a failure and needs to be re-examined.

And this of course is the situation in which Canada finds itself: while in 2016 Canada was ranked 10<sup>th</sup> in innovation inputs, we ranked 57<sup>th</sup> in our ability to convert these inputs to innovation outputs.

As a result, I suggest that we need to focus on what Canada wants from an effective innovation ecosystem ... and then work backwards to an identification of the innovation inputs that would support that ecosystem.

### A Focus on Innovation Outputs

Building on the platform of the new federal government, its 2016 budget and the policy statements and commitments of the prime minister and ministers, I would suggest the following innovation outputs are relevant as targets for a redesigned innovation ecosystem:

1. The creation or maintenance of middle-class jobs
2. Equitable access to those middle-class jobs (inclusiveness) and the training to maintain them
3. Cleaner economic growth (less waste and reduced greenhouse gas emissions)
4. Increased export revenues from globally competitive Canadian businesses

What metrics would permit the government to achieve these objectives?

I would suggest that the “keystone” metric that would monitor the government’s performance in achieving its innovation objectives (as part of its overall policy agenda) is this:

### Sales of innovative Canadian goods and services in global markets

There are three arguments supporting this conclusion:

1. Innovation occurs only when an innovative good or service is sold. Therefore sales (Olympic medals) are the key metric in assessing innovation performance.
2. Canada’s population (0.5 per cent of the world’s total) and the size of our economy (1.5 per cent of the world’s total) offer relatively small markets for innovative goods and services. Therefore, Canadian businesses must expand sales in global markets to be globally competitive at innovating.
3. Canadian businesses should not expect large subsidies from governments to support the creation of middle-class jobs, training, the adoption of clean technology and information and communications technologies and support for innovation activity. Rather, firms need to self-finance these investments from global export sales and the revenue those sales generate.

As a result, if this “keystone metric” is valid, then governments should measure the following components of the performance of Canada’s innovation ecosystem:

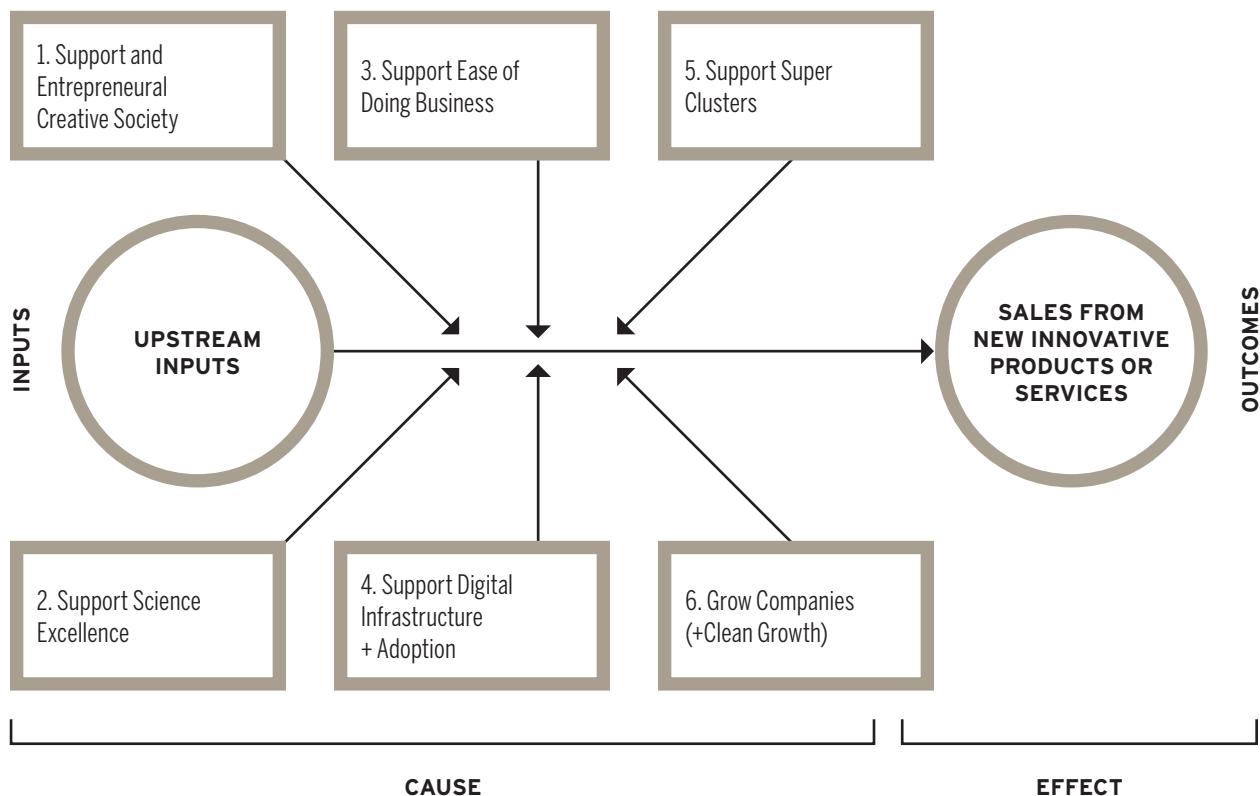
1. Number of new and innovative goods and services sold in global markets each year
2. Number of innovative goods and services sold in each national market (U.S., Europe, China, India, Canada, etc.)
3. Number of firms selling those goods and services
4. Size of those firms (small, medium, large)
5. Industry sector of those firms (cleantech, information and communications technologies, life sciences, aerospace, agri-food, fintech, advanced manufacturing, etc.)
6. Volume of new revenues from sales of those innovative products and services
7. Per cent of profit from those sales
8. Per cent of profit invested in creating or maintaining middle-class jobs
9. Per cent of profit invested in new research and innovation activity
10. Per cent of profit invested in adopting new technologies (particularly cleantech and information and communications technologies) and employee training

This keystone innovation metric, sales of innovative Canadian goods and services in global markets, would be the objective against which all other innovation input metrics would be assessed (i.e. amount of research funding, number of publications, number of patents, amount of venture capital, number of researchers, etc.). From the perspective of producing innovation results in global markets, such innovation inputs have relevance only to the extent to which they can be linked to the desired outcome of Canada’s innovation ecosystem, which is incremental sales of innovative Canadian goods and services in global markets. This outcome then generates the revenues so Canadian businesses can finance the creation of new middle-class jobs, provide training to maintain these jobs, invest in information and communications and clean technologies and invest in new innovation activity.

## 2.6. WHAT KEY CRITERIA SHOULD BE USED TO ASSESS NEW INNOVATION PROPOSALS?

The federal government has proposed to redesign the innovation ecosystem around six themes. I have organized these six themes on an input/output basis, as noted below, depending on how far away the activity is from producing an innovation result, such as the sale of innovative goods and services in global markets. For example, establishing a “creative” culture in a society or pursuing scientific research “excellence” are **upstream innovation activities** whereas supporting industrial clusters and company growth are **downstream innovation activities**, as noted below.

### INPUT/OUTPUT INNOVATION METRICS



The federal government will likely receive hundreds of proposals on each of these six themes throughout its complex consultation processes. How will these proposals be assessed? What criteria will be used to assess them? Schema 1 suggests one possible framework for discussion.

## SCHEMA 1: KEY CRITERIA TO ASSESS INNOVATION PROPOSALS:<sup>\*</sup>

Criteria	1 # New Innovative Goods/Services Sold (20%)	2 Increased Export Revenues – by Industry Sector (20%)	3 Middle Class Jobs Created (30%)	4 Increased Firm Investment in Cleantech & ICT (15%)	5 Increased Firm Investment in Research & Innovation (15%)	Total
<b>Individual proposals are allocated to one of the six consultation themes noted below.</b>						Score (out of 100%)
<b># 1 Entrepreneurial and Creative Society</b> - - -						54%
<b># 2 Global Science Excellence</b> - -						75%
<b>3. Ease of Doing Business</b> - - -						-
<b>4. Compete in a Digital World</b> - - -						72%
<b>5. Upscale Leading Clusters &amp; Partnerships</b> - -						-
<b>6. Grow Companies and Accelerate Clean Growth</b> - -						94%

\*Illustrative only

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## 2.7. ARE THERE GAPS IN THE DATA THAT WILL NEED TO BE FILLED IN ORDER TO MEASURE INNOVATION SUCCESSFULLY?

Yes, there are huge gaps in the data that would need to be filled in order to measure innovation successfully. In part, these have originated from the reduced role of Statistic Canada over the past eight years in producing innovation data, and the termination of many essential data sets. In fact, Innovation, Science and Economic Development Canada should be tasked with undertaking an open examination with all stakeholders about what data will be important to support the performance of and feedback about the operation of a redesigned innovation ecosystem.

However there are also new data gaps, a couple of which are noted below:

### **1. Middle-Class Jobs**

Budget 2016 was organized around creating 100,000 middle-class jobs. But nowhere was the nature of a middle-class job defined. What is it? What is the threshold income level? Does this vary by province? What is the salary range? Is it a permanent or sustainable job? Is it linked to a standard of living in different cities across Canada, as well as in rural areas?

We need clarity on the concept of a middle-class job and its application, as it increasingly becomes the focal point of “inclusive economic growth.”

## **2. Industry Technology Sectors**

We need standardized definitions of industries and activities that are included in references to priority federal industrial sectors such as: clean technology, life sciences, advanced manufacturing, fintech, digital media, nanotechnology, biotechnology, genomics, disruptive technologies, and so on.

## **3. Innovation Activity**

The federal government needs to confirm a definition of innovation that it will use in redesigning its innovation programs so that stakeholders will understand the boundaries of the behaviour by firms and other organizations that will be incentivized and encouraged. We suggest that the OECD definition be accepted for this project, including the four different types of innovation activity (Product Innovation, Process Innovation, Marketing Innovation and Organizational Innovation). Understanding and accepting these definitions will help us to rethink our approach to innovation. For example, the largest federal innovation program supporting the private sector is SR&ED (Scientific Research and Experimental Development), but it only supports research (an input) and *not* innovation (an output). And it specifically excludes any social science research (in economics, business, marketing, consumer psychology, etc.). Do these remarkable limitations on Canada’s largest business support program (at \$3.1 billion annually it is nine times larger than any other program) make sense any more as we increasingly focus federal innovation support on helping businesses access global markets.

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## **2.8. CONCLUSIONS ABOUT CANADA'S ABILITY TO SUCCESSFULLY INNOVATE AND INCREASE INNOVATION.**

Innovation does not occur until you have “sales” of a new product or service in global markets. Any activity before the sale is not innovation. It can however, reflect a “capability” to innovate. And this is Canada’s challenge. We have evolved an innovation ecosystem that has a significant capacity to innovate – but it just can’t do it very well. In addition, our innovation metrics have not provided us with enough accurate feedback about our poor innovation performance. Our metrics have focused largely on innovation “inputs” (e.g. published papers, patents and potential products) and not innovation “outputs” (actual sales of innovative goods and services in global markets).

As a result, we need to redesign our innovation ecosystem to focus more on achieving innovation results and, correspondingly, to identify and structure a logic model of the key innovation metrics to monitor our progress to achieve those results.



# INNOVATION BY SECTOR

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## 3.1 INDUSTRY CLUSTERS IN CANADA

To generate recommendations and big ideas to improve Canada's innovation performance, we needed to conduct field research on the Canadian innovation landscape. Early in the process we made the decision to focus on industry clusters, which the European Commission defines as follows:<sup>1</sup>

In more general terms, clusters can be defined as a group of firms, related economic actors, and institutions that are located near each other and have reached a sufficient scale to develop specialised expertise, services, resources, suppliers and skills. A common element of most cluster definitions is the aspect of a concentration of one or more sectors within a given region as well as the emphasis on networking and cooperation between companies and institutions.

Clusters are defined by relationships, not memberships, and their spatial boundaries are variable and not necessarily corresponding with political borders. Cluster geography may be defined by the distance and time that people are willing to travel for employment and that employees and owners of companies consider reasonable for meeting and networking. Geography is therefore not a stable concept but influenced by factors such as travel conditions, cultural identity, and personal preferences. New forms of transport and communication, such as the Internet, are also changing the spatial dimensions of a cluster.

There is no universally agreed-upon method on how to identify or calculate the number of industry clusters that exists in a country, but we can estimate the number with some level of confidence. Using data from the 2011 National Household Survey and a Dun & Bradstreet 2011 universal business establishment database, Canada's *Cluster Atlas*<sup>2</sup> identifies 230 distinct clusters in Canada. These clusters of resource, manufacturing and service industries are spread out across the country. Clusters can be found in big cities such as Toronto's finance cluster, which employed 307,963 people in 2011 in 12,495 different companies; in mid-sized cities, from Moncton's logistic cluster of 53 businesses that employed 5,061 people to Brandon's agricultural cluster, which was made up of 19 companies and employed 3,433 people.

<sup>1</sup> (European Commission, 2008) *The Concept of Clusters and Cluster Policies and Their Role for Competitiveness and Innovation*

<sup>2</sup> (Spencer, Gregory M, 2014) *Cluster Atlas of Canada*, Toronto, Local IDEAs

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But why focus on clusters instead of firms in general? First, there are some benefits to firms by being in a cluster.<sup>3</sup> Firms in clusters benefit from knowledge spillovers between firms and institutions within the cluster thanks to proximity. They create economies of scale and scope; for example, having a large number of tech companies in an area creates the conditions that allows law firms to specialize in legal issues specific to that industry. They create a “social glue” that links different actors in the cluster together, which creates trust and cooperation leading to the creation of new firms, products, and processes.

There is a growing body of empirical evidence that suggests that clusters create the conditions for innovation. Research by the European Commission (2008) found that innovative companies in clusters were twice as likely to apply for a patent than the general population of innovative companies. They also found that the cluster companies were twice as likely to contract out research to other firms and universities, and over 50 percent more likely to conduct market research for introducing new products or services. In a study of over 4000 Swedish firms, (Wennberg & Lindqvist, 2010) found that, controlling for other factors, firms in clusters create more jobs, pay higher wages and remit higher levels of taxes to the government than those not within a cluster.

To gather more data and inside knowledge on Canadian industry clusters, Canada 2020 assembled eight roundtables across the country that brought both private - and public - sector leaders together to discuss the bottlenecks to innovation in a specific, geographically centred industry cluster. The eight clusters we chose, from Vancouver’s cleantech and renewables cluster to Halifax’s culture and digital creative sector, were not meant to necessarily represent Canada’s most important clusters. Rather, we felt it was important to have a cross-section of industries and geographies to act as case studies so we could identify common bottlenecks to innovation that could be addressed through smart public policy. We specifically wanted to avoid falling into the common innovation research trap of over focusing on science and technology. Recall the Oslo Manual definition of innovation from Chapter 2:

“An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.”

This definition of innovation applies just as much to the agri-food industry as it does to the life sciences, so only through an examination of a cross section of industries can we truly understand the bottlenecks to innovation.

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<sup>3</sup> These are discussed in detail in *The Concept of Clusters and Cluster Policies and Their Role for Competitiveness and Innovation* (European Commission, 2008)

### 3.1.1 FINANCIAL SERVICE CLUSTERS IN CANADA

A well-functioning financial services sector is vital because it serves critical functions in our society. The sector is also economically important in its own right, directly employing 780,000 Canadians and accounting for 6.8 per cent of Canadian GDP in 2014, according to data from the Conference Board of Canada. By far the largest cluster of financial services firms is in the Toronto area, and they account for 32.3 per cent of Canada's financial services employment. Nearly one worker in twelve in the metro Toronto area is directly employed by the financial services industry, which accounts for 13.2 per cent of the area's GDP. Typically, Toronto is included in Top 10 rankings of global financial centres, with the Global Financial Centres Index ranking the city eighth in the world.<sup>4</sup> Toronto's financial sector also has substantial links to Waterloo's tech sector, and the two are often considered part of the same GTA-KW finance ecosystem.<sup>5</sup> Financial Technology (known as fintech) investments are growing rapidly in Canada, with OMERS Ventures reporting that 100 fintech start-ups in Canada have collectively raised more than \$1 billion in funding since 2010.<sup>6</sup>

### 3.1.2 INNOVATION IN THE FINANCIAL SERVICES INDUSTRY

The term “innovation” has mixed connotations in the financial services industry. While innovation can boost productivity and living standards, financial innovations, such as loan securitization, tranched securities and credit default swaps, are seen as having played a role in the U.S. financial crisis of 2007-2008.<sup>7</sup> Beck et. al. found that while increased financial innovation is correlated with higher GDP growth, it is also correlated with economic volatility and bank fragility.<sup>8</sup> As such, there is a stronger link between innovation and regulation than in most industries. Regulators need to ensure an environment is created in which beneficial innovations are not being stifled while at the same time consumers are protected and systemic macroeconomic risk is guarded against.

<sup>4</sup> All data from the Conference Board report: Financial Services – an Engine for Growth 2015

<sup>5</sup> One such example is the Munk School report Current State of Financial Technology Innovation.

<sup>6</sup> Remarks by Carolyn Wilkins, Deputy Governor of the Bank of Canada

<sup>7</sup> Financial Innovation and the Financial Crisis of 2007-2008 <http://jerrydwyer.com/pdf/innovation.pdf>

<sup>8</sup> Financial Innovation: The Bright and the Dark Sides <http://www.efa2012.org/papers/t1d2.pdf>

### 3.1.3 PAST STUDIES OF CANADIAN FINANCIAL SERVICES INNOVATION

We are not the first researchers to examine the state of innovation in Canada's financial services industry. Past Canadian examinations include:

**Conference Board of Canada (2015):** The Conference Board found that despite strong financial performance relative to its international peers, the Canadian financial sector was a productivity laggard. While Canadian financial companies scored quite well on input-based measures of innovation, these inputs were not manifesting themselves in labour productivity growth.

**McDonald-Laurier (2014):** The report discusses the number of different regulators in Canada that financial firms must answer to and raises worries about a lack of policy coherence between regulators. The authors recommend that the federal government create a "world-class Financial Innovation Institute whose mandate would be to identify, back and promote the adoption of the 'new' and put Canada at the forefront of 21st-century financial institutional leadership."

**Munk (2011):** There are some issues around the linkages between the financial sector and the Information and Communications Technology (ICT) sector highlighted by this study. Concerns are raised that Canadian financial institutions are not protecting their intellectual property to the same degree as their American counterparts and that the U.S. Patriot Act is causing issues for Canada's financial sector. Not all is gloomy, however, as the report discusses some comparative advantages the Toronto cluster has over international competitors, including "strong physical infrastructure in terms of the transportation network and a first-rate airport ... as well as a competitive research infrastructure in terms of the presence of world-class universities and community colleges."

**Munk (2015):** A three-sentence paragraph of the report does an excellent job of summarizing the findings of the paper: "While the GTA has all the necessary components for a dynamic and thriving fintech ecosystem, they are weakly linked. The consequence is that the parts do not currently add up to an effective ecosystem. In short: we have many of the essential parts, but are missing the system." The reasons cited for the lack of an effective ecosystem include the need to go to the U.S. for an adequate level of funding for fintech firms to scale up, the lack of a national securities regulator, difficulty getting regulatory approval in every province and the lack of inexpensive incubator centres. One interviewee cited coordination as being a problem: "There are few forums to connect. There are lots of products, campuses, financial institutions, and start-ups in the GTA, but it is hard to see a forum for all these people to come together."<sup>9</sup>

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### 3.1.4 WHAT OUR ROUNDTABLE TOLD US

Canada 2020 made its way to Bay Street in Toronto and assembled a group of financial industry experts, from government, non-governmental organizations, big banks and fintech startups. Some themes emerged in our two-hour conversation.

**Market structure and incentives:** When asked, "What is the biggest barrier to innovation in Canada's financial sector?" a common answer was the structure of the industry and the incentives that it creates. Canada's financial sector is dominated by six big banks. Due to the oligopolistic nature of the industry (caused, in part, by high barriers to entry), Canada's Big Six are more profitable than similarly sized banks in other countries. Combined, Canada's six largest banks earned \$35 billion in profit last year.<sup>10</sup> In the view of some start-ups, this creates an incentive for the banks to fight disruptive innovations, as those disruptions put oligopolistic profits at risk. However, the counter-argument was given that the banks recognize that these innovations are inevitable, so the banks have an incentive to be active participants, rather than facing challenges from outside, such as from global players like Google and Apple.

<sup>9</sup> Munk School - Current State of Financial Technology Innovation, page 16

<sup>10</sup> <http://www.cbc.ca/news/business/bank-profits-rise-1.3348661>

**Stability versus innovation:** Innovation is a tricky concept in the financial services industry since innovations are seen as playing a role in the financial crisis of 2008. The roundtable unanimously recognized that regulators have an important role in protecting consumers as well as in protecting the integrity of the financial system from systemic risks. It was recognized that regulators have the near-impossible task of finding a way to protect the system while not stifling useful innovations and keeping abreast of rapidly changing technologies.

A concern was raised that regulators are judged solely on their ability to prevent “bad things from happening,” which comes at a cost of innovation. One participant gave an analogy of judging road-safety regulatory bodies solely on the number of crashes, saying their response would be to “[make] all roads five miles per hour.” A suggestion was made that financial industry regulators be given a dual mandate of consumer protection and innovation development.

**“LOOKING BACK, WE WERE VERY LUCKY WE RAISED MONEY BEFORE WE HAD WRITTEN CODE ... WE SPENT THREE TIMES AS MUCH ON LEGAL AND REGULATORY COMPLIANCE AS WE DID ON IT.”**

The bulk of industry regulation applies equally to big banks and financial start-ups. Some members of the roundtable questioned whether this is always appropriate, given that the failure of small players does not create the systemic risk that the failure of a big bank would. The idea of a “regulatory sandbox,” a tool used from Singapore to the United Kingdom, was discussed. The sandbox would allow fintech companies that remained under a specified size to face a reduced set of regulations. Given that one of our fintech participants spent three times the amount of money on regulatory research as on writing html code, and another spent their first \$25,000 entirely on researching regulations, such an idea has a natural appeal. One participant was concerned that the sandbox could create a wall that would prevent firms from growing past a certain size, and might deter venture capital investment if the venture capitalists thought there was a chance the firm would not be able to one day “play outside the sandbox.”

**Cultural barriers to innovation:** A concern was raised that Canadian investors and managers may be too risk averse to be full participants in a highly innovative industry. As one participant put it, “[In Canadian MBA programs] there’s not a lot on how to take risk . . . In [New York], the mentality of grads out of the U.S. is to take risks. There’s an acceptance that if you do that and fail that’s OK. In Canada, there’s stigma around failure.” A suggestion was made that foreign investors from countries with higher appetites for risk, such as China, may be able to fill some of the financial (but not necessarily managerial) gaps.

**Immigration issues:** If there are talent (or cultural) gaps in the system, immigration might offer an answer. However, one roundtable participant noted that it takes so long to bring executive-level talent into Canada under the Temporary Foreign Worker Program that a candidate will have typically moved on to other opportunities by the time their application is approved.

**Access-to-capital gaps:** Members of the roundtable stressed the importance of looking at the entire life-cycle of a fintech company when discussing possible gaps in access to capital. The consensus was that seed funding for good ideas was available through angel investors and family members; as one participant put it, “There’s no shortage of people willing to write \$50,000 cheques.” The bigger challenge appears to be finding enough money to reach scale, with our fintech roundtable reporting that it is more difficult to find second-round funding than it is first. Canadian venture capitalists were seen as requiring higher rates of return or lower risk than their U.S. and Chinese counterparts, and there was a perceived talent gap between the quality of Canadian and American venture capitalists. Fintech companies partnering with banks was seen as an option, though there were concerns that accessing capital this way would come with too many restrictions. As one fintech start-up put it, “The challenge is allowing fintech to flourish while you’re in the hug of a big bank. The problem is I’d be dead in a year because I couldn’t go as fast as I need to go.”

**Collaboration:** Members of our roundtable saw increased collaboration as a way to increase innovation in the sector. One participant felt that there were tighter ties between the investment and fintech start-up communities in the United States, which allowed for information sharing and the building of trust and stated, “Interaction, sharing ideas among startups, isn’t something you get a sense of in Canada. We need a safe spot for founder-to-founder, investor-to-investor interactions.” Increasing interactions was seen as a way to identify gaps in the industry’s ecosystem and help match startups with investors. Some members of the roundtable felt that interactions between regulators and fintech start-ups were vital, while others believed that there was “no upside for [us] to talk to regulators.”

One participant called their interactions with regulators “unsatisfactory,” and described a typical interaction: They receive a letter from a regulator asking for information to determine whether or not they are compliance with a certain rule or regulation. A lawyer drafts a reply, at a cost of \$5,000. The regulator determines the startup is in compliance, but doesn’t bother to let them know. Conversely, if the regulator determines the startup is not in compliance, they receive another letter, hire the lawyer to write a reply, and wait to find out whether the regulator’s response will be silence or another letter.” One recommendation for an improved industry-to-regulator relationship is increased collaboration between companies, which would allow them to speak in a single voice through the publishing of industry letters, white papers and other means. As one regulator described the current situation, “Government hears so many voices and has to prioritize.”

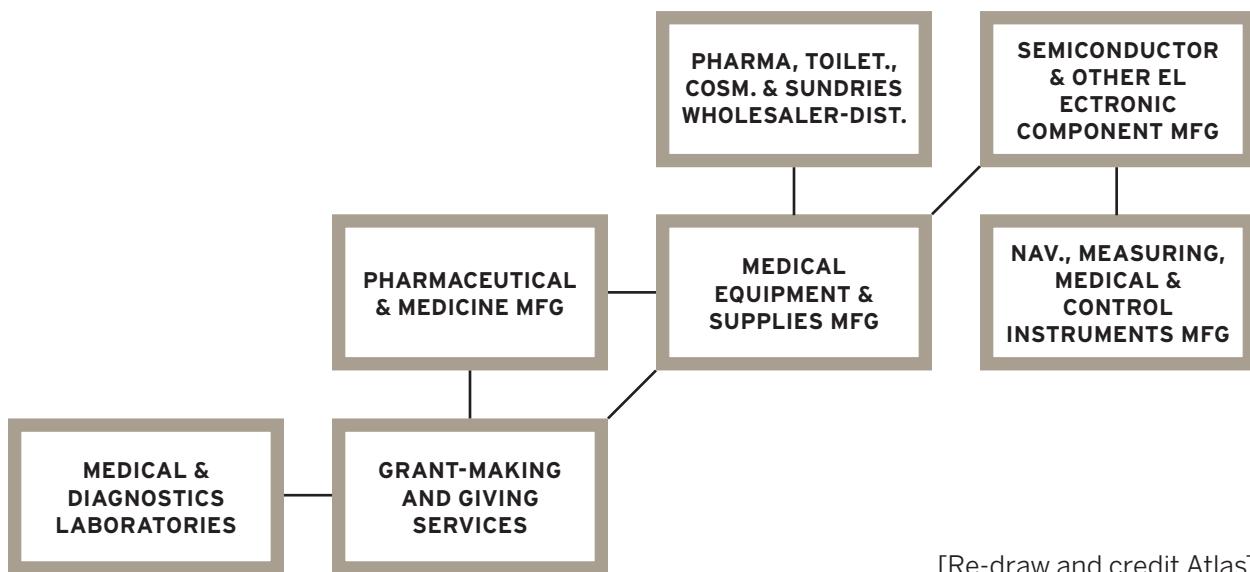
**“IF REGULATORY BARRIERS AND OTHER  
INNOVATION ROADBLOCKS ARE IGNORED, THERE'S  
GOING TO BE LESS CAPITAL IN THE SYSTEM. IF THE  
MESSAGE BROADLY TO THE INVESTMENT COMMUNITY  
IS, WE DON'T WANT TO... HELP ENTREPRENEURS BUILD  
UP THEIR BUSINESSES OR WE WANT TO PUT REGULATORY  
ROADBLOCKS IN THE WAY, [INVESTORS WILL WONDER  
HOW THEY CAN INVEST IN A BUSINESS THAT  
CAN'T SUCCEED IN THIS COUNTRY.”**

**Final thoughts:** Overall, the roundtable saw fantastic innovation potential in Toronto's financial services industry thanks to banks that compete on the international stage and a critical mass of skilled graduates between Waterloo and Toronto. Increased innovation would benefit consumers, by giving them additional choices, more convenience, greater access to capital and lower costs when choosing financial products. A failure to innovate would see the profitable parts of the industry swallowed up by large U.S. players, with Canadian banks largely becoming commodity producers.

## 3.2 LIFE SCIENCES

### 3.2.1 LIFE SCIENCES CLUSTERS IN CANADA

There are some life sciences clusters across the country, with roughly half residing in Ontario. A 2003 report by Simon Fraser University's Centre for Policy Research on Science and Technology identified Halifax, London, Montreal, Ottawa, Saskatoon, Toronto and Vancouver as the seven communities with life sciences clusters in Canada.<sup>11</sup> Other communities have emerging life sciences sectors as well; a 2014 report by the Hamilton Chamber of Commerce makes a compelling argument that their city has all the necessary ingredients for a sustainable life sciences ecosystem.<sup>12</sup> Life Sciences Ontario has estimated that, in 2014, 83,000 Ontarians worked for life sciences firms (under one definition of "life sciences"), generating more than \$40 billion in revenue for Ontario's life sciences industry.<sup>13</sup> The *Cluster Atlas of Canada* identifies seven metropolitan areas as having life sciences clusters (Hamilton, Kitchener-Cambridge-Waterloo, Montreal, Quebec City, Toronto, Vancouver and Winnipeg), with Toronto's cluster of 43,810 workers (in 2011) being the largest in terms of employment. The report author's definition of the life sciences includes the map of the ecosystem seen below:<sup>14</sup>



[Re-draw and credit Atlas]

<sup>11</sup> <http://www.sfu.ca/sfublogs-archive/departments/cprost/uploads/2012/06/0306.pdf>

<sup>12</sup> [http://www.lifesciencesontario.ca/\\_files/file.php?fileid=fileOfQuhTMjbF&filename=file\\_LifeScience10ClusterReport2014Final.pdf](http://www.lifesciencesontario.ca/_files/file.php?fileid=fileOfQuhTMjbF&filename=file_LifeScience10ClusterReport2014Final.pdf)

<sup>13</sup> Life Sciences Ontario Report 2015 report

<sup>14</sup> <https://localideas.files.wordpress.com/2014/05/cluster-atlas.pdf>

### 3.2.2 INNOVATION IN THE LIFE SCIENCES INDUSTRY

Concerns about the pace of innovation in the life sciences industry have made their way to the mainstream media, with one 2015 Globe and Mail headline going as far as asking, "Why is Canada's life sciences sector flatlining?"<sup>15</sup> The Globe piece indicates that while by many input measures, such as peer-reviewed research papers, Toronto's cluster is doing quite well, this does not manifest itself in a significant number of large publicly traded companies. Eric Reguly, the author of the Globe piece, believes that this is due, in part, to advantages commodity industries have over the life sciences, and argues that the flow-through shares model used in many commodity industries should be allowed in the life sciences.

The Expert Panel on Innovation also notes the disproportionately large number of small- and medium-sized enterprises in Canada's life sciences ecosystem. It does note that Canada's sector scores very well on many dimensions, as the nation is a top-10 competitor in pharmaceuticals and a top-5 in biotechnology. In the generic pharmaceutical industry, both Montreal and Toronto are significant players on the global stage. Similar to the Globe and Mail article, the expert panel notes that although in many areas research has been successful, much of the commercial exploitation takes place outside of Canada.

### 3.2.3 PAST STUDIES OF CANADIAN LIFE SCIENCES INNOVATION

Recent studies of innovation in Canada's life sciences industry include:

**Advisory Panel on Healthcare Innovation (2015):** Although this comprehensive study focuses on the larger issue of health care, there are some recommendations applicable to the life sciences industry, which include:

1. Federal-provincial collaboration in identifying and accelerating the adoption of potentially disruptive technologies that benefit patients and provide value for money.
2. Support the spread and scale-up measures to improve procurement through the Healthcare Innovation Agency of Canada.

<sup>15</sup> <http://www.theglobeandmail.com/report-on-business/rob-magazine/why-is-canadas-life-sciences-sector-flatlining/article24030375/>

3. Develop a federal strategy for the sector, which would aid companies in the commercialization of products, attract foreign investment to the field, use procurement to aid “high-impact innovations” and encourage the greater availability of capital.
4. Accelerate regulatory harmonization with the U.S. and provide advice and a road map of government policies to assist small- and medium-sized enterprises.

**BIOTECanada (2013):** The highlight of BIOTECanada's 2013 paper is that access to capital is the “missing ingredient” to the success of Canada’s life sciences clusters. Their respondents advocate that governments “facilitate access to risk capital” for the life sciences sectors. Due to the difficulty of accessing capital, firms are looking to licensing agreements or mergers and acquisitions as a way to grow, rather than growing through firm-level investments.

**Council of Canadian Academies (2009):** As part of its Expert Panel on Business Innovation, the council examines the life sciences as a case study and provides four broad conclusions:

1. While government research and development funding may be a *necessary* condition for success in the life sciences, it is not a *sufficient* one, as other factors play a role.
2. Government policies in the life sciences must be coherent between various public sector actors.
3. Given the long time frame between the discovery of a product and the introduction of that product to market, investors in the life sciences, private or public, must show unusually high levels of patience as well as “deep industry knowledge.”
4. There is a role for public policies to increase links between industry participants, given the high level of specialization in the life sciences ecosystem. They give the examples of linking companies with universities and research centres that have “great ideas, but few links to the marketplace.”

**Gertler and Vinodrai (2009):** In a study published in *European Planning Studies*, Gertler and Vinodrai examine the life sciences clusters in Canada’s three largest metropolitan areas (Montreal, Toronto and Vancouver) and three mid-sized centres (Ottawa, Saskatoon and Halifax) to determine how life sciences clusters emerge. There are some common themes in their analysis:

1. Path-dependency is critical and life sciences clusters emerged with the help of pre-existing strengths (and are not created out of whole cloth).

2. The “dominant actor leading the process of cluster emergence and dependence” differed from cluster to cluster. As such, there does not appear to be a “one-size-fits-all” model of cluster development in the life sciences.
3. Diverse life sciences clusters have lower levels of volatility than clusters that are concentrated in a small subset of the life sciences.
4. Public policies influence the success of the life sciences through some different mechanisms, including investments in research labs, provincial health-care expenditures and local economic development and technology transfer offices.
5. Universities and colleges do not always play the leading role in the formation and growth of life sciences clusters, despite the conventional wisdom to the contrary. Gertler and Vinodrai highlight the critically important roles that these institutions play in the development and attraction of life sciences talent to the local labour market.

**Life Sciences Ontario (2014):** In this “state-of-the-nation” paper, four challenges are identified for Ontario’s life sciences industry. First is the small size of Ontario’s life sciences firms, with only four per cent of companies employing more than 100 people. Second, access to capital is limited for growing life sciences companies. Third is Ontario’s below-average research-and-development expenditures relative to the OECD. Fourth is Ontario’s surprisingly high unemployment rate for 20- to 24-year-old science graduates (18.9 per cent). The paper argues for the need for a “coordinated strategic plan to grow Ontario’s Life Sciences sector.”

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### 3.2.4 WHAT OUR ROUNDTABLE TOLD US

The day after our financial services roundtable, Canada 2020 ventured to the MaRS Discovery District in Toronto. After a tour of Johnson & Johnson’s JLABS, we sat down in a MaRS boardroom with a group of industry leaders, NGOs and regulators to discuss innovation in the life sciences. Here is some of what they told us.

**Defining the life sciences:** When Canada 2020 started researching the life sciences industry, we did not have a precise definition of the sector. It turns out, we weren’t alone. Our panel discussed how “life sciences” was an umbrella term for many different areas, including pharmaceuticals, medical devices and (depending on whom you ask), health care, and how there was no standardized definition. Breaking life sciences down into different areas is important, as market structures and policy challenges often differ greatly between areas.

**Market structure:** The domination of the Canadian non-generic pharmaceutical industry by foreign firms was a concern. The panel noted that Canada risks having a “branch-plant” sector with the truly innovative work happening in the home markets. The sheer size of multinational players in the area creates a barrier to entry to new firms, but also offers funding opportunities for smaller firms with innovative ideas. Other parts of the life sciences ecosystem, such as medical devices, are seen as having lower barriers to entry.

**Funding:** Some participants saw obtaining early-stage funding in Canada as difficult , with later-stage funding somewhat easier to find. Israel was cited as a country that successfully addressed this problem through a seed funding program with the government contributing 15 per cent of the capital. Others described large bottlenecks on the path to commercialization, , with one roundtable member stating, “We have great ideas, but we’re not developing them so they can survive the component that comes after them.” Engagement with multinational enterprises and the health-care system was cited as a potential solution to the problem of commercializing innovation.

**The role of the health-care system:** Canada’s single-payer health-care system was seen as a competitive advantage, as it creates enormous purchasers of life sciences products that can use their buying power to effect change. Procurement policies in the health-care system would need to change to make this happen. The focus would need to be less on obtaining the lowest cost and more on driving innovation with outcome-based metrics for success, or, as one participant described, it, “running public services with private-sector discipline.”

**Collaboration:** One participant talked about the need for the sector to speak in a focused and unified voice, which includes “senior political involvement.” Australia was cited as a country that does this well, and concerns were raised about Canada’s ability to compete on the international stage and win global mandates without a unified national strategy. A second participant felt that Canada was at a disadvantage because this country does not have as many economic development officers in foreign jurisdictions as its competitors do; a cluster in Catalonia (Spain) was cited for being particularly effective at attracting foreign direct investment using this strategy. Finally, another member of the roundtable noted that Toronto’s life sciences ecosystem was not well understood, as research groups had never worked together to map it out, as has been done in some U.S. cities. Roundtable members believed that such a mapping would be of value, as it would identify potential gaps in the system, as well the existing strengths of the sector.

One concern was that while Canada excels at academic research in the life sciences, the country lags behind on commercialization. One participant felt that universities and individual researchers lack the proper incentives to drive innovation and that the idea of “selling out” creates a cultural barrier to scientists working on commercializing their findings.

**“CANADIAN RESEARCHERS TEND TO BE TOO HUMBLE ABOUT THEIR STRENGTHS, THEY DON’T SPEAK TO HOW STRONG THEY ARE SCIENTIFICALLY. THE GLOBAL SCIENTIFIC COMMUNITY IS SEEING VERY IMPORTANT PAPERS AND VERY IMPORTANT WORK COMING OUT OF CANADA, ESPECIALLY BEING DONE IN NEUROSCIENCE, BUT OVERALL THERE IS AN AVERSION TO EMBRACING, TO WORKING WITH INDUSTRY, SO THE NOTION OF COMMERCIALIZING, THE NOTION OF SELLING OUT IS STILL THERE.”**

**Final thoughts:** Participants in the roundtable were highly optimistic that an innovative life sciences sector would benefit all Canadians. The development of new medical devices and pharmaceuticals makes the lives of Canadians better. Furthermore, innovation can be in how Canadians access their health data, which would allow Canadians to make more informed health and lifestyle decisions. In the words of one roundtable participant, enhanced innovation will result in “benefits to patients, to the economy through reduced health-care costs, and through job creation.”

Strong life sciences clusters can help, but there was recognition that governments have tough choices to make. As one participant put it, “We are good at some things, not good at others, and we need to put our money where can generate the best returns . . . The money can’t be everywhere.” Another added, “We can’t have 10 of everything.” Finally, there was a recognition that trying to recreate the Silicon Valley and Boston life sciences clusters would be a recipe for failure; Toronto’s cluster would have to play to Toronto’s unique strengths.

## 3.3 TECHNOLOGY INDUSTRY

### 3.3.1 TECHNOLOGY CLUSTERS IN CANADA

As with the life sciences, just defining the technology or “tech” industry can be a bit of a challenge. In *The State of Canada’s Tech Sector, 2016*, Creig Lamb and Matthew Seddon advocate moving beyond the “information and communications” (ICT) industry and using a more broad-based definition that includes 22 different industries, including 10 in manufacturing and six in “information and cultural industries.” Using this definition, they find that the technology sector generated \$117 billion, or 7.1 per cent of Canada’s GDP, and employed 864,165 people in 2015.<sup>16</sup>

Using a more traditional definition of the technology industry, Lucas et. al. identify seven ICT clusters in Canada (Calgary, Cape Breton, New Brunswick, Ottawa, Toronto, Waterloo and Vancouver), with 11,615 people employed in ICT services and another 7,165 employed in ICT manufacturing in 2006.

### 3.3.2 INNOVATION IN THE TECHNOLOGY INDUSTRY

Canada’s technology clusters deliver as many innovations as any in the world. Part of the reason for that may be the high quality of life that Canadian technology hubs offer. In 2016, consulting firm Expert Market ranked the top technology hubs in the world, using four “work factors” and four “life factors.”<sup>17</sup> Three Canadian clusters made the top 20, with Toronto achieving a third-place ranking, Montreal finishing ninth and Vancouver 13<sup>th</sup>. The report found it was a particularly attractive time to start a business in Canadian cities, with Toronto, Montreal and Vancouver tying for first place on the “time to start a business” factor. Not all is necessarily well, however. The ranking of Canadian cities was diminished somewhat by the difficulty of achieving seed funding and lower start-up outputs and average salaries than elsewhere. As well, the Centre for Digital Entrepreneurship and Economic Performance (DEEP Centre) notes Canada’s relative lack of high-growth technology firms relative to the country’s global competitors, a sign of gaps in Canadian innovation.<sup>18</sup>

<sup>16</sup> The State of Canada’s Tech Sector, 2016 <http://brookfieldinstitute.ca/research-analysis/the-state-of-canadas-tech-sector-2016/>

<sup>17</sup> (Brant, Bobbi, 2016). Focus by Expert Market website, *Worlds Best Tech Hubs To Live and Work In*

<sup>18</sup> DEEP Centre, 2015

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### 3.3.3 PAST STUDIES OF TECHNOLOGY INDUSTRY INNOVATION

Recent studies of innovation in Canada's technology industry include:

**Cukier, Yap, Holmes and Rodrigues (2009):** "Skills shortages" will be a primary focus of any discussion about the state of Canada's tech sector. In *Diversity and the Skills Shortage in the Canadian Information and Communications Technology Sector*, Cukier et. al. study the skills shortage issue through five questions:

1. What is the public discourse regarding the ICT labour market shortage in Canada?
2. What is the empirical evidence regarding the labour market shortage?
3. What is the participation of women in the ICT sector?
4. What are the barriers to participation by women in the ICT sector in Canada?
5. What strategies may be employed to increase the "pipelines" to the sector?

The study notes that there are a wide variety of positions in the ICT sector, "from highly technical roles to hybrid roles, such as business analysts, in which the ability to bridge technology and business functions is essential." Given the broad nature of the ICT sector, it is crucial to not over-generalize when discussing skills shortages. Cukier et. al. find that "the skill sets in short supply are not primarily the core technology skills, but business skills and communication skills." To increase the participation of women and under-represented groups in the sector, one must consider both "overt forms of discrimination" and "systemic barriers." One such barrier is the "chilly climate" female engineering and computer science students can find in post-secondary institutions. They note that the "assumption that a degree in computer science or engineering is a prerequisite for a position in project management" may reduce the full participation of women in the industry. Stereotypes, the absence of female role models and work-life balance issues can also play a role.

**DEEP Centre (2015):** *Building Resilience: Innovation Ecosystems as the Foundations for Growth in the 21<sup>st</sup> Century* is a summary of the 2015 Waterloo Innovation Summit, which brought together "over 280 senior public- and private-sector decision-makers and leaders to discuss the development of effective innovation ecosystems." The summit focused on three key themes: Foundations for Growth, Scaling Up, and Embracing Risk and Disruption. One participant provided this succinct summary of the Waterloo ecosystem's challenges: "Focus on whether you are content to be the 'farm team' that sends talented people and companies to Silicon Valley."

What will it take to create an environment where the same players can hit home runs at home?" The report ends with the following seven broad recommendations to build an innovation ecosystem:

1. Invest in necessary infrastructure and connectivity.
2. Move beyond startups to scaleups.
3. Extract better ecosystem data.
4. Take a more aggressive approach to the recruitment of high-tech management talent.
5. Better enable and support industry-academic partnerships.
6. Focus on building effective research and development support systems.
7. Pursue disruption.

**Lucas, Sands and Wolfe (2009):** The authors examine eight ICT clusters in Canada by asking the following questions:

- What are the critical factors that contributed to the emergence and development of the individual clusters in their specific locations?
- What is the relative importance of local versus non-local factors in supporting the overall dynamism of the clusters?
- What are the most important factors that contribute to the ongoing competitiveness of the clusters?

The study takes issue with Porter, whose 1998 report concludes that governments "cannot create clusters by fiat" and finds that governments do play a vital role "in creating the antecedent conditions for cluster emergence." They advocate that governments invest in higher education and in "cutting-edge" research in the social sciences, the hard sciences and engineering. They find that successful firms in an ICT cluster have "early and successful access to external markets" and that both local and non-local dynamics are critical to ensuring this success. Thriving clusters must ensure that both private and public initiatives "complement each other and [build] on existing regional strengths," and local civic associations are cited as having a pivotal role to play.

**Wolfe D. A. (2016):** In *A Policy Agenda for the Digital Economy*, Wolfe lays out a set of policy recommendations with a focus on, "building on and supporting Canadian strengths in software" and scaling them more effectively. The recommendations include the following:

**1. Creation of a technology development agency:** Wolfe argues that “what is lacking in the Canadian system is a focused and autonomous agency charged with the mission of stimulating radical innovations that are close to the technological frontier.” He cites the U.S., Israel, Finland and Ireland as successful adopters of this model. In his view, these agencies are successful when they are “effectively insulated from short-term political pressures to produce results” and are relatively inexpensive, with budgets typically ranging from \$300 million to \$400 million per year.

**2. Development of a federal strategy for the sector:** The purpose of the strategy would be to identify existing strengths and “make strategic decisions about the areas where we could achieve maximum leverage in the shortest time frame with the minimum amount of additional federal spending.” Wolfe stresses that the process of developing this strategy needs to be iterative, given the constantly changing nature of the sector.

**3. Increase availability of risk capital:** Wolfe advocates Canada adapt the U.S. Small Business Incentive Research program, whereby federal agencies must set aside a portion of their research and development budgets to assist small enterprises with technological innovation. Adoption would not involve simply copying the U.S. program, as the program would need to be tailored to Canada’s circumstances.

**4. Policies to build firms to global scale:** The paper advocates for a new program that would identify Canada’s most promising start-ups and “provide them with resources in strategy, revenue generation, talent management and growth capital to help them scale up” and serve global markets, not just continental ones.

**5. Local and regional strategies for digital innovation:** Wolfe notes that the local context is important when considering the challenges that firms and ecosystems faces. He cites *The Action Plan for Prosperity* and summarizes a set of policies designed to strengthen clusters at the regional and local levels. There needs to be alignment between academia (universities, colleges and research institutions) and the private sector, he concludes, particularly when it comes to research and training. Furthermore, the report advocates “the creation of a national network to share know-how and best practices on how to improve cluster competitiveness and reinforce cluster development.”

### 3.3.4 WHAT OUR ROUNDTABLE TOLD US

At the beginning of August, we headed to Communitech in Kitchener, Ont., and met with a group of two dozen representatives from start-ups, established technology firms and government and asked them to identify the biggest bottlenecks to innovation in the technology sector. Here is what they told us.

**Technical skill gaps:** As with past roundtables and reports, skills shortages and technical skills gaps were cited as the No. 1 issue facing technology firms. In the view of the participants, there were simply not enough trained workers to fill the technical jobs generated by firms, though they were encouraged by expansions to the University of Waterloo and Western University’s co-op programs.

Despite these skills shortages, roundtable members recognized that there are communities that are largely locked out of the technology sector. One participant noted how Canada, unlike the U.S., lacks quality data on the participation rates of women and visible minorities in the sector. Despite the fact (according to one roundtable member) that in many cases that visible minorities are disproportionately *more* likely to use technologies such as Twitter, they are largely excluded from the development of those technologies. Over-reliance on “paper” credentials was seen as an issue, and roundtable participants noted that, despite skills shortages, many firms were unwilling to hire from non-traditional sources. There appeared to be universal agreement that companies, governments, universities, colleges and high-schools all need to do more to increase the technical skills of under-represented communities, for both human-rights reasons and as a practical way to fill technical skills gaps. Infrastructure also plays a role, with access to low-cost broadband in community housing cited as one way to bridge the digital divide. A number of roundtable members lamented that the task of skills development is too often left to underfunded, or unfunded, community organizations.

**Business skill gaps, commercialization and scaling up:** Many members of the roundtable expressed concern that talent shortages in the tech sector are frequently thought of only in terms of science, technology, engineering and math (STEM) skills. A number of participants noted a lack of managerial talent in Canada, particularly for helping high-growth firms scale-up. Gaps were identified in business school curriculums, and there was a general feeling that business schools train their students to be managers in traditional, slower-growth industries and that high-growth firms require a different skill set. The Canadian pool of experienced managers, particularly product managers, for high-growth firms was seen as too small for Canada’s current needs, and only immigration was cited as a short-term fix. The low rate of commercialization in the sector was a related issue cited, and this could be linked to a lack of managerial talent. Participants noted that while many useful innovations were being generated, they were not being sufficiently commercialized. One roundtable member felt that this was, in part, due to a far greater focus on measuring the inputs of innovation than the outputs. Another suggested that non-tariff-based trade barriers make it difficult for Canadian companies to export to key markets, and that Canadian trade negotiators focus too much on the export of physical goods, such as cars and oil, and not enough on the export of digital goods and services.

**Talent retention:** Retention was cited as one of the biggest issues plaguing the Kitchener-Waterloo cluster, with more than one roundtable member lamenting the high number of technology workers and University of Waterloo graduates that migrate to Silicon Valley in California. The roundtable was largely in agreement that smart, ambitious young people migrated because they wanted to be “where the action was.” A few roundtable members felt that the Kitchener-Waterloo cluster suffered from a branding and marketing problem: Canadians were simply too polite to celebrate their successes, and so they suffered a shortage of “evangelists” for the local cluster. The participants believed that the more publicly visible visionaries there were for the cluster, the more the talent would see it as a place “where the action was.”

It was noted by several members of the roundtable that solely in terms of disposable income, technology workers were better off in the Waterloo cluster owing to the exceedingly high cost of living in the San Francisco area. It was noted that improving both intercity and intracity transit would help retain workers, as it would allow the technology sector's workers to get around the city and get to the big-city amenities of Toronto without having to pay the considerable expense of a car.

Improved *talent attraction* was seen as a way of also increasing *talent retention*, as smart, ambitious people want to be around other smart, ambitious people and it would increase the overall number of opportunities in the cluster. Finally, one participant felt that we should not see people going to the U.S. to work as wholly negative, as those technology workers are often “brand ambassadors” for Canada and create valuable links between the Silicon Valley and Kitchener-Waterloo ecosystems.

**Talent attraction:** There was considerable consensus around the table that Canada's immigration and foreign-worker programs were ill-suited to the needs of the technology sector and participants were cautiously optimistic about coming reforms. Roundtable participants reported that application processes can take six months or more, a length of time unworkable for high-growth industries. Roundtable participants believe there is a global war for tech talent, and that we are losing to jurisdictions with more responsive immigration and foreign-worker programs.

**Access to capital:** A lack of access to capital was seen as one reason why talent migrates to Silicon Valley, though some roundtable participants felt there was reasonable access to private venture capital in Canada. One participant felt the biggest gap between Canadian and American venture capital access was the lack of appetite for “moonshots” in Canada; it was felt that very high-risk but potentially high-reward companies would likely need to go to the U.S. for funding.

**Funding program coherence:** Several of our roundtable participants talked about the “alphabet soup” of government funding programs, many of which have overlapping mandates. One member cited the findings of the Jenkins Report and said that the “excessive compliance costs for claimants” creates a barrier to access. Another advocated that the application process be streamlined and noted that an application process that takes six months or more is incompatible with a fast-moving industry like the tech industry. One participant suggested that the federal government could do a better job of providing “tailored advice” to help small- and medium-sized businesses navigate the system. Building on that comment, another member cited Mexico's ProMexico as best-in-class.<sup>19</sup>

**Final thoughts:** At the beginning of the roundtable, one participant simply said, “Three things worry me. Access to talent, access to markets and access to capital.” Those themes permeated the discussion. It was not largely centered on what governments should be doing more of, but rather on what they can be doing better (or occasionally less of). Coherence was an over-arching theme of the two-hour discussion; it was felt that government policies, whether they be on training, infrastructure, research and development or immigration are often overly complicated or at odds with the stated priorities of those governments.

<sup>19</sup> These sentiments are echoed in Boothe, 2016.

## 3.4 AGRICULTURE AND AGRI-FOOD CLUSTERS

### 3.4.1 AGRICULTURE AND AGRI-FOOD CLUSTERS IN CANADA

The Canadian agriculture and agri-food sector plays an important role in the Canadian economy and cannot be ignored when we investigate innovation opportunities. The combination of continued population growth, climate change and changing demands from the marketplace make this economic sector rich with possibilities.<sup>20</sup> The agriculture and agri-food sector generated \$103.5 billion in 2012, which accounted for 6.7 per cent of GDP. Overall, an estimated half of all primary production in the Canadian agriculture and agri-food sector is sold for export, making Canada the world's fifth-largest exporter.<sup>21</sup> Canada is a world leader when it comes to agriculture, as it has nearly 70 million hectares of farmland and seven per cent of the world's renewable fresh water resources. As the consolidation of farms continues, Canada's average farm size is now larger than the U.S.'s and Brazil's. Farming has become steadily more capital intensive.<sup>22</sup>

The *Cluster Atlas* identifies nineteen separate geographic agricultural clusters across Canada; only the construction industry, at 22, has more clusters across the country.<sup>23</sup> Nearly half of the country's agricultural clusters are found in Ontario, with Brantford, Centre Wellington, Chatham-Kent, Guelph, Kawartha Lakes, Kitchener-Waterloo, Leamington, Norfolk and St. Catharines-Niagara all cited as having active agriculture clusters. Kitchener-Waterloo's is the largest cluster with 9,449 people employed in 2011. The remaining clusters are equally split between Quebec (Drummondville, Granby, Saint-Hyacinthe, Saint-Jean-sur-Richelieu and Victoriaville) and Western Canada (Abbotsford-Mission, Brandon, Chilliwack, Lethbridge and Saskatoon).

The food and beverage processing portion of the agri-food sector is the country's largest manufacturing sector by employment, with more than 245,000 people employed in it in 2013. That same year, capital investments in this sector rose seven per cent to \$1.8 billion.<sup>24</sup> The *Cluster Atlas* identifies fifteen distinct food and beverage clusters across Canada, with two in Eastern Canada (Moncton and St. John's), four in Quebec (Granby, Montreal, Saint-Hyacinthe and Saint-Jean-sur-Richelieu), six in Ontario (Belleville, Brantford, Hamilton, Kitchener-Waterloo, London and Toronto) and three in Western Canada (Abbotsford-Mission, Lethbridge and Vancouver). The Atlas breaks down the food and beverage processing industry into twelve sub-industries, as shown on the next page.

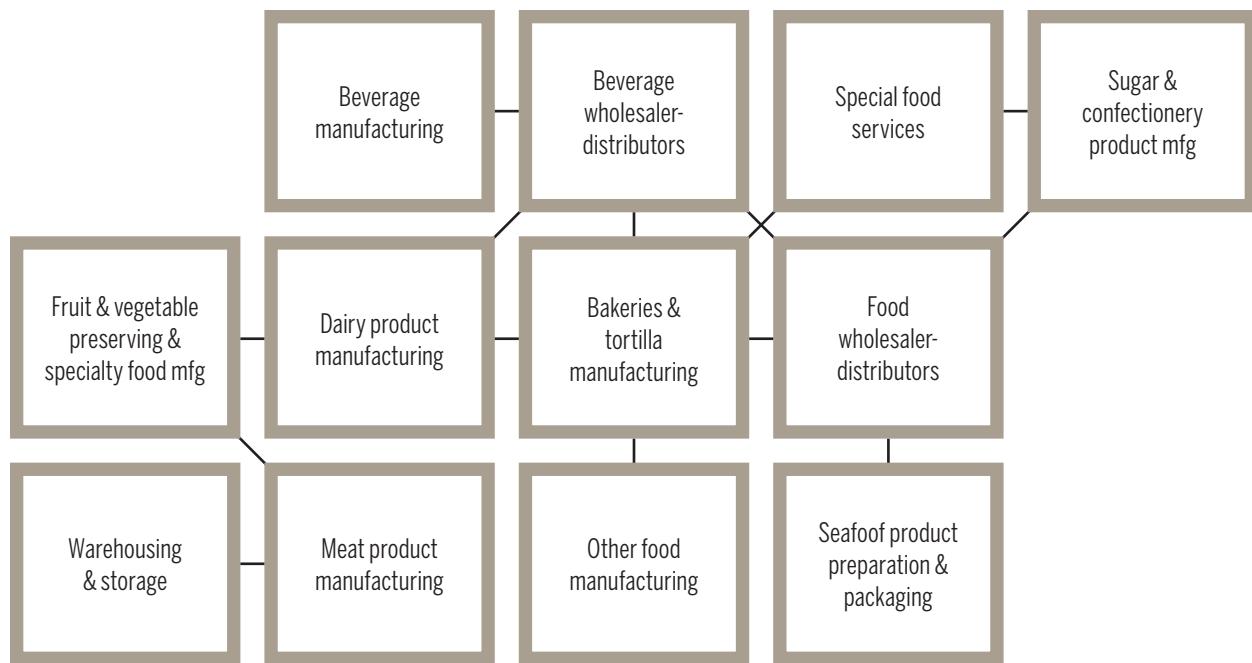
<sup>20</sup> Agriculture and Agri-food Canada, 2015

<sup>21</sup> Global Investment Attraction Group, 2014

<sup>22</sup> Global Investment Attraction Group, 2014

<sup>23</sup> Spencer, 2014. Automotive is tied with agriculture with 19.

<sup>24</sup> Global Investment Attraction Group, 2014



[Taken from Cluster Atlas]

### 3.4.2 INNOVATION IN THE AGRI-FOOD INDUSTRY

The June 2014 Senate report on agriculture noted the importance of innovation in the agriculture and agri-food sector in Canada: “Despite Canada’s wealth of arable land and water, Canadian farmers today can produce more food with fewer resources. This productivity is made possible by the discovery and adoption of research-driven new technologies and processes.”<sup>25</sup>

At the same time, chronic unprofitability within the agriculture sector in Canada,<sup>26</sup> combined with increased international competition and a lack of innovation, has many calling for rethinking how the Canadian agriculture and agri-food sector is approached. This project started with an analysis of several high-profile reports into the Canadian agriculture and agri-food sector.

<sup>25</sup> Standing Senate Committee on Agriculture and Forestry, 2014

<sup>26</sup> Canadian Agri-Food Policy Institute, 2011

### - **3.4.3 PAST STUDIES OF AGRI-FOOD INNOVATION**

We are not the first researchers to examine the state of innovation in Canada's Agriculture and Agri-food sector. Past Canadian examinations include:

**Standing Senate Committee on Agriculture and Forestry (2014):** This committee investigated the state of research and innovation in the Canadian agriculture and agri-food sector. They called for an emphasis on both quality agri-food products and product differentiation. While they note the successful role of the government in creating an environment that encourages innovation in Canada, they highlight several areas of concern. First, they note that the government needs to strengthen and improve the regulatory framework within Canada to strengthen the approval process for new products, modernize animal health and disease control regulations, bolster IP protection and harmonize regulations at an international level. Second, they call for the government to adopt a long-term vision with government support for research and innovation work. Third, they call for an increase in partnerships and collaboration within the industry and an elimination of barriers at both the national and international levels in relation to innovation partnerships. Fourth, they call for the professional development of workers in agriculture and agri-food sectors to allow these workers and the public to take full advantage of innovation opportunities.

**Agriculture and Agri-food Canada (2015):** The report discusses the current trends and emerging opportunities for innovation available to the food processing industry. The piece highlights changes in consumer preferences due to shifting demographics, environmental concerns, a desire for more information and a need for convenience foods. It then discusses the resulting opportunities for innovation, including the use of innovative ingredients, and emerging technologies, such as food processing and preservation technologies and technologies related to food quality and safety. The piece ends by calling for further research and analysis of the opportunities.

**Ashton, Richards and Woods (2015):** Innovation in food processing companies is examined in this report. It uses three cases to investigate the type of innovations occurring in these firms, the involvement in the innovation throughout the supply chain, the length of time for the innovation to be realized and the nature of growth that resulted from the innovation. They found that all three companies investigated had seven or more innovations in various states of completion. These innovations were primarily product innovations and process innovations. All three companies used supply chain partners outside of their companies to aid in the development of their innovations. The innovations were divided, almost equally, between being *short and intense* and *long and continuous*. Six types of growth were identified in these three cases, including growth as an increasing share of the existing market or expanding the size of the market, growth as remaining competitive or increasing efficiency and growth as creating new companies or increasing employment.

**Canadian Agri-Food Policy Institute (2011):** This report starts with the premise that “Canada is not realizing the full potential of a major strategic asset – the country’s agri-food sector.” It calls for a united approach throughout the country with short-term goals strategically created to meet the long-term goal of becoming “the world’s leading producer of nutritious and safe foods produced in a sustainable, profitable manner.” They call for a systems-based approach in which all agri-food stakeholders work together. They propose a five-part solution including a centre for good food citizenship, food system smart innovation, food system risk management, leadership in sustainability, and enabling regulatory change.

### - **3.4.4 WHAT OUR ROUNDTABLE TOLD US**

The day after our Kitchener technology industry roundtable, we headed northeast on Highway 7 to Guelph, Ont., where we met some of Canada’s leading experts in the agriculture and agri-food industry. Here is what they told us:

**Efficacy requirements:** The need, in some cases, to prove not just the safety of a product but its efficacy was seen by some at the roundtable as a barrier to innovation. One roundtable participant described the barriers created by efficacy requirements: “In some cases, Ontario agri-technology start-ups are launching their products in the United States instead of Canada since it is faster and the markets are bigger. These companies are enjoying millions in sales and Canadian farmers do not have access to the technology, even though Canadian taxpayers helped fund the innovations through various grants and loans over several years. We could solve this problem by harmonizing regulations with the U.S.A. and realizing we are too small to demand sovereignty in everything. There is no evidence to suggest the U.S. regulatory system is vastly inferior to ours. As was mentioned by others today, our onerous efficacy requirement is parental in nature and means that commercializing these innovations can take about three years longer in Canada. We have already harmonized important areas like human and environmental safety. Getting rid of the efficacy requirement does not seem to be too much to ask.”

**Regulatory coherence:** Roundtable participants discussed the incredible complexity of the agriculture and agri-food regulatory environment and said how difficult it can be for small- and medium-sized companies to navigate. They felt that agri-food manufacturers have a particularly difficult time navigating the system, because they have feet in both the agricultural and industrial worlds. One roundtable participant gave an anecdote of an agri-food manufacturer looking for government assistance to commercialize a potentially breakthrough innovation. “We don’t deal with manufacturing, you need to talk to industry,” they were told by agriculture regulators. Industry regulators offered a similar response, saying, “We don’t deal with agriculture.”

**Regulatory mindset:** A few members of our roundtable felt that to be the biggest regulatory barrier was the goal of regulators. As one participant put it, “The government needs to shift out of its parental mindset. The mindset is protectionist, slow and safe. It is problem-oriented, rather than potential-oriented. If we want to be the most trusted system in the world, then the way we create policy needs to change.”

**Provincial barriers to innovation:** One roundtable participant described the challenges as follows: “In one program, we are required to use a provincial body to be our agent to access funds from the federal government, so innovation becomes parochial. We must always try to force-fit innovation into an Ontario scenario. True innovation knows no borders. The vast majority of possible innovations in agriculture will serve the interests of all provinces and ideally multiple countries. If they can’t, then it is unlikely any will be of a size that matters. And yet, one of the filters we use to assess if we can take on an innovation is whether it will mainly benefit Ontario agriculture. This occurs while at the same time the federal government is encouraging us to expand nationally outside of Ontario. In other words, we are funded by federal money administered by a province and the province wants innovation to be provincially-focused while the feds wants us to expand nationally.”

**Funding gaps:** Funding issues, beyond provincialism, were also identified. One participant suggested that Canada should take lessons from Israel, where government programs ensure funding for companies at every single lifecycle stage and there are active supports to help innovators navigate commercialization. Another suggested that the way that funds are allocated for multi-year projects needs to be more flexible; the money is allocated equally each year in some programs, but companies typically have much greater needs in a project’s middle years than in the early and later years. On average, roundtable members supported funding models that put decision-making at the local level.

**Infrastructure gaps:** The lack of rural access to broadband internet was seen as a hindrance to innovation for farmers and small agri-food companies: It impedes the adoption of the “internet of things” technologies, the acquisition of new techniques and methods, and access to foreign markets. One roundtable member suggested that Canada does not do enough to learn from best practices around the world.

**Final thoughts:** Overall, the roundtable’s consensus was that agri-food needs to be recognized as a strategic sector for the country. The global challenges of a rising world population and climate change create a world of opportunities for Canadian agriculture and agri-food companies. But Canada will only fully capitalize on its potential if we have innovative, entrepreneurial companies, embrace the changes brought on by a big data revolution and get the regulatory regime right.

## 3.5 CULTURE AND DIGITAL CREATIVE SECTORS

### 3.5.1 CULTURAL AND DIGITAL CREATIVE CLUSTERS IN CANADA

Creative industries, such as the arts and video-game manufacturing, have become an important sector of the economy in Canada and globally.

Action Canada, a national fellowship program with a focus on Canadian public policy, notes that the cultural sector in Canada was worth more than \$84 billion in 2007, which was more than the insurance industry, the hotel and restaurant industry, or the agriculture, forestry, hunting and fishing industries combined.<sup>27</sup> There are more than 1.1 million jobs in this sector.<sup>28</sup>

Industries and organizations that make up Canada's creative sector include: advertising, architecture, craft, design, fashion, television, information technology, software, publishing, museums, galleries, libraries, plus the performing and visual arts. Canadian brands in many of these industries are very strong and globally known.<sup>29</sup>

### 3.5.2 INNOVATION IN THE CULTURAL AND DIGITAL CREATIVE INDUSTRY

Action Canada notes that Canadian innovation policy generally focuses on innovation in the hard sciences. Given the importance of the creative industries, it calls for an innovation policy that focuses on innovation within the creative industries.

<sup>27</sup> (Action Canada, 2014) *Creativity Unleashed: Taking innovation out of the laboratory and into the labour force*

<sup>28</sup> (Cowan, Edgar, 2015) The Global and Mail, *Canada's creative industries can lead the economic challenge*, <http://www.theglobeandmail.com/report-on-business/rob-commentary/canadas-creative-industries-can-lead-the-economic-charge/article25236146/>

<sup>29</sup> (Cowan, Edgar, 2015) *The Global and Mail, Canada's creative industries can lead the economic challenge*

Edgar Cowan noted in the *Globe and Mail* that Canada's creative industries could be "an ideal gateway to a long-term strategy for improving our competitiveness and our capacity for innovation, leading to a more certain, sustainable future economy."<sup>30</sup> The Ontario Innovation Agenda unveiled in 2008 included a focus on innovation in the creative industries in an attempt to "foster innovation, create good jobs and address the persistent challenge of lagging productivity."<sup>31</sup>

The publishing industry has struggled with innovation in some areas, but has been successful in others. For example, it has "embraced digital technology for internal workflow processes, for supply chain systems and processes, and for marketing and sales."<sup>32</sup>

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### 3.5.3 PAST STUDIES OF CULTURAL AND DIGITAL CREATIVE INNOVATION

There are a few examinations of innovation in the Canadian creative industries:

**Action Canada (2014):** This report asked the question, "How can we better leverage the competitive strengths of our creative industries to create a more prosperous nation?" The authors noted that the creative industries are important components of the Canadian economy and that Canada needs to develop policies on innovation within the creative industries to keep pace. The authors recommended the creation of a Canadian Council for Creativity that would promote creativity in business, public policy and education in order to encourage all sectors to embrace creative skills. They also recommended the creation of a Year of Creativity in Canada to encourage people to see the role of creativity in innovation.

**Hilchie (2006):** Jayson Hilchie noted in an article for the *Huffington Post* that video-game development in Canada contributes \$3 billion to the GDP. Canadians in video-game development have pushed the boundaries of interactive digital entertainment through innovations in "computational and technological power, the complexity of level design, the rendering of 3D graphics and the immersion of the gameplay experience." He calls for Canada to focus on talent development and retention, including leveraging both education and immigration to allow the seamless and efficient movement of highly skilled workers in the technology fields.

<sup>30</sup> (Cowan, Edgar, 2015) *The Global and Mail, Canada's creative industries can lead the economic challenge*

<sup>31</sup> (Castledale, 2008) Ontario Media Development Corporation Book Industry Advisory Committee, *A Strategic Study for the Book Publishing Industry in Ontario*

<sup>32</sup> (Castledale, 2008) Ontario Media Development Corporation Book Industry Advisory Committee, *A Strategic Study for the Book Publishing Industry in Ontario*

**Castledale (2008):** This report on the book publishing industry in Ontario noted the inability of the province's (Canada's?) Industry to take advantage of economies of scale as occurs in the U.S. At the time, Canada published about 16,000 new English language titles a year while the U.S. published some 300,000. The report, commissioned by the Ontario Media Development Corporation Book Industry Advisory Committee, noted the dramatic changes that digital technology was triggering in book publishing. The report also noted that the industry needed help both in terms of capital and technical expertise to participate and innovate while becoming more competitive.

**Newman (2008):** The Ontario Ministry of Tourism and Culture commissioned a report examining what Ontario public libraries will look like and the service they will offer in 2020. They reported that public libraries are very innovative in terms of how they "respond to a new social, technological and economic environment." Libraries and librarians use innovative practices and services, such as offering digital access to books, partnering with provincial and federal governments to offer programs, and hosting maker-spaces within their buildings, to meet the changing needs of their patrons and communities. This report highlighted the role libraries have in helping communities access and create innovations.

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### 3.5.4 WHAT OUR ROUNDTABLE TOLD US

The Canada 2020 team headed east to Halifax and assembled a roundtable of some of the best arts and creative minds in the Maritimes. Our meeting at the Nova Scotia College of Art and Design's Port Campus at Pier 21 brought together stakeholders in the film, music, publishing and gaming industries, along with representatives from NGOs and government. Here is what they told us:

**Importance of cross-sector collaboration:** Many members of our roundtable talked about the importance of having writers, musicians, animators, programmers and filmmakers all within the same ecosystem, as it takes dozens of different skills to develop a product. One participant indicated that if one of those areas becomes weak, the whole ecosystem "falls apart." But our stakeholders felt there was the need for further collaboration. One member suggested the importance of business graduates and artists speaking the same language, and felt there was benefit from business students taking arts courses and arts students taking business courses. Another added that Canadian postsecondary institutions we need to "bring arts, science and digital media together. You can't be in silos all the time. We talk about STEM – it should really be STEAM (including Arts)."

**Talent retention:** Getting talented young people to stay in Halifax was seen as an issue, with one participant stating that “we don’t have a problem attracting people to our universities, the problem is getting them to stay.” Roundtable participants believed that students left Halifax not because they were looking for more money, but they were rather looking for more excitement. As one stakeholder described it, “We have to remember that a 22-year-old wants excitement, not job security and a health-care system … What they think about is, ‘Where can I go that’s sexy, cool and exciting?’” Improving Halifax’s image and quality of life was seen as the way to retain additional young workers. Another participant said young people had a misleading picture of the Halifax economy because when the economic data they were presented with related to the province as a whole. In fact, economic growth in the city substantially exceeds that of the rest of the province. However, one participant indicated that job prospects were uneven in the arts sector, with some portions of the ecosystem featuring limited job prospects and high unemployment.

**Quality of life:** Good infrastructure and good government policy decisions were seen as important to generating the quality of life needed to retain talent. As one roundtable participant described it, “Young people say, ‘I won’t live here without bike lanes,’ or a train. It is easy for government to talk about industrial innovation, harder to keep in mind the creative end. I feel like the freeze in arts funding is hurting us. We cannot lose sight of things like co-op art galleries and the like, because they create marketability. This is the stuff that people miss when they move to a smaller city.” Others indicated that there were benefits to being in a smaller centre, adding, “It is important to think about the scrappiness and DIY factor in Halifax. When we grow, we will lose part of that.” Finally, one participant felt Halifax should ensure it not enact policies that would make the cluster too homogenized, adding, “We’ve worked to support our aboriginal community, our African-Canadian community and our Gaelic community. How do you create a policy discussion without losing sight of that quilt-work?”

**Immigration and talent attraction:** Some components of the ecosystem, particularly gaming, need to rely on immigration to fill roles. But as one participant put it, immigration can add jobs to the local ecosystem instead of taking jobs from it: “Our struggle is in finding talent. We’ve been lucky finding people locally, but each time we recruit for specific positions, it’s a struggle. We have to rely on immigration, but understanding and applying Canada’s immigration programs require resources. Innovation brings value to individuals or business, but it also gives brings value back to the community.”

Some roundtable members said they were hesitant to hire foreign graduates of local schools, concerned the federal government would not allow them to remain in the country when their Post-Graduation Work Permit expired. The organizations did not want to hire and train workers if they did not believe they had a reasonable chance of retaining them.

As one participant described it, “International talent wants to stay. The immigration paperwork is difficult for international recent graduates, and a lot of employers are nervous about work visas. There is a lot of misunderstanding about immigration and work visas, and a lot of paperwork. People want to stay, but there is a lot of red tape.”

Navigating the immigration system was seen as an issue for small- and medium-sized businesses in Halifax, which does not have the network of experienced immigration lawyers that a larger centre like Toronto has. Finally, one participant indicated that the issue was not just young workers, and the barriers are as much cultural as they are regulatory: “There is a lot of focus on youth, but we are looking also for mid-level and senior staff. Jobseekers are looking for more opportunities. Attitude and quality of place is definitely part of it.”

**Final thoughts:** Given the size of the Halifax market, it was not surprising to see roundtable participants emphasize “brain drain” more than those in some of our other roundtables. In general, roundtable participants placed a great deal of emphasis on the difficulty of navigating funding and regulatory systems and the lack of resources to assist them in the local ecosystem. In particular, the lack of stable program funding was cited as a particular irritant, as it made it difficult for organizations to make long-term plans. Despite all of this, the mood of the roundtable was upbeat, and there was a great deal of energy in the room and substantial optimism about the future of the local cluster.

**“WE SHOULD SEE CULTURE AS A FOURTH PILLAR OF SUSTAINABILITY - AS WELL AS SOCIAL, ENVIRONMENT AND ECONOMIC SUSTAINABILITY. WHEN WE TALK ABOUT INNOVATION, WE DEFAULT TO IT AS AN ECONOMIC ISSUE, BUT IT'S ALSO IMPORTANT TO LOOK AT SOCIAL INNOVATION, ENGAGING CITIZENS. THERE IS A TWO-WAY RELATIONSHIP - HOW DO WE LEVERAGE INDUSTRIES, AND HOW DO WE ENSURE ARTS, CULTURE AND CREATIVE ORGANIZATIONS CAN LEVERAGE THE POTENTIAL OF BROAD SECTORS.”**

## 3.6 EXTRACTIVES

### 3.6.1 EXTRACTIVES CLUSTERS IN CANADA

Extractive industries compose a major sector in Canada, the fifth-largest producer of oil and natural gas in the world as of 2013<sup>33</sup>, with more than 75 per cent of the world's mining and exploration companies calling the country home<sup>34</sup>. All of the Canadian extractives companies (oil and gas, utility, mining and water companies) are experiencing challenges as they attempt to remain competitive in the global economy. These challenges include lower commodity prices, reduced profit margins and rising costs.

The *Cluster Atlas of Canada* lists 16 different mining clusters across Canada and an additional 13 oil and gas clusters<sup>35</sup>. Mining clusters exist in eight of 10 provinces, with only Newfoundland and Labrador and P.E.I. lacking established clusters. Ontario leads the way with four mining clusters (Greater Sudbury, North Bay, Thunder Bay, Timmins) and Quebec is next with three (Rouyn-Noranda, Sept-Îles, Val-d'Or).<sup>36</sup>

Oil and gas clusters are less geographically dispersed, with 10 of 13 clusters found in the province of Alberta.<sup>37</sup> The three remaining clusters are located in Sarnia (Ontario), Regina (Saskatchewan) and Fort St. John (British Columbia). Activities in the cluster include transportation and manufacturing activities in addition to extraction, as the Cluster Atlas below shows:

<sup>33</sup> (Global Affairs Canada, 2015), *Oil and Gas Industry: Canada's competitive advantages*

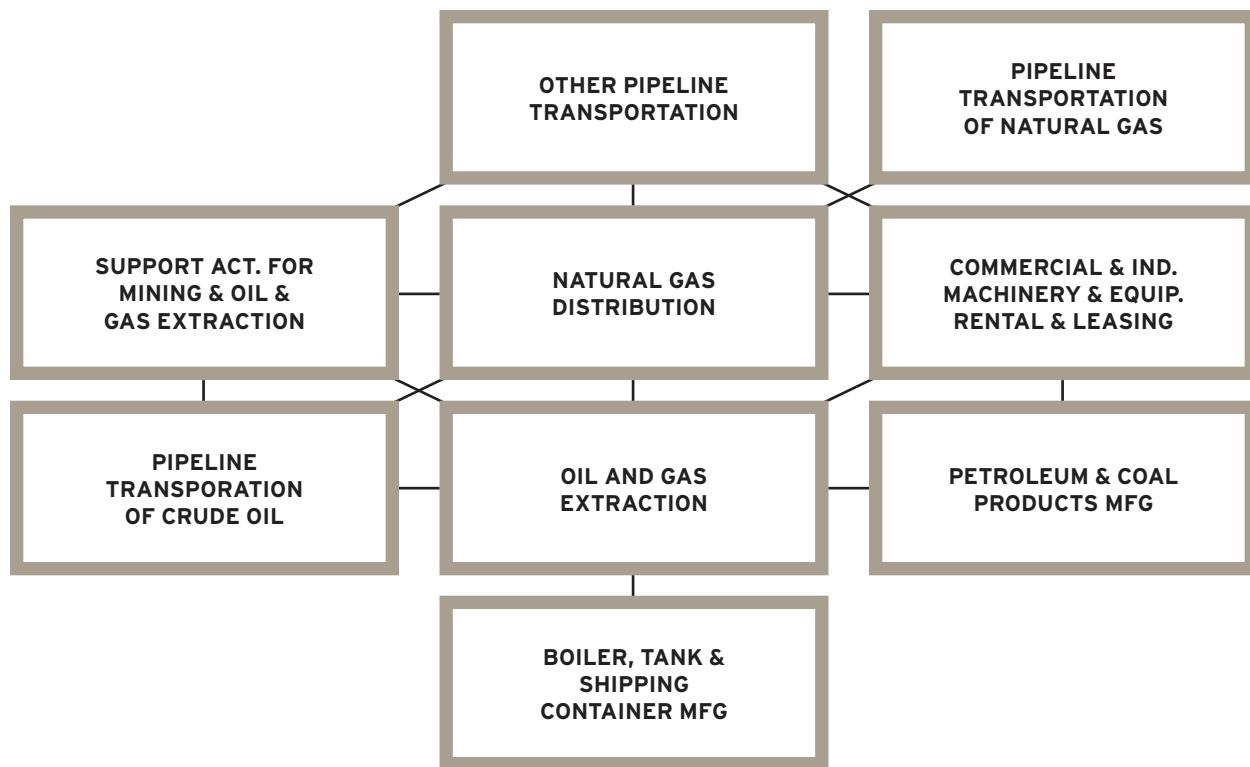
<sup>34</sup> (Mattner, 2012), Institute for the Study of International Development,

*The Development Impact of Extractive Industries: Policy Options for CIDA*

<sup>35</sup> (Spencer, 2014), *Cluster Atlas of Canada*

<sup>36</sup> The remaining clusters are in Bathurst, N.B.; Calgary, Alta.; Cape Breton, N.S.; Edmonton, Alta.; Kamloops, B.C.; Prince George, B.C.; Regina, Sask.; Saskatoon, Sask.; Thompson, Man.

<sup>37</sup> Specifically, Calgary, Cold Lake, Edmonton, Grande Prairie, Lloydminster, Medicine Hat, Okotoks, Red Deer, Sylvan Lake and Wood Buffalo.



### 3.6.2 INNOVATION IN THE EXTRACTIVES INDUSTRY

Innovation in the extractives sector has focused on minimizing costs by improving the upstream processes and improving the management, transportation, transformation and use of extractives.<sup>38</sup>

Collaboration via private- and public-sector partnership is seen as key to ongoing innovation in this field because of the cost and complexity of technology development.

Companies working in this sector have expressed concerns that recent lower commodity prices and reduced profit margins will make innovation more difficult and yet more important.

Canada has several research and development tax incentive programs in Canada to stimulate investment in innovation. Many of these programs are aimed at the extractives sector.

<sup>38</sup> The ideas in this section are based on Natural Resources Canada's 2015 report, Innovating for a Strong Canadian Energy Sector.

### - **3.6.3 PAST STUDIES OF EXTRACTIVES INNOVATION**

**Natural Resources Canada (2015):** In *Innovating for a Strong Canadian Energy Sector*, Natural Resources Canada presents an overview of innovation in Canada's energy and minerals and metals sectors. The report highlights the importance of innovation to maintaining Canada's competitive edge in these sectors and the ongoing need for collaboration in technology development and use within this sector because of the high level of complexity of this field. The report calls for ongoing partnerships across the private and public sectors to ensure continued innovation. The report notes that as harder-to-access resources are needed and companies around the world face pressure to safeguard the environment, innovation will become ever more important.

**Mining Association of Canada (2013):** The brief report *Energy Investments and Innovation in the Canadian Mining Sector* focuses on the research and development and innovation investments that Mining Association of Canada member companies have made to both improve energy efficiency and reduce emissions, which totalled \$677 million in 2013. Examples such as the use of wind and liquefied natural gas to fuel both mobile and on-site power are highlighted. The need for innovation in technology that will allow more efficient energy use at remote mining sites, including improvements in provincial and territorial power grids, is also highlighted.

**Monitor Deloitte (2016):** *Innovation in Oil and Gas* in Canada 2016 examines current perspectives on innovation in the oil and gas industry in Canada. It highlights a complex set of issues, including rising costs, multiplying risks, environmental concerns and shrinking margins. The report notes that while innovation in this environment is imperative, most companies in the sector "do not have the resources, capabilities or leadership commitment to innovate to the degree they know they should." Through the study of 10 companies, the report authors found that this sector has begun to innovate, but the innovations are not well co-ordinated and are limited by a focus on using technology to either reduce costs or develop better extraction methods.

The report also states that driving innovation beyond the technological requires organizations to mobilize outside the technical and R&D groups in the organization. It is here that traditional structures can work against oil and gas companies. This report calls for companies in the sector to expand their innovation to include areas outside of technology and to develop an environment in which companies collaborate with both oil and gas technology providers, other sectors and stakeholders and the federal and provincial governments.

**Deloitte (2015):** *Gaining ground in the sands 2015: Pipeline 2020* examined the role of innovation for pipeline companies. It notes the difficult situation pipeline companies find themselves in across North America. The debate over the safety of pipelines and the need for investment to keep old infrastructure safe and functional has been difficult for the sector. The authors of this report call for the industry to see these challenges as opportunities to invest in technology that can make their sector safer and more productive. Their recommendations include using big data, smart connectivity and new sensor technologies to allow for real-time evidence-based decision making. They conclude by highlighting the need for companies to begin to make budget and R&D decisions now to ensure they are competitive in 2020.

### - 3.6.4 WHAT OUR ROUNDTABLE TOLD US

The Canada 2020 team headed to the offices of Bennett Jones in Calgary, Alta., where we assembled a group of private- and public-sector leaders in the oil, gas and mining sectors. Here is just some of what we heard in our two-hour session:

**Willingness to innovate:** Many roundtable participants thought that other industries could take lessons from Alberta's oil industry. They pointed to the sector's willingness to take big risks and a lower fear of failure than seen in other industries. One participant believed that taking a risk that led to bankruptcy was seen as a black mark in most Canadian cities, but that Calgary was more open to second and third chances. Another believed that this was out of necessity, stating "without innovation, we would not have been able to turn the oilsands into a profitable industry that creates wealth for Canada."

Another roundtable participant added that "to be competitive we have to innovate or we do not survive. Being out west, a lot of us are rural-based. That is an innovative culture baked into you, people who do not accept the status quo." Roundtable participants felt that despite this, there was still room for a culture-shift in the sector toward a willingness to innovate.

The mining sector was seen somewhat differently, with one participant noting:

"We need to distinguish between three kinds of innovation. Core innovations are day-to-day things you do in your operations. Adjacent innovations are things that are transferred from one industry to another. Transformational innovations are technologies that create whole new industries or whole new ways of doing things. In mining, we are good at core innovations, but not good at adjacent or transformative ones. We are 'first to be second.' It comes down to risk, and the Canadian industry is risk-averse. When we are forced to make our operations profitable, we find a way. But when a mine is in production, we tend not to make improvements. We fine-tune, but we don't take the next step and find significant improvements."

**Need to collaborate with other sectors:** Many roundtable participants noted the need for the cluster to work with other sectors, to obtain and adopt adjacent innovations. Several noted that the cluster is both a user and a developer of high-tech innovations, particularly around the internet of things. Another gave examples of MRI technology that is used for medical innovations and for monitoring pipeline health. One participant mentioned the difficulties in collaborating with institutes of higher education, noting that universities tend to be insulated from market pressures. He noted that “part of the Canadian problem is that some guy at a university in a lab coat may think he’s developing innovations, but the output may only be theoretical or on a longer time horizon. The real innovation in Calgary is people chasing money and chasing their goals. If we spend money on innovating in a university environment, it won’t get done or be real.”

A final participant added the need for government to work directly with the sector, rather than through intermediaries like universities that do not understand the market pressures facing the industry.

**Brownfield challenges to innovation:** Roundtable participants felt that it was not hard to incorporate innovative technologies and processes when designing new facilities, but incorporating them into existing operations was difficult. As one participant put it, “one of the other defining features of our industry is the size of the capital investments involved. If something goes wrong, such as an unplanned outage, the impact is enormous. That impacts whether you pursue innovation, as well as what kinds of innovation you pursue. So changing something fundamental to your technology or your processes could be really risky.”

**Perception consequences:** Many participants made a point of noting that labour or environmental troubles at one company reflect badly on the industry as a whole meaning one firm’s poor performance imposes a negative consequence on all other firms in the industry.

“Yes, firms in the industry are competing with one another. But when it comes to the environment, we realize that this sector is competing not against each other, but against other fuels. So we are only as strong environmentally as our weakest performer,” said one roundtable participant.

The Syncrude tailings pond incident was an example cited by another participant, who stated: “When that incident happened, a negative perception was placed on every firm in our industry. Even companies without tailings ponds got labelled poor environmental stewards.”

**Talent shortages:** Some roundtable participants believed that these perceptions make it difficult for the sector to attract young innovators.

“We are one of the most vilified sectors in Canada and around the world. It impacts our ability to attract talent. We need creative people, and they often choose other sectors. There’s a lot of competition for innovators – why would they want to work on a problem for one of the most vilified sectors in Canada when they can work on something that instead makes them feel good?”

Another noted that these perceptions spill over to government policies, as negative public perceptions make governments disinterested in working with the cluster.

**Small-business challenges:** Two roundtable members noted that small- and medium-sized enterprises (SMEs) face uphill challenges when it comes to commercializing innovations, despite these companies being well-positioned to be innovative. One roundtable member noted that “SMEs face huge problems, but lots of the technological innovation comes from SMEs. Much of the problem is that they are not business savvy, they are not market savvy, and they do not know how to work the regulatory and granting systems. The IRAP [Industrial Research Assistance Program] can help these companies, but there is a limit.”

Another participant noted that “there is a bias in how innovative ideas and projects get funded. There is a place where we get stuck if we are not big enough but also not small enough to just be considered a start-up. The big guys are interested in reducing costs. The little guys are innovating and going after the gold rush. We get stuck at \$2 million of capitalization.”

**Access to capital:** Feelings were mixed about the ability of firms to access capital. One participant noted that “Calgary is one of the easiest places to get capital and support. It is innovation-central, not because of the ideas, but because you can form capital very quickly. If you can speak about it and sell it competently, you can get money.”

Others disagreed, with one stating, “Capital is not all that available, you do have to work hard for it. It is called ‘the valley of death’ for a reason, and it exists in our industry.”

All participants agreed that the size of capital investments and the length of time it takes to put a project together creates challenges that other industries do not have. Several roundtable participants cited Sustainable Development Technology Canada as a funding partner that understands the needs of industry.

**Pressures to innovate:** Roundtable participants largely felt that innovation was driven by “necessity,” and without that necessity, it would be easy to get complacent. Falling commodity prices, in the view of many members, create a need for innovation. Participants felt that Governments can also create that need through their policy decisions. Several felt that prescriptive regulations that require the use of certain technologies were harmful to innovation.

Outcomes-based regulations, by which governments require companies to hit certain targets but do not force the use of particular technologies, give companies incentives to create innovative technologies and to do so at the lowest possible cost, the participants said.

Finally, roundtable participants believed that government can also create pressures to innovate through “moonshots,” such as John F. Kennedy’s promise to put a man on the moon by the end of the 1960s, or Alberta premier Peter Lougheed’s creation of the Alberta Oil Sands Technology and Research Authority (AOSTRA) and his tasking it with developing technologies to make production in the oilsands economically viable. There was a consensus that governments at all levels were trying to do too much and that they should instead focus on “picking winners” that had the potential to produce significant returns on investment.

**Final thoughts:** Despite the challenges the cluster has faced, from falling commodity prices to the Fort McMurray wildfires, the mood in the room was remarkably upbeat. People in the extractive industry, while recognizing the pressures they face, also believe the current situation has given them a need and an opportunity to become more innovative.

**“AS AN INDUSTRY, WE KNOW EACH OTHER. WE KNOW WHO WE COMPETE WITH. IN A CAPITAL-CONSTRAINED ENVIRONMENT LIKE WE ARE IN NOW, YOU WILL LIKELY SEE US WORK TOGETHER MORE. IT WILL FORCE US TO WORK TOGETHER MORE. WHAT’S UNIQUE THOUGH, IS THAT WE HAVE FIGURED THAT OUT, BECAUSE WE KNOW ONE ANOTHER, WE TRUST ONE ANOTHER.”**

## 3.7 CLEANTECH AND RENEWABLES

### 3.7.1 CLEANTECH AND RENEWABLES CLUSTERS IN CANADA

Canada is one of the world's leaders in the production and use of renewable energy. In 2012, renewable energy represented 17 per cent of Canada's total energy supply. This was a dramatic increase from a decade earlier. Wind and solar energy are some of the fastest-growing sources of electricity in Canada yet Canada has also started to produce energy from both biomass and tidal sources.<sup>39</sup>

In addition to supplying Canadians with electricity, renewables play an important role in our trade with the U.S. Several provinces are net exporters of hydro-generated electricity to the U.S.

### 3.7.2 INNOVATION IN THE CLEANTECH AND RENEWABLES INDUSTRY

Canada's renewable electricity generating capacity has increased greatly since 2002 and continues to increase as the sector continues to innovate. Collaborative work by all levels of government on both policies and programs has helped to drive and support this innovation.

### 3.7.3 PAST STUDIES OF CLEANTECH AND RENEWABLES INNOVATION

**Innovation PEI (2016):** This organization's website focuses on the goals of wind power in P.E.I. At the moment, more than 30 per cent of P.E.I.'s electricity is supplied by "a combination of provincially owned and private wind developments."

The site, which represents an organization with members of government, post-secondary institutions and industry leaders, states that P.E.I. has always been at the forefront of wind energy development. P.E.I. is, according to the authors, attempting to diversify in the green energy field by not just focusing on the next generation of wind developments but also by investigating hydro and biomass and biofuel opportunities. In addition to exploring different types of green energy, P.E.I. is focusing on "attracting new renewable energy research and development and commercialization activity."

<sup>39</sup> The ideas in this section are based on Natural Resources Canada's 2013 report, A Global Leader in Renewable Energy.

**MaRS Advanced Energy Centre (2014):** The *Canadian Energy Innovation Summit* report focuses on themes and ideas that emerged from a summit hosted by the Government of Ontario and the MaRS Discovery District.

This report starts with a focus on how Canada can become “a global leader in energy innovation” with demand-driven innovation that allows for rapid action, a tolerance for risk and the ability to learn from failure. They note that many of the energy innovations are in high-tech sectors that could help the traditional Canadian energy sector diversify. This diversification could help create new jobs and reduce Canada’s sensitivity to traditional energy costs.

The first of the five ideas that emerged was to encourage greater collaboration in Canada to identify common goals and interests for the country’s natural energy assets. The second was to create more private-public partnerships to allow the private sector to play a larger role in technology innovation. The third idea was to encourage energy innovation already being developed in Canada and export it worldwide. The fourth idea was to ensure that Canadian clean technology companies could access risk capital and early stage financing. The final idea was to emphasize the social and economic benefits that are linked to clean energy.

**Natural Resources Canada (2013):** The *Canada – A Global Leader in Renewable Energy* report focuses on the need for all jurisdictions in Canada to continue both collaborating and sharing information on renewable energy. It also noted the importance of the federal government sharing information from its research, development and demonstration projects. The final recommendation was to investigate opportunities to share information on policies and best practices through Canada’s participation in the activities of the Renewable Energy Technology Deployment technology collaboration program of the International Energy Agency (IEA-RETD).

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### 3.7.4 WHAT OUR ROUNDTABLE TOLD US

The day after our extractives roundtable in Calgary, we headed west to Vancouver’s TELUS Gardens and met with some leaders in the cleantech and renewables sector. Here is what we heard:

**Funding gaps:** One participant felt that government financing programs were quite useful for the early stages of product development, but not for obtaining financing for commercialization. He said that “Sustainable Development Technology Canada is terrific for early stage innovation,” and cited government support through the Scientific Research and Experimental Development Tax Incentive, the National Research Council Canada, the Industrial Research Assistance Program, and others. “There’s a lot of baked-in support before it gets to commercialization. There is help from the public sector to get across the ‘valley of death.’” he said. Then he added, “But when you get to the first market entrant, there is not a lot of debt financing or private capital. These companies are light on assets, so banks won’t lend to them. So companies, even if they do make it across the ‘valley of death,’ do not have the necessary assets or financing to commercialize.”

Another roundtable member cited investor hesitancy to invest in companies that make physical goods, stating “most angel investors invest in digital, not ‘stuff.’ There is a belief that if you produce things, produce hardware, the Chinese will just beat you to it, so these companies do not get the angel funds that tech companies do.”

Finally, a roundtable member suggested that the flow-through shares model used in the extractive industry be extended to cleantech.

**Political risk:** Several roundtable participants cited political risk, particularly with uncertain or changing regulations. One cited uncertainty around the future of bioenergy regulations as scaring away investment. Another said government regulatory clauses stating that programs, such as EcoENERGY, are “subject to change” frighten away international investors despite the fact they are rarely used. Finally, one roundtable participant believed companies were simply playing wait-and-see, stating “new climate and energy policies in government across Canada will take a while to become real, so the private sector is sitting back, particularly in the energy space. Policy uncertainty matters.”

**Need to pick winners:** As with many of our other roundtables, some members felt that government policies covered too many areas, and instead should be focused on a few key priorities. One participant forcefully argued for the need for large-scale reform, stating: “We need to make some big changes to the innovation ecosystem. We need to rip the Band-Aid off. We have been trying the same strategies for 20 years. The Canadian market is too small for mass adoption, so we need to look at other markets. We need more winners abroad. We need to be more ‘American.’”

Another suggested the use of innovation councils to pick winners on technologies.

A third cited the U.S. Defense Advanced Research Projects Agency (DARPA) as providing funding in priority areas that align with U.S. goals and noted that Canada lacked an equivalent. However, one member cautioned that if the government is picking winners, they are leaving people out: “There is a lot of opportunity for creativity if more people get at a shot at it. If the government picks winners, who gets left out?”

**Regulation as a driver of innovation:** Several of our roundtable members noted that strong regulations could both make society better off and spur the need for innovation. As one put it, “Being able to tie innovation to broader societal problems works. We need to get more traction with that.” Another added that “if we had stronger water-quality regulations, we would have more innovation in Canada. Water-treatment technologies are being sold down south, but, largely, not here.”

**The importance of government procurement:** Some roundtable participants suggested that governments should place a greater emphasis on innovation during the procurement process. One member gave a way of doing so, stating, “When government writes RFPs [requests for proposals], they can embed ‘innovation.’”

“They can give points to early stage demonstrations or points for first customers. Using the government’s infrastructure funds, they can incent innovation; they can find a mechanism. As well, the innovation process is a full life-cycle, so if governments are willing to fund something up front, they should be willing to fund it the entire way.”

In so doing, the government should not ignore the value of adopting innovative technologies not developed in Canada, with a participant noting, “It is frustrating that what is interesting to the government is only stuff that was developed here. While we all understand there is pressure to create jobs here, ‘CanCon’ requirements in funding rounds often ignore the benefits of global knowledge. We could be tapping into expertise from around the world.”

**Need for coherence and collaboration:** A common theme of this roundtable was the need for policy coherence and “systems thinking.” One member suggested that higher education could be a catalyst for this: “In Canada, we’re big, we’re provincial. What about what other countries are doing? What about the Swedish model? There, universities specialize in different areas. Think of the Horizon 2020 programs in Europe. There’s knowledge-sharing in their various innovation clusters. Canada is not part of these clusters. We may indirectly make use of them, but we don’t have a plan.”

Another added, “Systems thinking is essential. Distributive energy is a good model for Canada. It allows us to become global experts because it involves more than one system. There’s a strong digital aspect to the grid, too. But it’s hard to commercialize; it needs partners, but this is a place where the government can play a role.” Finally, one member noted that coherence would require alignment of provincial policies and priorities, stating, “Energy is not a federal responsibility. So instead we need maybe a systems-approach that’s regionally focused, but aligned.”

**Final thoughts:** Although Calgary's extractives cluster and Vancouver's cleantech and renewables cluster would appear to have little in common, many of the same themes emerged. In both roundtables, we heard that outcomes-based regulations could drive innovation. We heard about gaps in funding and about the barriers to commercialization. Finally, we heard about the need for governments to "pick winners" and avoid spreading themselves too thinly. Perhaps the two clusters are not so different after all.

## 3.8 COMMON THEMES

The seven clusters we studied all have some unique innovation opportunities and threats. While there are many obvious differences between the clusters, a number of common themes emerged in the roundtables that affect the ability of firms in each cluster to achieve scale and become more innovative.

**Access to capital:** In almost every roundtable, at least one participant would describe funding gaps in their cluster. In our financial services roundtable, we were told that "there's no shortage of people willing to write \$50,000 cheques," but there were funding gaps in later rounds, with companies often needing to seek financing from outside of Canada. The consensus in our technology industry cluster was that access to capital has improved over the past decade, but there was still little appetite in Canada to fund high-risk but potentially very high-reward "moonshots." There was less consensus in our extractives roundtable, with some members stating that capital was easy to come by, but another participant stating "capital is not all that available, you do have to work hard for it. It's called 'the valley of death' for a reason, and it exists in our industry."

**Attracting and retaining talent:** The ongoing struggle of ensuring firms have access to enough skilled workers was raised in many of the roundtables. Concerns were raised about the lengthy and complicated immigration system in the financial services industry roundtable; technical skills gaps in the tech industry roundtable; negative perceptions of the extractives sector; and talent retention in the culture and digital creative industry roundtable. The consensus in our tech roundtable in Kitchener-Waterloo was that attracting and retaining talent in Canada was difficult because of the appeal of Silicon Valley. Similarly, in our digital creative roundtable, participants stated that young talented workers left Halifax for more exciting cities. While not identical concerns, there was an underlying theme of needing to find new ways to compete globally to attract and keep people with valuable skills.

**Risk tolerance:** The ability to take risks plays a vital role in being innovative and was highlighted in three of the roundtables. In the financial services industry roundtable, this took the form of concerns about needing to balance financial regulations to protect consumers from risk with allowing the financial services industry to take the risks necessary to be innovative. In the tech industry, we heard how Canadian venture capitalists are slow to invest in “moonshots” and take on high risk for high rewards. The cleantech and renewables participants spoke of a lack of investment in the industry because of uncertain and changing policies and regulations. While not identical concerns, the underlying theme is of a need to create spaces for risk within innovation throughout the sectors.

**Regulatory barriers and coherence:** Working within incredibly complex regulatory environments was a theme raised by participants in several of the roundtables. For the agricultural and agri-food sector, this took the form of concerns about a complex and difficult-to-navigate regulatory environment – especially for small and medium-sized businesses. In comparison, the cleantech and renewables cluster saw regulatory coherence as a way to spur innovation by aligning priorities, policies and regulations throughout Canada. For example, one participant noted, “If we had stronger water-quality regulations, we would have more innovation in Canada.” Within the financial services industry, concerns were raised that regulations designed for large companies were inappropriate for start-ups and act as barrier to innovation. There was an underlying theme of needing to find coherence within policies in order to not just allow innovation, but to encourage it. Overly complex or incoherent regulations acted to stifle innovation, in the view of our roundtable participants.

**Picking winners:** Roundtable participants largely believed that governments need to focus on a few key priorities and are currently spreading funding and attention too thinly across many priorities. This theme was identified within the roundtables as a need for the government to “pick winners.” In our cleantech and renewables roundtable, several participants felt that the Canadian government needs to pick areas of innovation to fund and not to try to fund every area. However, there was not total consensus as another member pointed out that by picking winners the government would be leaving out some areas that could have been very successful. Members of our life sciences roundtable also felt that the government needed to make some tough choices and focus funding on the strengths of Toronto’s cluster. For example, one participant noted “the money can’t be everywhere,” and another stated, “We can’t have 10 of everything”

WHY DO WE FALTER AT THE ADOPTION PHASE?  
THAT'S IMPORTANT FOR GOVERNMENT TO CONSIDER.





# CREATING BIG IDEAS TO DRIVE INNOVATION

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## 4.1 CREATING BIG IDEAS TO DRIVE INNOVATION – LESSONS FROM THE PAST

In Chapter 2, we saw that Canada's innovation performance has been subpar at best. In the nine years since the release of the first Global Innovation Index<sup>1</sup> Canada's innovation ranking has slid from eighth in the world to 15<sup>th</sup>.

Our decline in performance is not due to a lack of studying the issue. As part of the process of generating big ideas for innovation, we read dozens of past Canadian reports on the topic, many of which contained recommendations of their own.

In total, we discovered hundreds and hundreds of distinct innovation recommendations. Many of these recommendations were the product of 2002's *Canada's Innovation Strategy*, launched by the federal government. As part of the project, the government released two white papers, *Achieving Excellence: Investing in People, Knowledge and Opportunity* and *Knowledge Matters: Skills and Learning for Canadians*.<sup>2</sup> A few months after the release of these papers, the government held a *National Summit on Innovation and Learning*. There were some similarities between its process and the one undertaken by Canada 2020. In both cases, there was a cross-country engagement process that included expert roundtables. Armed with this information, 500 individuals met at the summit held in Toronto, Ont. The discussions and findings of the summit were released as *The National Summit on Innovation and Learning: Summary*.<sup>3</sup> As with this Canada 2020 report, a set of "Big Ideas" to drive innovation was generated from the summit, with the 18 recommendations listed below:<sup>4</sup>

1. Enable the relationship between the receptor community and universities, colleges and researchers. Strengthen receptor capacity.
2. Continue to expand university-based research across Canadian universities — large and small — by strengthening university research infrastructure (for example, establish a permanent program for the reimbursement of indirect costs; expand research funding to the granting councils, to the Canada Foundation for Innovation and to the Canada Research Chairs; and ensure participation across universities of all sizes and disciplines).

<sup>1</sup> Global Innovation Index (2016).

<sup>2</sup> Government of Canada, *People, Knowledge and Opportunity* and *Achieving Excellence: Investing in People, Knowledge and Opportunity* (2002a).

<sup>3</sup> Government of Canada, *Knowledge Matters: Skills and Learning for Canadians* (2002b).

<sup>4</sup> Government of Canada, *The National Summit on Innovation and Learning: Summary* (2002c).

3. Expand successful programs that support commercialization by broadening and deepening the mandates of programs (for example, the Industrial Research Assistance Program and Technology Partnerships Canada).
4. Reduce or eliminate capital taxes at the federal and provincial levels.
5. Improve the functioning of the Scientific Research and Experimental Development (SR&ED) Program.
6. Develop new tax-based instruments to stimulate seed and early-stage investments (for example, tax credits for angel investors).
7. Accelerate regulatory reform (to 2005).
8. Establish a pan-Canadian literacy and essential skills development system, supported by federal, provincial and territorial governments. Establish programs to improve literacy and basic skills based on individual and community needs and interests.
9. Integrate innovation-related skills in curricula (including interdisciplinary, cross-curricular, risk-taking, problem-solving approaches to learning).
10. Adjust the system of student financial assistance to meet the changing needs of students, the post-secondary education sector and the knowledge-based economy (for example, assistance levels, debt and repayment issues, under-represented groups, e-learning).
11. Expand capacity in the post-secondary system by increasing infrastructure (physical, human, financial) using cost-effective design principles.
12. Increase participation levels of under-employed groups (including women, youth, people with disabilities, visible minorities and Aboriginal people).
  - a. Encourage the use of Prior Learning Assessment and Recognition (PLAR) through occupation-based collaborative projects to include non-formal and informal learning and skills.
  - b. Improve access to training, apprenticeship and post-secondary internship programs to target Aboriginal people, persons with disabilities, new Canadians and other under-employed groups.
13. Provide incentives and programs (for individuals and organizations) to increase in-house training and apprenticeship training carried out by industry.
  - a. Use sector councils to channel workplace training programs.
  - b. Create a new industry-led training corporation or a number of sectoral training bodies to champion and oversee training for trades and technical skills that are in high demand; make use of college and university programs as well.
  - c. Expand apprenticeship programs and create more relevant industry training programs through partnerships and collaboration between industry, government and academic institutions.

14. Undertake a comprehensive plan to improve the process for recognizing foreign credentials (for example, allow the process to begin overseas; co-ordinate credential evaluation processes; set up a single source of information on licensing requirements; establish norms for work experience; develop resources for employers; and use programs such as the Canadian Council for Human Resources in the Environment Industry).
15. Collaborate with local (rural, urban and Aboriginal) social, economic and community development stakeholders across municipal, business, voluntary and NGO sectors to prepare long-term community innovation plans and strategies.
16. Support the growth of clusters by fostering the development of local “kernel” research institutions and schools, facilitating cross-community partnerships, providing information on best practices for building clusters and creating entrepreneurial networks; and capitalizing on the benefits and synergies of geography to encourage spinoffs, innovation and the dissemination of ideas.
17. Extend broadband access across the country into rural and remote areas (according to community-specific access needs) to bring cultural, social (e-health), economic (e-business) and learning (e-learning) communities of interest together to encourage the dissemination, implementation and customization of community solutions (e-everything).
18. Enhance the learning capacity of children, youth and adults from rural and Aboriginal communities by providing support programs and educational opportunities tailored to the needs of the local community: develop content to match technology; establish local centres of excellence; set up strong schools; establish community access centres; increase broadband to support distance education; engage young people in actual innovation; and increase access to capital (for example, tax-free bonds).

Although this set of ideas is 14 years old, almost all of these ideas could still appear on an innovation big ideas list today. This alone should illustrate the difficulty in developing and implementing innovation policy. But if that is not enough, then consider that as part of the 2002 innovation strategy, the government released the following four knowledge performance targets:<sup>5</sup>

1. By 2010, rank among the top five countries in the world in terms of R&D performance.
2. By 2010, at least double the amount invested in R&D by the Government of Canada.
3. By 2010, rank among world leaders in the share of private sector sales from new innovations.
4. By 2010, raise venture capital investments per capita as in the United States.

<sup>5</sup> Government of Canada, *Canada's Innovation Strategy: Do It Yourself Kit* (2002d).

This list of goals is worrying for two reasons. The first is that, as far as we can find, the federal government never made any public attempt to measure Canada's progress towards these goals or conduct a post-mortem analysis of our performance.<sup>6</sup> The data we do have on our performance since 2002 is alarming. For example, for the first goal, "R&D" performance is typically measured by gross domestic expenditure on R&D (GERD) as a percentage of GDP. According to the OECD, Canada's performance has declined since 2002:<sup>7</sup>

GERD AS A PERCENTAGE OF GDP FOR CANADA			
YEAR	GERD AS A % OF GDP	RANK	AS A % OF TOP 5 AVERAGE
2002	1.99%	12 <sup>th</sup> IN WORLD	62.6%
2010	1.84%	15 <sup>th</sup> IN WORLD	52.3%
2014	1.61%	19 <sup>th</sup> IN WORLD	44.0%

THE FAILURES OF PAST INNOVATION STRATEGIES  
MUST BE A WAKE-UP CALL. IF WE REFUSE TO CHANGE  
OUR THINKING, IF WE CONTINUE TO PROPOSE  
THE SAME SET OF POLICIES, WE WILL ULTIMATELY  
ACHIEVE THE SAME RESULTS.

<sup>6</sup> Kampe (2016). The website *What is a post-mortem?* identifies three goals of a post-mortem analysis: "to identify the things we did right, so that we can remember to try them again in similar situations," "to note the things that should have been done differently, so that we can refine our techniques in the future" and "to note the things that we did wrong, and to suggest alternative approaches or safety measures that we should employ the next time we face a similar problem." Each of these would be very useful to the current government when designing their upcoming innovation agenda.

<sup>7</sup> Organisation for Economic Co-operation and Development (2016). A counter-argument has been put forward in *Gross domestic expenditure on R&D* that the problem is not a lack of R&D spending, but rather problems with how Canada measures R&D spending. Impact Centre (2016) describes the "data measurement" argument in some detail. Another argument that has been put forward is that Canada's performance decline is due to "composition effects," most notably the declining share of manufacturing as a percentage of GDP; see Conference Board of Canada, 2015b's *Business Enterprise R&D*.

Our report can in part be considered a post-mortem analysis of past innovation agendas. And despite the overall lacklustre performance since 2002's National Summit, there have been many individual policy successes from which we can learn. The fourth idea on the 2002 list, "reduce or eliminate capital taxes at the federal and provincial levels" has largely been fulfilled. For example, Ontario eliminated capital taxation for manufacturing and resource companies effective 2007, which then was extended economy-wide effective 2010.<sup>8</sup>

In our post-mortem analysis of more than 20 years' worth of innovation recommendations, some common themes emerged among policies proposals that were successfully implemented over those that were not:

1. **Actionable:** The idea is not just an aspirational goal such as, "make innovation a top of mind concern for young Canadians," but rather a clear and specific identifiable policy as "eliminate capital taxes."
2. **Identifiable responsibility:** In the proposal, there was a clear single party who would be responsible to design, implement and enforce the policy. Where there are multiple potential responsible parties, a "free-rider" problem often exists.
3. **A focus on causes, not symptoms:** Policies that are implemented successfully tend to be those that focus on the root causes of the underlying problem, rather than simply addressing the observable symptoms.

The latter theme is particularly important. To design a policy to address the root causes of a problem, one must begin by asking the right questions.

**Recommendation:** *Innovation policy recommendations, when possible, should be actionable, should identify a responsible party for enacting the reforms and should focus on causes rather than root symptoms.*

<sup>8</sup> Ontario Ministry of Finance. Webpage - Capital Tax (2016)

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## 4.2 GETTING THE BEST ANSWERS REQUIRES ASKING THE BEST QUESTIONS

The Public Policy Keltner List<sup>9</sup> gives a set of six questions analysts can use when evaluating public policy proposals. The six questions are as follows:

1. What is the policy?
2. What is the policy meant to accomplish?
3. Will the policy accomplish what it intends to accomplish?
4. What will the policy cost?
5. Does the policy have any unintended consequences (either positive or negative)?
6. Is this the best policy for the job?

We believe this approach has a great deal of value when examining big ideas for innovation. Given the discussion in the previous sections, we have altered this list to include questions on identifiable responsibility, accountability and economic inclusion and autonomy and merged three others:

1. What is the idea?
2. Who will be responsible for administering the idea?
3. What mechanisms for accountability or measurement can be put in place for the idea?
4. What failures is the idea trying to solve?
5. What are the potential benefits of the idea and what are the costs?
6. Will the idea increase economic inclusion and/or enhance autonomy? If so, how?

Before we get to the big ideas, some explanation of questions four through six is warranted.

<sup>9</sup> M.P. Moffatt, "A Public Policy Keltner List," *Worthwhile Canadian Initiative* website <https://goo.gl/FuW3YA> (Dec. 30 2011).

## 4.3 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

Too often, discussions of Canadian innovation policies involve leaps of logic or are based on premises that may not be true. For example, here are three commonly cited innovation policy arguments:

- Canadian start-ups find it difficult to obtain venture capital. Therefore the government should find a way to increase the pool of venture capital.
- Canadian companies in innovative fields cannot find enough skilled workers. Therefore the government should find a way to increase the number of skilled workers in those fields.
- Canada has more small companies and fewer medium-sized companies than other developed countries. Therefore governments need to remove the regulations that are preventing Canadian companies from scaling up.

None of the conclusions need necessarily be true, and each of these phenomena may be the result of more benign forces that are outside of the government's control:

- Venture capitalists choosing not to invest in companies may be the result of a broken system. However, it may simply be that the market has recognized that the profits to be had in that industry do not outweigh the risks. As such, a lack of investment may not reflect a limited pool of funds, but rather a limited pool of profitable investment opportunities.
- A lack of skilled workers in an industry could be the result of any number of failures. It could also be the labour market rationally determining that the opportunity costs of entering the field exceed the benefits. As such, a lack of skilled workers may not reflect a gap in skills training, but rather relatively low wages and benefits in an industry.
- Canadian companies may be smaller than those in other countries for any number of reasons, including Canada's relatively low population density and the long distances between cities.

To design smart innovation policy, we need to understand the root causes of the phenomena we are observing. If we do not, we may be trying to solve the wrong problem, or worse, trying to fix a system that is functioning as it should. Public policy should explicitly seek to address some form of failure, typically a market or regulatory failure. When analyzing markets, economists consider a variety of types of market/regulatory failure.

First, we start with sources of market failure. Economist Christopher T.S. Ragan defines a *market failure* as describing “a situation in which the free market, in the absence of government intervention, fails to achieve allocative efficiency,” where *allocative efficiency* is obtained when “for each good produced, its marginal cost of production is equal to its price.”<sup>10</sup> When the link between marginal cost and price is broken (that is, when we lack allocative efficiency), the market will over- or under-supply a good relative to a well-functioning market. These are some ways markets can fail; below we detail a few that could impact the level of innovation in Canada.

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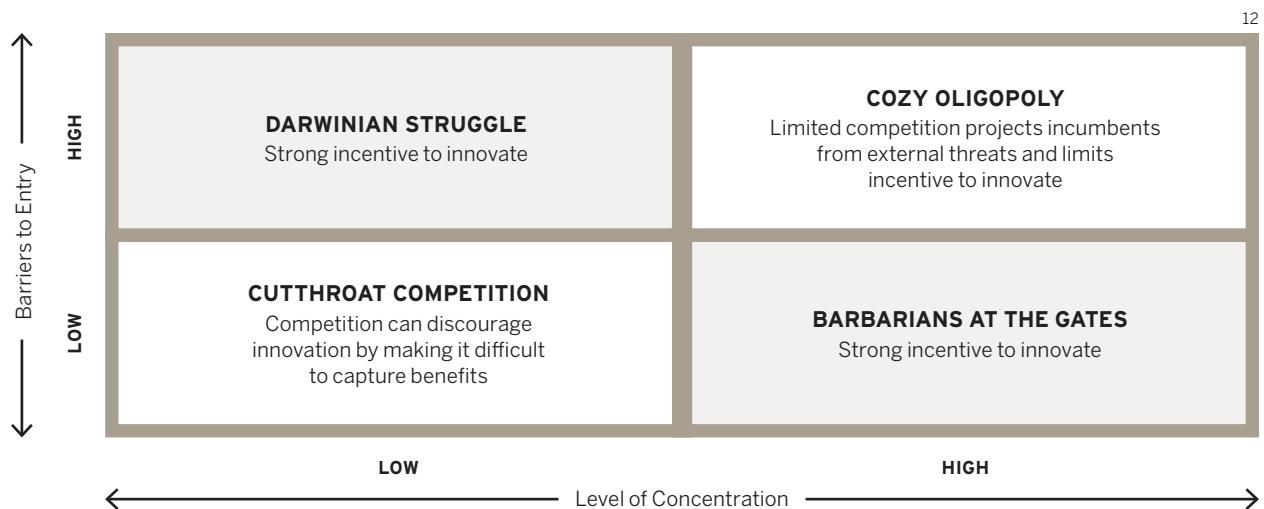
### 4.3.1 MARKET POWER

Any student of Economics 101 is taught that when the many buyers’ and the many sellers’ assumptions of perfect competition are weakened, market inefficiencies can result. Imperfect competition is a commonly cited reason for Canada’s substandard innovation performance, as there are high levels of industry concentration in many sectors of our economy (a concentrated market is one with few firms and little competition). This industry concentration can be due to a variety of reasons, such as regulations barring foreign competitors, Canada’s low population density and the existence of natural monopolies. Innovation is often necessitated by competition, so monopolies and oligopolies (markets with only a handful of firms) tend towards low levels of innovation and above-average profits. The *Expert Panel on Business Innovation*<sup>11</sup> notes that profit margins are typically higher in Canada than in the United States, which is indicative of markets with lower levels of competition. Not surprisingly, finding ways to open up our markets to competition is a common recommendation in innovation reports.

The Expert Panel also makes a compelling argument that the inverse relationship between market concentration and barriers to entry plays a role. The report argues that industries with low levels of concentration (that is, high levels of competition) and low barriers to entry will lack innovation as there are zero economic profits to be had and all market competitors are simply trying to survive. The report illustrates the interaction between barriers to entry and the level of industry competition on a 2x2 matrix.

<sup>10</sup> Ragan, Christopher T.S. *Microeconomics: Fourteenth Canadian Edition* (2016).

<sup>11</sup> Expert Panel on Business Innovation. Council of Canadian Academies, *Innovation and Business Strategy: Why Canada Falls Short* (2009).



An important lesson from the matrix is simply that the threat of competition (through low barriers to entry) to an oligopolistic industry can motivate innovation. But we should not over-focus on market structure, as there are other forms of market and regulatory failure restricting innovation in Canada. As well, an increase in competition leading to “cutthroat competition” could yield less, not more, innovation.

### 4.3.2 THIN MARKETS

When economists typically think about market failure in relation to the number of market participants, they are thinking of oligopolies (few sellers, many buyers) or oligopsonies (few buyers, many sellers). But thin markets, where there are both few sellers and few buyers can exhibit signs of market failure and operate much differently than thick markets, where there are significant numbers of buyers and sellers. Typically, thin markets exhibit fewer transactions, less liquidity, most price volatility and wider bid-ask price spreads than thick markets.

Market thickness is particularly important for labour markets. In an examination of the academic labour market, Gan & Li, found in 2004 that even when the ratio of jobs to candidates was constant, there was a higher probability of a successful job match when markets were thick than when they were thin.<sup>13</sup>

In the United Kingdom, a 2009 NESTA report argued that the venture capital market also suffers from a thin markets problem, “where limited numbers of investors and entrepreneurial growth firms within the economy have difficulty finding and contracting with each other at reasonable costs.”<sup>14</sup>

Given the importance of both labour markets and venture capital to innovation, market failures stemming from thin markets are worth considering.

<sup>12</sup> Expert Panel on Business Innovation. Council of Canadian Academies, *Innovation and Business Strategy: Why Canada Falls Short* (2009), 111.

<sup>13</sup> Gan, Li; Li, Qi. NBER Working Paper. *Efficiency of Thin and Thick Markets* (2004).

<sup>14</sup> Paul Nightingale, et al., NESTA, *From funding gaps to thin markets: UK Government support for early-stage venture capital* (2009).

### 4.3.3 EXTERNALITIES AND KNOWLEDGE SPILLOVERS

A simplifying assumption in many economic models is that individuals and firms receive the full benefits from their actions and are charged for the full costs of those actions. However, that often fails to hold in practice, as described by Perloff & Brander:

An **externality** occurs when a person's well-being or a firm's production capability is directly affected by the actions of other consumers or firms rather than indirectly through changes in prices. The effect is *external* in the sense that it occurs outside a market and hence has no associated price. A firm whose production process lets off fumes that harm its neighbors is creating an externality for which no market exists. In contrast, the firm is not causing an externality when it harms a rival by selling extra output that lowers the market price.

Externalities may either help or harm others. An externality that harms someone is called a *negative externality*. A chemical plant creates a negative externality when it dumps its waste into the water, reducing the profits of a firm that rents boats on the lake and the utility of visitors to the lake. A *positive externality* benefits others. By installing attractive shrubs and outdoor sculpture around its building, a firm provides a positive externality to its neighbours.<sup>15</sup>

Externalities are important, in part, because of their effect on allocative efficiency. Markets left to their own devices will produce too much of goods and services with a negative externality, as producers receive the full benefits of production but pass some of their costs along to third parties. The converse is true in the presence of positive externalities, where the associated good or service will be undersupplied, as the producer pays for the full cost of production but some of the benefits accrue to others.

Positive externalities play a particularly important role in innovation, through technological spillovers (also known as information spillovers or knowledge spillovers). Grossman & Helpman describe a *technological spillover* as a situation in which a firm can "acquire information created by others without paying for that information in a market transaction" and "the creators (or current owners) of that information have no effective recourse, under prevailing laws, if other firms utilize information so acquired."<sup>16</sup> These spillovers are important because they act as a mechanism through which innovations are propagated throughout an economy. However, because they exhibit a positive externality, in the absence of government intervention, a suboptimal amount of information will be created, as information creators do not receive the full economic benefits of their creations.

<sup>15</sup> Jeffrey M. Perloff and James A. Brander, *Managerial Economics and Strategy*, (Pearson, 2014).

<sup>16</sup> Gene M. Grossman and Elhanan Helpman. *Innovation and Growth in the Global Economy* (MIT Press, 1991).

Given the value of knowledge spillovers to the economy along with the fact they will naturally be undersupplied, a body of literature has emerged on how the rate of these spillovers can be increased. Geographic concentration appears to be a particularly important mechanism. Gerald Carlino distinguishes between two types of geographic spillovers:<sup>17</sup>

The first, Marshall-Arrow-Romer spillovers (or MAR spillovers) involve knowledge dissemination between firms in the same industry. A body of evidence has accumulated about their importance, from Chyi, Yee-Man and Wen-Hsien finding in 2012 evidence of R&D spillover in Hsinchu (China's) tech cluster<sup>18</sup> to Kloosterman finding in 2008 evidence of knowledge spillovers in the Dutch architectural industry.<sup>19</sup>

The second type of spillovers, Jacobs spillovers, involve knowledge transfers between industries in the same city. These spillovers can lead to entire new industries, such as financial services and tech working together to create the fintech industry.

Increasing the rate of knowledge spillovers can increase innovation, but it also exacerbates the positive externality problem, creating a further need for government intervention to incentivize knowledge creation.

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#### 4.3.4 NETWORK EXTERNALITIES AND CO-ORDINATION FAILURES

The value of a good or service to a user depends on some factors, including the number of other users of that product. For these types of products, a user's purchase decision creates a positive externality for other users, as described by Perloff & Brander:

A good has a **network externality** if one person's demand depends on the consumption of the good by others. If a good has a positive network externality, its value to a consumer grows as the number of units sold increases.

The telephone provides a classic example of a positive network externality. When the phone was introduced, potential adopters had no reason to get phone service unless their family and friends did. Why buy a phone if there's no one to call? For Bell's phone network to succeed, it had to achieve a *critical mass* of users – enough adopters that others wanted to join.<sup>20</sup>

<sup>17</sup> Gerald A. Carlino, "Knowledge Spillovers: Cities' Role in the New Economy," *Business Review* (2001).

<sup>18</sup> Yih-Luan Chyi, Lai Yee-Man, and Liu Wen-Hsien, "Knowledge spillovers and firm performance in the high-technology industrial cluster," *Research Policy* (2012): 556-564.

<sup>19</sup> Robert C. Kloosterman, "Walls and bridges: knowledge spillover between 'superdutch' architectural firms," *Journal of Economic Geography*: 545-563

<sup>20</sup> Jeffrey M. Perloff and James A. Brander, *Managerial Economics and Strategy*, (Pearson, 2014).

This externality poses a challenge for innovation, as many innovations exhibit network effects. In the absence of a market intervention, some potentially useful innovations may fail to “catch on,” due to the large positive externalities inherent in their adoption. As well, older innovations can be “locked in” due to having overcome those externalities.<sup>21</sup>

The phenomenon of useful innovations not being able to achieve the critical mass for adoption can be thought of as a co-ordination failure; if enough of us could agree to adopt the technology we would be better off, but such an agreement is not made due to transactions costs. The value of co-ordination to users creates market opportunities for entrepreneurs who can find a way to overcome the transactions costs problem; we see this from everything from eBay for online sales to Tinder for dating. Successful market solutions to the co-ordination problem caused by network externalities tend to create natural monopolies, as the value to the customer is in the fact that everyone uses the same one.

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### 4.3.5 INFORMATION ASYMMETRIES

We saw in the section on externalities that markets can produce suboptimal amounts of information due to the positive externalities generated by knowledge. Markets can also fail due to *asymmetric information*, “where one party to a transaction has more or better relevant information about the transaction than the other party.”<sup>22</sup> Hall notes that the informational asymmetries pose issues in the financing of innovations.<sup>23</sup>

In the R&D setting, the asymmetric-information problem refers to the fact that an inventor or entrepreneur frequently has better information about the nature of the contemplated innovation project and the likelihood of its success than potential investors. Therefore the marketplace for financing the development of innovative ideas looks like the “lemons” market modelled by Akerlof.<sup>24</sup> In his model, the good (used) cars sell for a lower price in order to compensate the buyer for the possibility that the car is a lemon. In this setting, the seller of potential returns to R&D or innovation offers a higher return (lower price) to compensate the buyer for the possibility that the project is not as good as is claimed. The lemons’ premium for R&D or innovation will be higher than that for ordinary investment because investors have more difficulty distinguishing good projects from bad when the projects are long-term R&D investments than when they are short-term or low-risk projects.<sup>25</sup> In the most extreme version of the lemons model, the market for R&D projects may disappear entirely if the asymmetric-information problem is too great.

<sup>21</sup> Ulrich Witt, “‘Lock-in’ vs. ‘critical masses’ — Industrial change under network externalities,” *International Journal of Industrial Organization* (1997): 753-773.

<sup>22</sup> Christopher T.S. Ragan, *Microeconomics: Fourteenth Canadian Edition* (2016).

<sup>23</sup> European Investment Bank, Bronwyn H. Hall. *The financing of innovative firms*, EIB Papers (2009).

<sup>24</sup> G. A. Akerlof, “The market for ‘lemons’: Quality, uncertainty, and the market mechanism,” *Quarterly Journal of Economics* (1970).

<sup>25</sup> Hayne E. Leland and David H. Pyle, “Informational Asymmetries, Financial Structure, and Financial Intermediation,” *Journal of Finance* (1977).

There are a variety of ways that governments can correct information asymmetries. Disclosure laws are one mechanism, where sellers are required to disclose relevant information to potential buyers. Those laws are not appropriate in all contexts of informational asymmetry; Hall notes that in R&D settings, such a mechanism would simply allow for information to be copied, which would serve to reduce innovation substantially.

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### 4.3.6 REPUTATIONAL SPILLOVERS AND EVANGELISM EXTERNALITIES

In our roundtables, we heard a great deal about how the actions of one actor in a cluster can affect the reputation of the entire cluster, which impacts their ability to innovate. Consider these three comments from our extractives roundtable:

**Comment 1:** “Yes, firms in the industry are competing with one another. But when it comes to the environment, though, we realized that this sector is competing not against each other, but against other fuels. So we are only as strong environmentally as our weakest performer.”

**Comment 2:** “When the Syncrude tailings pond incident happened, a negative perception was placed on every firm in our industry; even companies without tailing ponds got labelled as poor environmental stewards.”

**Comment 3:** “We are one of the most vilified sectors in Canada and around the world. It impacts our ability to attract talent. We need creative people, and they often choose other sectors. There’s a lot of competition for innovators – why would they want to work on a problem for one of the most vilified sectors in Canada when they can work on something that instead makes them feel good?”

Put these three comments together, and the implication is clear: the actions of one firm can create a negative reputational externality on the other firms in the cluster, which limits their ability to attract talent and investment opportunities. These reputational spillovers can also be positive in nature. Consider the following three statements made at our tech industry and digital creative roundtables:

**Comment 1:** “People think about going to the States as an aspiration. Aspiration is huge – we need to create a culture where people aspire to go to the best company.”

**Comment 2:** “We have to remember that a 22-year-old wants excitement, it’s not job security and health care system. What they think about is, ‘Where can I go that’s sexy, cool and exciting?’”

**Comment 3:** “Young people don’t go to Silicon Valley because it pays better. When you factor in the cost of living, your disposable income is much higher here than it is there. They go to the Valley because it’s the ‘place to be,’ it’s where the action is. We need evangelists who can tell our story and make us seen as ‘where the action is.’”

The ability of firms to attract talent and investment is based, in part, on the perception of the cluster as to “where the action” is. There are opportunity costs to being an evangelist for a cluster, as it can be a significant time commitment talking up the benefits of the cluster and inspiring others. However, the benefits of evangelism are not solely captured by the evangelist, but rather are dispersed among the companies that make up that cluster. As such, there is a positive externality to cluster evangelism, and it likely will be undersupplied by the market. A possible solution would be for the firms of the cluster to band together and compensate the evangelist, but this leads to a collective action problem, where firms are better off free-riding off each other and letting the other firms in the cluster contribute, so ultimately few firms contribute.<sup>26</sup>

#### 4.3.7 REGULATORY FAILURE

Not only are markets prone to fail under certain conditions, so too are even well-meaning attempts to correct them. Regulatory failures can come in a variety of forms, as outlined by Lodge:<sup>27</sup>

1. **Analytical failure:** The analysis of a situation was flawed.
2. **Intervention failure:** The regulatory activity was inappropriate in addressing a diagnosed problem, or the detection of a situation was wrong.
3. **Co-ordination failure:** Regulatory intervention did not occur because of problems of jurisdictional over- and underlap among different bodies.
4. **Political failure:** In certain circumstances, early intervention is not feasible.
5. **Design failure:** The statutory basis and the resources of a regulator are insufficient to address a particular problem.

<sup>26</sup> The collective action problem is described in detail by International Encyclopedia of the Social Sciences in 2008: “The logic of collective action as written about in Mancur Olson’s 1965 piece in the Harvard Business Review, “The Logic of Collective Action: Public Goods and the Theory of Groups,” which has proved to be applicable to a broad range of social and economic situations, assumes that co-operation must be explained by the individual’s cost-benefit calculus rather than that of the group because the group as a whole is not rational but can only consist of rational individuals. Groups often seek public goods that are available, once they have been generated, to everyone, including those who did not contribute to producing them. Because individuals potentially can receive the benefits of public goods without having contributed to their production, they have an incentive to let others pay for them.”

<sup>27</sup> Martin Lodge, “Managing Regulatory Failure,” LSE Knowledge Exchange (2015).

A separate but not unrelated issue is that of *regulatory capture*, where a regulator works to enhance the welfare of the industry at the public's expense. Perloff & Brander suggest this could be due to regulators being drawn from the industries they are regulating, so they are sympathetic to the needs of that industry. They also suggest it could be because regulators may wish to work in that industry in the future, so they are careful not to offend potential future employers. It may also be due to regulators simply receiving higher quality information from groups representing industry than they do from groups representing the public interest.<sup>28</sup>

While not market or regulatory failures, we need to consider the role that risk aversion and inequality of opportunity also play in amplifying market failures related to innovation.

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### 4.3.8 RISK AVERSION

Economists have many different, mostly technical, definitions of risk aversion but all relate to the conditions under which an individual will choose an unexpected outcome over a “sure thing.” The more risk averse the individual, the higher the expected payoff will need to be to take an action with an uncertain outcome (e.g., invest in a tech start-up) rather than an action with a certain outcome (e.g., invest in a government bond). In most of our roundtables, we heard that Canadian investors are more risk averse than their global counterparts. There is some empirical evidence to support this claim, with studies by RSA<sup>29</sup> and Deloitte<sup>30</sup> finding evidence this is true, though a 2014 Conference Board of Canada report<sup>31</sup> did not find significantly higher levels of risk aversion among Canadians.

Risk aversion is not a market failure; it is simply a preference. However, it can amplify the effects of market failures. High levels of risk aversion deter people from developing or investing in promising new ideas or companies. As we saw earlier in this chapter, these ideas and companies have positive spillover effects, through knowledge spillovers and thickening of markets. As such, high levels of risk aversion deter individuals from engaging in the kind of activities that generate positive externalities. So while risk aversion is itself not an externality, it limits the creation of positive externalities. By addressing high levels of Canadian risk aversion, governments can increase investment and the knowledge spillovers they create. They can do this by either “de-risking” investments (typically by absorbing some of the risk themselves) or finding ways to alter preferences, so investors are more willing to absorb risks themselves.

<sup>28</sup> Jeffrey M. Perloff and James A. Brander, *Managerial Economics and Strategy*, (Pearson, 2014).

<sup>29</sup> RSA Canada, *Citizens are risk averse new study reveals*, Canadian News Wire (2010).

<sup>30</sup> John Morrissey, “Risk aversion at heart of Canada’s poor productivity performance, Deloitte says,” Business, Canada.com, June 15, 2011.

<sup>31</sup> Conference Board of Canada, Michael Grant, *Innovation and Canadian Business Survey, 2014: What’s Risk Got to Do with It?* (2014).

### 4.3.9 INEQUALITY OF OPPORTUNITY

To discuss the role “inequality of opportunity” plays in innovation, first we define the term. Unfortunately, there is no universally agreed upon definition in the social sciences, so we will use a definition of *equality of opportunity* created by Ricardo Paes de Barros and others:

**Equality of Opportunity:** “The situation in which all individuals, independent of exogenous circumstances, have the same opportunities in life. ‘Circumstances’ as used here are socially determined exogenous factors, such as gender, race, or socioeconomic background, beyond an individual’s control, and about which there is broad agreement that they should not have a role in outcomes. In a situation of full equality of opportunity, these circumstances neither hinder nor contribute to the individual’s achievement.”<sup>32</sup>

It is unfair to anyone who is denied opportunity due to irrelevant “circumstances.” But the effects of the denial go well beyond the individual. Society is harmed in several ways when talented people are excluded from reaching their full potential. Firms are harmed as the pool of available workers and investors is smaller than it otherwise would be. Like risk aversion, inequality of opportunity is not a market failure, but it interacts with market failures,<sup>33</sup> through the thinning of markets and the reduction of investments leading to knowledge spillovers.

Inequality of opportunity is different than income inequality, though the two interact with each other in important ways. Inequality of opportunity can cause income inequality, as those denied opportunities will have limited earning potential. However, as described by Miles Corak, income inequality can also cause inequality of opportunity, as parental income can affect the opportunity for their children in three ways:

“First, parents may transmit economic advantages through social connections facilitating access to jobs, admission to particular schools or colleges, or access to other sources of human capital. Second, parents may influence life chances through the genetic transmission of characteristics like innate ability, personality, and some aspects of health which are valued in the labour market. Third, parents may influence the lifetime earnings prospects of their children in subtle ways, like through a family culture and other monetary and non-monetary investments that shape skills, aptitudes, beliefs, and behaviour.”<sup>34</sup>

Government actions that increase equality of opportunity, either through addressing income inequality or other root causes of opportunity equality, can increase Canada’s level of innovation.

Now we have a taxonomy of potential failures for government policy to address; we can then move on to the benefits and costs of those policies.

<sup>32</sup> Ricardo Paes de Barros et al., *Measuring Inequality of Opportunities in Latin America and the Caribbean* (World Bank, 2009).

<sup>33</sup> Though the inequality of opportunity in some cases could be caused by a variety of market failures.

<sup>34</sup> Miles Corak, *Income Inequality, Equality of Opportunity, and Intergenerational Mobility* (2013).

## 4.4 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

The existence of a market or regulatory failure, in and of itself, does not justify a particular government solution. An attempt to address a market failure could introduce other, potentially larger, market failures, as described by the *Theory of the Second Best*. In it, Bueno de Mesquita gives an example of a mining industry monopolist. Standard economic theory suggests that monopolies create a market failure; output in a monopoly industry will be lower, and prices higher, than in perfect competition. However, if governments were to break up the monopoly, production may increase, but so too may pollution, a negative externality. Thus the attempt to correct one market failure (monopoly) could exacerbate another market failure (negative externalities), leaving the government with a difficult decision to make.<sup>35</sup>

We must also consider the fiscal cost in correcting the market failure. Government dollars are scarce and come with an opportunity cost; using those funds somewhere else may yield larger benefits than using them to correct a particular market failure.

Where available, we cite studies or experiences in other jurisdictions when discussing the potential benefits and costs of a policy. Since we are not limiting ourselves to policies that have been tried and tested in other jurisdictions, this information is often not available.

<sup>35</sup> Ethan Bueno de Mesquita, *Political Economy for Public Policy* (Princeton University Press, 2016).

## 4.5 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY?

To analyze the effect of the policy on economic inclusion and autonomy, we first need to define *economically inclusive innovation* and *autonomy enhancing innovation*.

### 4.5.1 ECONOMICALLY INCLUSIVE INNOVATION

Dr. Raghunath Mashelkar of the Global Research Alliance, defines “inclusive innovation” in the context of India as follows:<sup>36</sup>

Inclusive innovation is any innovation that leads to affordable access of quality goods and services creating livelihood opportunities for the excluded population, primarily at the base of the pyramid, and on a long term sustainable basis with a significant outreach.

Dr. Mashelkar identifies five key principles in his definition of inclusive innovation:

1. **Affordable access:** The results of innovation must reduce both the cost of production and the cost of distribution of goods and services.
2. **Sustainable basis:** Affordable access must be through market principles, not through unsustainable government subsidies.
3. **Quality goods and services:** The goal of inclusive innovation is “not to produce low performance, cheap knock-off versions” of existing technologies, but rather to “invent, design, produce and distribute quality goods and services that are also affordable for the majority of the people.”

<sup>36</sup> Raghunath A. Mashelkar, Inclusive Innovation, Global Research Alliance website <https://goo.gl/6iOC7P> (accessed 2016).

4. **Access to excluded population:** The focus should be on providing access to the “base of the pyramid,” which includes “the poor, the disabled and the elderly.” Globally this should include those with incomes of less than \$2 U.S. a day.
5. **Significant outreach:** The benefits should reach a large number of people, not just a subset of the population.

Since, unlike Dr. Mashelkar, we are operating from the context of a developed country, we will need a slightly altered definition of inclusive innovation. We propose the following:

**ECONOMICALLY INCLUSIVE INNOVATION IS ANY INNOVATION THAT, THROUGH MARKET FORCES, LEADS TO A COMBINATION OF INCREASED ACCESS TO HIGH-QUALITY GOODS AND SERVICES, HIGHER WAGES OR EXPANDED JOB MARKET OPPORTUNITIES FOR BOTH THE MIDDLE CLASS AND THE POOR.**

#### 4.5.2 AUTONOMY ENHANCING INNOVATION

Recall from Chapter 1 that our best evidence from the psychology literature suggests that personal autonomy, not wealth, is the key to happiness in developed countries such as Canada. Innovation typically creates enhanced automation and globalization, which bring their benefits, but can also have unintended consequences. One of these consequences is feelings of a loss of control for communities that are left behind by the economic changes.

In our view, human-centered innovation requires that innovation, on net, increases autonomy and self-determination for individuals, families and communities. Adapting the work of Fischer and Boer,<sup>37</sup> we propose the following definition for autonomy enhancing innovation:

<sup>37</sup> The exact quote in Ronald Fischer and Diana Boer's 2011 piece in the *Journal of Personality and Social Psychology* piece, “What Is More Important for National Well-Being: Money or Autonomy?” that we have adapted is “Researchers examining the antecedents of a sense of freedom have revealed the importance of democracy, economic development, and liberal values (Inglehart et al., 2008; Johnson & Lenartowicz, 1998; Welzel & Inglehart, 2010; Welzel, Inglehart, & Klingemann, 2003). Therefore, these findings support a causal link where the greater freedom afforded to individuals in more individualistic societies then translates in greater choices and opportunities to develop and follow their personal goals, and this ultimately leads to greater well-being.”

AUTONOMY-ENHANCING INNOVATION IS ANY INNOVATION THAT TRANSLATES INTO GREATER CHOICES AND OPPORTUNITIES FOR INDIVIDUALS, FAMILIES AND/OR LOCAL COMMUNITIES TO DEVELOP AND FOLLOW THEIR ECONOMIC AND SOCIAL GOALS AND CREATES OR STRENGTHENS THE CAUSAL LINKS BETWEEN THE CHOICES MADE AND THE OUTCOMES ACHIEVED BY THOSE ACTORS.

**Recommendation:** Innovation policy recommendations, when possible, should be economically inclusive and autonomy enhancing.

## 4.6 CONCLUSION

To eliminate the bottlenecks limiting innovation, Canada must be willing to address the root causes. Bottleneck elimination can be accomplished through asking the right questions and focusing on the underlying market and regulatory failures. However, we must never forget that we are not seeking innovation for the sake of innovation. In our view, the big ideas to push Canadian innovation forward must strive for innovations that are both economically inclusive and autonomy enhancing.

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# - **TEN BIG IDEAS TO DRIVE INNOVATION**

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In Chapter 1, we gave our mission statement for this project:

Our mission is to create a set of Big Ideas with the potential to increase innovation in Canada, which, if enacted, would have measurable results, whose benefits would be well understood, and that would increase the economic well-being and personal autonomy of the middle class and those working hard to join it.

To generate this list of big ideas, we travelled around the country, getting feedback from a variety of experts in both the private and public sectors to discover the major bottlenecks to innovation. In our travels, we examined eight separate industry clusters across the country, recognizing that clusters accelerate innovation through knowledge spillovers. Based on this feedback, we set out to determine the market and regulatory failures that could be causing the bottlenecks to innovation. Examining the successes and failures of past innovation proposals, we set out to create a set of big ideas that are actionable, identify a responsible party for enacting the reforms and focus on causes rather than symptoms. Furthermore, following the lead of the Council of Canadian Academies' 2009 Expert Panel on Business Innovation<sup>1</sup> and others, we took a firm-centric view of innovation when crafting our big ideas. We made the decision not to limit our recommendations to one level of government, as we believe all levels of government, along with firms, institutions of higher education and Canadians all have a role to play to make Canada more innovative.

To analyze and describe these ideas, we used our list of six innovation policy questions from Chapter 4:

1. What is the idea?
2. Who will be responsible for administering the idea?
3. What mechanisms for accountability or measurement can be put in place for the idea?
4. What failures is the idea trying to solve?
5. What are the potential benefits of the idea and what are the costs?
6. Will the idea increase economic inclusion and/or enhance autonomy? If so, how?

Armed with these questions and the feedback we received from our roundtables, we propose the following 10 big ideas to enhance Canadian innovation:

<sup>1</sup> Expert Panel on Business Innovation, *Innovation and Business Strategy: Why Canada Falls Short* (Council of Canadian Academies, 2009).

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# 5.1 BIG IDEA 1 - CREATION OF A PARLIAMENTARY COHERENCE OFFICE AND OFFICER

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## 5.1.1 WHAT IS THE IDEA?

One of the most common issues we heard in our roundtables was the lack of coherence in many areas of government policy, particularly in the area of funding programs. Policy coherence, as defined by the OECD is the “systematic promotion of mutually reinforcing policy actions across government departments and agencies creating synergies towards achieving the agreed objectives.”<sup>2</sup> Policy incoherence can be the result of a lack of communication between departments or a result of conflicting priorities and objectives.<sup>3</sup> It often results in well-meaning policies either conflicting or being unnecessarily confusing.

**Recommendation:** *The Government of Canada should create a Parliamentary Coherence Office and Officer. Similar to the Parliamentary Budget Officer, this position and office will be non-partisan and will provide independent and objective analysis to Parliament on the coherence of government policies.*

The Parliamentary Coherence Office and Officer will work to highlight regulatory failures in which different policies contradict each other. For example, policies that create agricultural subsidies on ingredients that are used to make junk food may be in conflict with health policies that encourage consumers to lower their intake of that same junk food. Not only do these contradictory policies confuse Canadians, they also have a long-term economic impact. The New York Times reported on a similar policy conflict in the United States and noted, “the subsidies damage our country’s health and increase the medical costs that will ultimately need to be paid to treat the effects of the obesity epidemic.”<sup>4</sup> Similarly, in its report on policy and nutrition, the United Nations System Standing

<sup>2</sup> Institute for International Integration Studies, *What is policy coherence?* Trinity College Dublin (2010).

<sup>3</sup> Ministry of Foreign Affairs of Denmark, *Coherent Policies for Global Development* (2014).

<sup>4</sup> Anahad O’Connor, “How the Government Supports Your Junk Food Habit,” *The New York Times*, July 19, 2016.

Committee on Nutrition noted the need for coherence within policies to ensure trade policy is supportive of a country's nutritional objectives and stated:

"The degree of coherence and/or incoherence between trade policy and nutrition action depends on a wide range of factors, including the forms of malnutrition and the foods affected; the characteristics of sub-populations and food systems in countries; and the trade reforms and existing policy and institutions in place in countries and trading partners."<sup>5</sup>

Another example is the standardization of the way the date is recorded. Different Canadian governmental agencies write the date in different ways (dd/mm/yyyy; mm/dd/yyyy; yyyy/mm/dd), which increases the chances that individuals fill out forms incorrectly. This lack of standardization is also an issue outside of Canada. The National Post reported in 2011 that "a U.S. customs form requests the day first, and its military abides by the same but spells out the abbreviation for the month — but its civilian population has agreed to write the month first."<sup>6</sup>

A final example of this need for policy coherence is the policies that create subsidies for the fossil fuel industry. CBC News reported in 2015 that Canada has policies in place to both subsidize fossil fuel industries and to end the use of fossil fuels.<sup>7</sup>

By identifying these regulatory failures, this office can start the process of prioritizing, co-ordinating and implementing efforts in policy coherence.

Given that the "alphabet soup" of funding programs with "overlapping mandates" was frequently cited as an issue at the roundtable, we would recommend innovation policy coherence be among the first issues studied by the OPCO.

<sup>5</sup> United Nations Standing Committee on Nutrition, *Enhancing Coherence between Trade Policy and Nutrition Action* (2015).

<sup>6</sup> Kathryn Blaze Carlson, "Is 02/04/12 February 4, or April 2? Bill seeks to end date confusion," *National Post*, October 29, 2011.

<sup>7</sup> Margo McDiarmid "G20 countries spend \$450B a year on fossil fuel subsidies, study says," *CBC News*, November 12, 2015.

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### 5.1.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

The position of Parliamentary Budget Officer was created by the federal government as part of the Federal Accountability Act (2006).<sup>8</sup> The creation of an Office of the Parliamentary Coherence Officer would follow a similar process

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### 5.1.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

The accountability and measurement mechanisms put in place for the Parliamentary Budget Office can be reused in the creation of the Parliamentary Coherence Office

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### 5.1.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Regulatory Failure:** From an innovation perspective, the overarching goal of policy coherence is to ensure that policy objectives avoid negative consequences which would affect innovation.

**Market Power:** Unnecessarily complex regulatory environments create both barriers to entry for new firms as well as barriers to growth, as described by the Canadian Chamber of Commerce:<sup>10</sup>

“I deal with enough policy hassles overseas. Why does Canada’s policy environment have to be so complicated?”

<sup>8</sup> Parliament of Canada, *Federal Accountability Act* (2006).

<sup>9</sup> Government of Canada, *Parliament of Canada Act* (2016)

<sup>10</sup> Canadian Chamber of Commerce, *Manufacturing Innovation: Driving Canada’s Biggest Sector through Disruptive Technologies* (2014).

SME<sup>11</sup> manufacturers in Canada often struggle to understand and comply with the underpinning details, incentives, steps and variances among the myriad of policy frameworks in which they operate. As a result, the cumulative impacts and costs of government policies can be barriers to innovation, just as thickening borders between countries — a common complaint of manufacturers — is a barrier to exporting.<sup>12</sup>

## **5.1.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?**

**Benefits:** There are two main ways that increasing coherence will help increase Canadian innovation. First, by identifying conflicting policy objectives we can start the process of addressing these conflicts and reducing the costs associated with the resulting confusion. Second, policy coherence can exploit the potential for positive spillovers and consequences by addressing potential policy synergies across all levels of government.<sup>13</sup>

**Costs and Risks:** This position and office are modelled on the PBO and OPBO. The operating budget for the PBO and OPBO was \$2.8 million for the 2014-15 fiscal year.<sup>14</sup>

There is a risk that the government ignores the work of the OPCO. The European Centre for Development Policy Management investigated the Policy Coherence for Development (PCD) work and found that there is a lack of political support for the work of PCD despite agreement on the importance of the initiatives. As a result, departments responsible for PCD throughout Europe are under-resourced and isolated.<sup>15</sup>

Another risk will be the potential for government interference in the work of the OPCO. Learning from the experiences of the OPBO, the OPCO will remain independent by not reporting to a cabinet minister. By ensuring the office is funded and by making the office non-partisan, these risks can be avoided as much as possible.

<sup>11</sup> Small and medium enterprises.

<sup>12</sup> Canadian Chamber of Commerce, *Manufacturing Innovation: Driving Canada's Biggest Sector through Disruptive Technologies* (2014).

<sup>13</sup> Institute for International Integration Studies, *What is policy coherence?* Trinity College Dublin (2010).

<sup>14</sup> Office of the Parliamentary Budget Officer website, *Office of the Parliamentary Budget Officer* (About Us) <http://www.cbo-dpb.gc.ca/en/about> (accessed 2016).

<sup>15</sup> Florian Krätké, "Policy coherence: a sensible idea lost in translation?" *The Guardian*, November 11, 2013.

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### 5.1.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** A lack of policy coherence often results in unnecessarily complicated systems that exclude people from participating. This lack of coherence harms small businesses that do not have the resources to navigate incoherent policy environments particularly. The federal government<sup>16</sup> found that “regulatory costs and their impact fall disproportionately on small businesses, as these businesses have fewer resources to devote to compliance. Stated another way, the fixed costs of regulatory compliance for larger firms can be spread over a larger employee and revenue base.” It calculated in 2011 that the regulatory burden for firms of between one and four employees was \$1,029 per employee, whereas for firms with 100 to 499 employees the per-employee regulatory burden was \$149.

**Autonomy:** Confusing regulations due to a lack of policy coherence may deter individuals from starting businesses, though we are not aware of any studies that have examined this issue.

To ensure that economic inclusion and autonomy are priorities for government policy, we would recommend that within the OPCO mandate there be a requirement to consider both economic inclusion and autonomy when analyzing government policies.

<sup>16</sup> Industry Canada, *Evaluation of the Paperwork Burden Reduction Initiative* (2013).

## 5.2 BIG IDEA 2 - DATA: OPEN, SHARED, STEWARDED AND TRANSPARENT

### 5.2.1 WHAT IS THE IDEA?

A common theme that emerged during the roundtables was the importance of access to both research data and government data. Data is a valuable resource for innovation, as long as it is available and easily accessible.

#### **Part 1. Research Data**

Canada has a good track record of funding research in the sciences, social sciences and health sciences through granting councils. However, this data is often not stored in a way that means it is protected and shareable among researchers. Without a robust data stewardship program, the data that has already been generated is at risk of being lost, recreated or under-utilized. By storing the data properly, in a comprehensive network of trusted digital data repositories, it will be available to be re-used in a variety of ways, not just by other researchers, but by innovators throughout Canada.

**Recommendation:** *The federal Minister of Science should follow through on the first “top priority” given in her mandate letter from the prime minister: “Create a Chief Science Officer mandated to ensure that government science is fully available to the public, that scientists are able to speak freely about their work and that scientific analyses are considered when the government makes decisions.”<sup>17</sup>*

**Recommendation:** *Building on the work done by Research Data Canada and the Tri-Agency Statement of Principles on Digital Data Management,<sup>18</sup> the Chief Science Officer should create a national program to manage the digital research data funded by the federal government.*

<sup>17</sup> Office of the Prime Minister, *Minister of Science Mandate Letter* (2015).

<sup>18</sup> Government of Canada, *Tri-Agency Statement of Principles on Digital Data Management* (2016).

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**Recommendation:** Any group conducting research funded by the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council or the Social Sciences and Humanities Research Council should be required to create a robust data-sharing plan and deposit their data to be shared promptly with others in an accessible, secure and curated repository.

Researchers will not be responsible for the storage of the data. Each university and institute will need to ensure that their researchers have access to a research data management (RDM) program, both the system and policies, to easily and properly store their data.

**Recommendation:** The Chief Science Officer should require that universities and institutes receiving funds from federal agencies create a research data management (RDM) program to ensure their researchers store their research data properly. This RDM program would include creating policies and procedures as well as the repository itself.

Universities and institutes may choose to create their own RDM program or use an RDM program already in use at their university or institute. Either way, the data in these programs should be easily accessible to others both inside and outside of the original university or institute.

**Recommendation:** The Chief Science Officer should work with research institutions and universities to create a comprehensive network of trusted digital data repositories that provide reliable, long-term access to all research data deemed to be of enduring value that researchers and innovators can easily access.

Universities and institutes will need to be held accountable to ensure that data is properly stored and accessible in these programs.

**Recommendation:** The Chief Science Officer should create a national agency that monitors, oversees and sanctions specific standards for use by Canadian researchers in storing their data.

## Part 2. Municipal Data

Canadian cities produce and collect a wide variety of data on aspects of city life such as employment, transit, road accidents and living conditions that are used in their decision-making processes. However, most of this data is only used internally despite the fact that it could be used by innovators (municipal administration, businesses, universities, academies, research facilities and citizens) to create new services, products and businesses.

**Recommendation:** Building on the work of the Helsinki Region Info-share (HRI) Service in Helsinki, Finland, and Canadian cities like Oakville, Vancouver and Toronto, we recommend the creation of Open Data Cities (ODC) a pan-Canadian coordinating organization, which will act as a bridge between cities providing open data and individuals and organizations who wish to use this data.

The ODC will be responsible for:

1. helping cities prioritize data releases
2. helping cities ensure data is accessible for a variety of user needs
3. collecting and giving user feedback to cities regarding the data and service
4. ensuring quality control of all data released

The aim of the ODC is to make municipal statistical data open, timely, free to use and easily accessible to all.

**Recommendation:** *The ODC should create a web portal that will allow users to search for data from all participating cities.*

**Recommendation:** *The ODC should work with municipalities to help them identify new data sets they can create and should work to connect separate data sets either within the municipality or with several municipalities together. This collaboration will include the creation of a taxonomy and the standardization and description of data and data-collection methods.*

**Recommendation:** *The ODC should host events to encourage developers, public servants and members of the public who have identified problems to work with the open data to solve municipal challenges and create innovations.*

### **Part 3. Transparency of Past Government Records**

In Budget 2016, the federal government proposed creating “a simple, central website” where Canadians could submit data requests to any government institution or department.<sup>19</sup> While commendable, there is still a missing link. The mandate of Library and Archives Canada (LAC) is to acquire and preserve governmental records of archival value and to make them available to the public. In theory, if a Canadian wanted past documents, he or she could submit a request to LAC. However, in his 2014 report on LAC, the auditor general found that LAC was not “acquiring all the archival records it should from federal institutions,<sup>20</sup> and that the disposition authorities, “which tell federal institutions which records can be disposed of when no longer needed and which records must be transferred to Library and Archives Canada,” were both incomplete and out of date. Also, LAC had a backlog of 98,000 boxes of government archival records. While LAC reports that this backlog has been eliminated, it is unclear what records were found and how to access them.

This lack of clarity means that it is possible that if a Canadian submitted a request on the proposed website, they may not get the items requested. If they did get them, they might not be given in a useful format, and they may not be provided promptly.

<sup>19</sup> Government of Canada, *Budget 2016* (2016).

<sup>20</sup> Office of the Auditor General of Canada, *2014 Fall Report of the Auditor General of Canada* (2014).

**Recommendation:** A dedicated and funded program in LAC to digitize all past government records of value should be created.

**Recommendation:** A system of accountability by which the progress of this program is audited quarterly should be created.

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### 5.2.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

For the research data proposals, we would recommend the newly created Chief Science Officer be responsible for the idea, given his or her responsibility to ensure “government science is fully available to the public.” The municipal data and transparency of data proposals should fall under the purview of the president of the Treasury Board, as the prime minister mandated he “expand open-data initiatives and make government data available digitally.”<sup>21</sup> It may be prudent, however, to create a board formed from the participating cities to oversee the operation and execution of the ODC.

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### 5.2.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

Universities and institutes will need to be held accountable to ensure that their research data is properly stored and accessible. For municipal data, we would recommend the ODC issue an annual report and measure how Canadian cities are doing regarding opening their data, using measurements of readiness, implementation and impact. Furthermore, Library and Archives Canada (LAC) would need to report regularly on their progress, including measurements of the readiness, implementation and impact of the data being digitized.

<sup>21</sup> Office of the Prime Minister of Canada, *President of the Treasury Board of Canada Mandate Letter* (2015).

## - 5.2.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Regulatory Failure:** We have data that is being collected and has value, but it is not being made available for use, which is preventing knowledge spillovers. By making data more easily available, researchers will have more timely and complete information to build into their research, creating an environment in which new products and processes may be developed more quickly and easily.

**Inequality of Opportunity:** By not releasing data and making it easily available, we are disproportionately benefitting firms and individuals that have the resources and ability to recreate thess data or discover ways to access them. Our proposal levels the playing field to ensure equal opportunity to be innovative.

## - 5.2.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** Innovation will be encouraged by releasing research data to innovators as well as to other researchers. Opening up municipal data can help drive the creation of innovative businesses and services that deliver social and commercial value. By making government data open, we can better understand actions the government has taken in the past.

**Costs and Risks:** There is a risk that Canadian researchers may be resistant to sharing their data. We believe it is important to follow the lead of the United States and make data management and specifically data sharing a requirement of the Tri-Council research grants. There will be a financial cost to universities and colleges, but we believe these can be kept manageable.

For the ODC proposal, the main risk is that a system will be built that cities will refuse to join. The financial costs are relatively modest, with the yearly budget for the Helsinki Region Info-share (HRI) Service in Helsinki, Finland, being less than \$100,000.<sup>22</sup>

The main risk to our transparency proposal is setting a goal the government cannot meet. In 2014, the auditor general of Canada noted that LAC was behind schedule on retrieving government documents and had a growing backlog of approximately 98,000 boxes of records.<sup>23</sup> There is a potential that LAC will find this goal too onerous and may fall behind schedule again.

<sup>22</sup> Olli Sulopuisto, "How Helsinki Became the Most Successful Open-Data City in the World," *City Lab*, April 29, 2014.

<sup>23</sup> Office of the Auditor General of Canada, *2014 Fall Report of the Auditor General of Canada* (2014).

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### 5.2.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** By ensuring that research data is available to other researchers and innovators, we can ensure that economic opportunities are not limited because of a lack of data. The availability of this data will be particularly valuable to small businesses that do not have the resources to collect large amounts of data.

**Autonomy:** Better access to municipal data will give citizens and community groups the tools they need to understand the decisions of local governments better and influence those decisions through evidence-based proposals.

## 5.3 BIG IDEA 3 - THICKEN LABOUR MARKETS

### 5.3.1 WHAT IS THE IDEA?

In early 2015, the Mowat Centre assembled a roundtable of executives from the emerging information and communications technologies sector in London, Ont., and asked them about their bottlenecks to growth.<sup>24</sup> They identified attraction to and retention of talent in London as their most pressing challenge. Talented technology workers told companies they were reluctant to move to or stay in London for two reasons:

1. There are a limited number of information and communications technologies companies in the London area, so if they ever needed to change jobs, they were concerned they would not be able to find employment quickly in the city.
2. While they could find meaningful employment in the city, they were part of a “power couple” and had concerns about their spouse’s ability to obtain a good job locally. In most cases, the spouse was highly educated and had a very specific skill set valued by only a handful of employers.

Both of these problems are ones of thin labour markets with only a handful of buyers and sellers. Thin labour markets are often self-perpetuating. A limited number of firms causes talent to migrate out of a centre, preventing new firms from emerging, causing a further erosion of talent from the market.

The “power couple” issue of both individuals having employment opportunities is a particular concern for mid-sized cities. In a seminal 2000 piece, Dora Costa and Matthew Khan examined the migration patterns of college-educated Americans between 1940 and 1990.<sup>25</sup> They found significant “power couple” migration to large centres (defined as cities over two million in population). In 1990, 50 per cent of all dually college-educated couples lived in the cities, compared with 32 per cent in 1940. Contrast this to the proportion of couples where neither had college educations, which had only modest growth in the period (from 27 per cent in 1940 to 34 per cent in 1990). Power-couple migration to large cities is not simply due to the college educated (regardless of their relationship status) migrating to larger centres;

<sup>24</sup> Michael P. Moffatt and Rachel Parker, “We asked a group of tech executives: ‘What does it take to grow in London, Ontario?’” Mowat Centre (2015).

<sup>25</sup> Dora L. Costa and Matthew E. Kahn, “Power Couples: Changes in the Locational Choice of the College Educated, 1940-1990,” *Quarterly Journal of Economics* (2000).

Costa and Kahn estimate that “coincidental couple concentration suggests that at most 35 per cent of the increase in power-couple concentration in large cities is attributable to the growing urbanization of the college educated.” Ultimately, families matter and drive location choice.

In our view, this leaves Canadian governments with two options:

1. Focus its innovation agenda on the three census metropolitan areas with more than two million people (Toronto, Montreal and Vancouver) and recognize that, as it stands, labour markets are too thin in other Canadian cities to support sustainable clusters except in unusual cases. Develop a suite of policies that addresses the issues inherent in further migration to big cities (rapidly rising real-estate prices, lack of affordable housing, traffic gridlock and overstretched transit systems) as well as the issues inherent in de-populating secondary centres (falling property values and a shrinking tax base’s inability to properly service the existing stock of infrastructure).
2. Actively work to “thicken” labour markets in mid-sized cities, which will allow for the emergence of clusters in these cities.

In our view, the government should take the second approach, while recognizing that “the big three” will continue to grow and have the challenges associated with growth.

In the global war for talent, workers will migrate to areas that give them the most career opportunities. As non-compete agreements limit career opportunities, talent will naturally migrate to jurisdictions that lack such agreements. One example is California, where non-compete clauses are invalid and unenforceable unless they fall under some very specific exemptions,<sup>26</sup> which is oft-cited as a major factor in the success of Silicon Valley’s technology sector.<sup>27</sup> Or as Bijan Sabet, a general partner at Spark Capital told Fortune, “If you’re a graduate of MIT who studied a specialty like robotics and a Massachusetts company says, ‘Come here and sign this non-compete,’ and a San Francisco company says, ‘We know this isn’t your last job — do whatever you want,’ which would you choose?”<sup>28</sup> Peer-reviewed studies back up this phenomenon, with Matt Marx, Jasjit Singh and Lee Fleming finding that “non-compete agreements are responsible for a “brain drain” of knowledge workers out of states that enforce such contracts to states where they are not enforceable. Importantly, this effect is felt most strongly on the margin of workers who are more collaborative and whose work is more impactful.”<sup>29</sup>

<sup>26</sup> Horwitz & Armstrong, “Enforcing Non-Compete Clauses In California,” *Horwitz & Armstrong*, May 12, 2014.

<sup>27</sup> Chris DeVore, “Silicon Valley Keeps Winning Because Non-Competes Limit Innovation,” *Techcrunch*, February 18, 2016.

<sup>28</sup> Claire Zillman, “Are noncompete agreements hurting tech innovation?” *Fortune*, July 1, 2015.

<sup>29</sup> Matt Marx, Jasjit Singh and Lee Fleming, “Regional disadvantage? Employee non-compete agreements and brain drain,” *Research Policy* (2015).

A 2016 study by the U.S. Department of the Treasury on the economic impact of non-compete contracts found that “the effect of maximal enforcement of non-compete contracts, relative to minimal enforcement, is five per cent at age 25 and 10 per cent at age 50.”<sup>30</sup> The Treasury study also found that California’s restrictions on the use of non-compete clauses both thickens labour markets and increases innovation through a process of knowledge diffusion. They find that “employee departures impose costs on their firms, but yield benefits for destination firms and act to broadly disseminate improvements in technologies and best practices. Non-compete enforcement can stifle this mobility, thereby limiting the process that leads to agglomeration economies.”

While non-compete clauses are often difficult to enforce in Canada (putting us closer to the minimal enforcement end of the spectrum), no province has gone as far as California and simply banned the use in most instances.<sup>31</sup> We would advocate that provinces consider doing so. Explicitly banning non-compete clauses would create less uncertainty of the rights of workers, increase worker mobility and help Canada attract and retain talent. Such a ban would likely lead to higher wages in many industries, so naturally firms will raise concerns about the effect even modestly higher wages will have on their competitiveness. Given that higher wages will lead to attraction and retention of talent in Canada and incent more students into entering innovative fields, we believe it is a price worth paying. Finally, given that we are trying to create economically inclusive innovation, we see higher wages that are driven by market forces as a feature, not a detriment.

**Recommendation:** Canadian provinces should follow the lead of California and explicitly ban the use of non-compete agreements, to attract and retain talent.

An obvious way to address the thin-market problem is through linking mid-sized cities through intercity transit. Consider London, Ont. London’s Census Metropolitan Area (London CMA) has a population of just under 500,000, which includes the city of London, the city of St. Thomas and rural areas and towns around London. The CMA is simply too small to have a significant number of jobs in every occupation, limiting opportunities for couples that work in two different occupations. Furthermore, individuals might be hesitant to take a job in a community with a small number of companies in that same industry. A large number of companies in an industry creates an “option value” for a worker; if they need to leave their job at their existing company, there are plenty of alternatives, which should make it relatively easy to switch companies. However, if there are few local companies in their industry, then workers are “locked in” to their current employer and risk prolonged unemployment should they leave that employer. This potential for “lock in” and unemployment creates significant risk for workers considering taking a position in that community. This problem is particularly acute for ‘power couples,’ where employment options for two people have to be considered.

<sup>30</sup> U.S. Department of the Treasury, *Non-compete Contracts: Economic Effects and Policy* (2016).

<sup>31</sup> Jason Hanson and Sandra Cohen, “Restrictive covenants in employment contracts: Canadian approach,” Practical Law Company (2012).

This thin market problem has a straightforward solution. If it is easy and inexpensive to live in one community but work in other, then the effective population of the community (and its clusters) grows. Consider all of the Census Metropolitan Areas (CMAs) and Census Agglomerations (CAs) of population sizes of 75,000 or more, within 200 kilometers of London, Ont.

COMMUNITY	POPULATION
<b>LONDON CMA</b>	<b>474,786</b>
<b>LONDON CMA + &amp;75K CMA/CAS LESS THAN 100KM AWAY</b>	<b>1,177,002</b>
<b>LONDON CMA + &amp;75K CMA/CAS LESS THAN 150KM AWAY</b>	<b>2,143,227</b>
<b>LONDON CMA + &amp;75K CMA/CAS LESS THAN 200KM AWAY</b>	<b>8,437,721</b>

If Londoners can easily, affordably and reliably get to employment opportunities within 100 kilometres of the CMA, the effective size of London's employment market grows to almost 1.18 million people by adding the Kitchener-Cambridge-Waterloo CMA (population 477,760), the Brantford CMA (135,501) and the Sarnia CA (89,555).<sup>32</sup> Make the radius 150 kilometres, and the market size nearly doubles to 2.14 million by adding the Hamilton CMA (721,053), the Guelph CMA (141,097) and the Chatham-Kent CA (104,075). Finally, a travel radius of 200 kilometres creates an effective market of more than eight million by adding the Toronto CMA (5,583,064), the St. Catharines-Niagara CMA (392,184) and the Windsor CMA (319,246).

Currently, an individual in London who wishes to take a job in one of these communities (or an individual in one of these communities who wishes to take a job in London) can only commute by car unless they have an incredibly flexible work schedule. This time by car is essentially wasted time, where the individual is away from family and cannot work because they are driving. Taking a train or a bus, on the other hand, allows individuals to complete work while they commute. Unfortunately, the earliest a Londoner can arrive at Toronto's Union Station by train is 8:35 a.m., assuming the train is on schedule. These time limitations makes commuting by train impractical for jobs that involve morning meetings. The situation is worse for commuters taking the opposite trip, as someone living in Toronto cannot arrive in London until 9 a.m. at the earliest. On the return trip, travellers to London or Toronto must leave before 8 p.m., which makes attending dinner meetings difficult.

Increased and more reliable train service, with earlier and later options than currently offered, would significantly help thicken mid-sized markets. Given the challenges these cities are currently experiencing, we recommend this happen as soon as possible. While high-speed rail is a fantastic technology, these cities do not have 15 years or more to be connected to each other, so we recommend enhanced investments in existing transportation technologies happen as soon as possible.

<sup>32</sup> All population data from *Census metropolitan area of London, Ontario* (Statistics Canada, 2011).

**Recommendation:** Both the federal and provincial governments should increase their funding of intercity transit between cities, with a focus on projects that can be completed quickly and increase the availability and reliability of transit between communities.

Finally, clusters in all-sized markets could be thickened by ensuring that no Canadians are excluded from employment opportunities in clusters due to “socially determined exogenous factors, such as gender, race or socioeconomic background, beyond an individual’s control.”<sup>33</sup> The first step to addressing barriers to exclusion is having better data so we can determine their root causes. These root causes could include those with the proper skills lacking employment opportunity as well as individuals being unable to obtain the skills they need, which leads us to the following two recommendations:

**Recommendation:** Statistics Canada should conduct a yearly employment survey of clusters, with a focus on employment levels for traditionally under-represented groups, including women, visible minorities and Aboriginal Canadians.

**Recommendation:** Statistics Canada should collect post-secondary education access rates by ethnic background and family income.

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### 5.3.2 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

No new mechanisms are needed, as this idea mostly involves governments doing more of what they already do (transit funding, data collection). Changing rules around non-compete agreements is a one-time activity.

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### 5.3.3 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Thin Markets:** This proposal is explicitly designed to thicken markets, as the goal is to increase the pool of available workers for hire in fast-growing clusters.

<sup>33</sup> Ricardo Paes de Barros et al., *Measuring Inequality of Opportunities in Latin America and the Caribbean* (World Bank, 2009).

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**Inequality of Opportunity:** This idea increases opportunities for those who get left out of clusters, either due to geography (lack of transit) or because they belong to a traditionally under-represented group.

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### 5.3.4 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** Thicker, more-inclusive clusters create economic wealth and opportunities for all Canadians.

**Costs and Risks:** Transit is extremely expensive to build, so there is a risk that the benefits do not outweigh the costs. Statistics Canada could have difficulties collecting the needed data because of privacy concerns or budget. Finally, a lack of non-compete agreements could deter companies from supplying worker training.

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### 5.3.5 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** Allowing people to live farther from work increases their affordable housing options as they are not “forced” to purchase expensive housing if they work in an expensive city. Thickening markets in mid-sized cities will lead to spin-off job creation in those centres, which too often have seen job losses through automation and globalization. Finally, a focus on increasing labour market opportunities for excluded groups increases their ability to access good paying jobs.

**Autonomy:** Increased intercity transit increases autonomy for individuals, as it increases the number of places they can gain employment (or live). It increases their ability to stay with and see a partner who works in a different city. It provides additional opportunities for places to travel to and people to see.

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# 5.4 BIG IDEA 4 - RE-INVENT FIRM AND INFRASTRUCTURE FINANCING IN CANADA

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### 5.4.1 WHAT IS THE IDEA?

Canada needs to re-think both the ways firms obtain financing and how infrastructure is financed. We will start by examining the problems of bottlenecks to firm financing.

A common theme that emerged during the roundtables was the difficulty in obtaining financing, which was seen as being partly responsible for Canadian firms failing to scale-up. Problems cited included difficulty obtaining second- and third-stage venture capital, unnecessarily complicated and occasionally incoherent government funding programs and barriers to obtaining financing to commercialize innovations. Furthermore, roundtable participants discussed how government funding programs often compete with private lenders on some dimensions, while failing to address financing market failures on other dimensions. We believe Canada needs to re-invent firm financing, with a focus on addressing the core market and regulatory failures at play. Here are our recommendations on how Canada can do so.

**Recommendation:** *The Cooperative Capital Markets Regulatory System (CCMRS) or provincial governments should create an online finance matchmaking portal (FinMatch) where eligible small and emerging companies can be matched with both private and public providers of capital.*

On the demand side for capital, entrepreneurs or companies could apply to join FinMatch, for a nominal fee, at one of three levels. FinMatch would vet applications and successful applicants that met the “listing requirements” for that level would be entered into the system:

- Level 1: Pre-startups looking for pre-seed capital for businesses they would like to start.
- Level 2: Startups that have been in business less than two years.
- Level 3: Established companies that have been in business two or more years.

On the supply side of capital, accredited investors could apply to join the portal with a modest yearly subscription fee. These accredited investors would include individuals, financial institutions, businesses and government entities, such as the Business Development Bank of Canada (BDC) and Export Development Canada (EDC).<sup>34</sup> Furthermore, all firms that met the Level 3 “listing requirements” would also be given the option to obtain accredited investor status, which would allow them to act as suppliers of capital.

FinMatch would act as a matchmaking service between suppliers of capital and entrepreneurs needing funding. FinMatch would suggest potential matches, but members of the system would also be able to view the profiles of other members.<sup>35</sup> Within FinMatch, firms could be matched with accredited investors and raise funds in some different ways, including (but not limited to) the following:

- a. Loans and other debt instruments
- b. Grants and loans from government funding agencies
- c. Selling (or buying) whole companies to (or from) other accredited investors

Once a company reached a certain size, it would be able to apply for Level 4 status, which would allow shares in the company to be traded on FinMatch. The Level 4 “listing requirements” would be less onerous than those for firms wishing to list on exchanges such as the TSX Venture Exchange, but would still provide protection to potential investors. As well, the “listing fees” and “annual sustaining fees” would be set substantially lower than those of traditional exchanges.

Our equity market portion of the FinMatch recommendation is adapted from a 2013 recommendation made by the U.S. Securities and Exchange Commission Advisory Committee on Small and Emerging Companies. In their *Recommendation Regarding Separate U.S. Equity Market for Securities of Small and Emerging Companies*,<sup>36</sup> the advisory committee detailed a plan to reduce the barriers preventing high-growth firms from obtaining equity funding. While the proposal was intended for the U.S. market, the first four points of the advisory committee’s proposal are particularly relevant to Canada’s firm-financing ecosystem:

1. The Committee believes that current U.S. equity markets often fail to offer a satisfactory trading venue for the securities of small and emerging companies because they fail to provide sufficient liquidity for such securities and because the listing requirements are too onerous for such companies.

<sup>34</sup> The Ontario Security Commission’s accredited investor exemption includes individuals of sufficient financial means along with individuals who currently are, or once were, a registered adviser or dealer, other than a limited market dealer; financial institutions; governments and governmental agencies; insurance companies; pension funds; registered charities; certain mutual funds, pooled funds and managed accounts; companies with net assets of at least \$5 million; persons or companies recognized by the OSC as an accredited investor. The accredited investor exemption. (Ontario Securities Commission, 2016).

<sup>35</sup> Subject to the user’s privacy settings. Privacy would naturally be a concern in a system like FinMatch, but we believe dating websites provide a good template for allowing users to decide who can access parts of their profile.

<sup>36</sup> Security and Exchange Commission, *Recommendation Regarding Separate U.S. Equity Market for Securities of Small and Emerging Companies* (2013).

2. The frequent failure of U.S. equity markets to offer a satisfactory trading venue for small and emerging companies has discouraged initial public offerings of the securities of such companies, undermines entrepreneurship, and weakens the broader U.S. economy.
3. Establishing a separate U.S. equity market specifically for the securities of small and emerging companies, where these companies would be subject to a regulatory regime strict enough to protect investors but flexible enough to accommodate innovation and growth, offers promise of providing a satisfactory trading venue for small and emerging companies, which may encourage initial public offerings of their securities.
4. A possible feature of an appropriate regulatory regime for such a market would be limiting investor participation to accredited investors who meet a standard designed to assure that the regulatory protection afforded is appropriate given the characteristics of those investors.

We believe that the creation of such a portal would better match sources of capital with investment opportunities, increase liquidity and make it easier for Canadian companies to scale up through mergers. Canada's lack of mid-sized firms is a commonly cited reason for the country's lagging innovation and productivity;<sup>37</sup> we believe the merger activity that FinMatch would facilitate would accelerate firm growth and assist aging business owners to receive value for their companies. Finally, FinMatch would make it abundantly clear where the holes in Canada's firm-financing system are and where government programs are competing with private lenders (and each other).

In an ideal world, there would be a single portal at the federal level rather than separate portals in each province, though it may be possible for the five provinces and one territory that have joined the *Cooperative Capital Markets Regulatory System*<sup>38</sup> to have a single portal. However, given the lack of a national securities regulator, the portals will most likely need to be administered by the provinces.

**Recommendation:** *The federal government should continue negotiations to create a national securities system that includes all provinces and territories.*

While we believe FinMatch would be incredibly useful, we also recognize that it is not a silver bullet and would take substantial time to develop. As such, we have additional recommendations, including the following:

**Recommendation:** *Given the positive externalities created by growing knowledge-creating firms, Canadian tendencies towards risk aversion and ultra-low interest rates on government borrowing, we recommend the federal government significantly increase the funds allocated to the Venture Capital Action Plan and implement the recommendations of the auditor general<sup>39</sup> as they pertain to selection process, performance measurement and reporting.*

<sup>37</sup> *What's Happened to Canada's Mid-Sized Firms?* (Business Development Bank of Canada, 2013).

<sup>38</sup> As of August 2016, British Columbia, New Brunswick, Ontario, Saskatchewan, Prince Edward Island and Yukon are members of the Cooperative Capital Markets Regulatory System. (Cooperative Capital Markets Regulatory System, 2016).

<sup>39</sup> Office of the Auditor General of Canada, *2016 Spring Reports of the Auditor General of Canada, Report 1 – Venture Capital Action Plan* (2016).

The cost of capital for the federal government is incredibly low, with nominal bond yields hovering around one per cent for 10-year bonds and under 1.7 per cent for 30-year bonds, both under the Bank of Canada's two-per-cent inflation target.<sup>40</sup> Given this incredibly low cost of capital and the positive externalities created by growing knowledge-creating firms, the federal government is well-positioned to make equity investments in companies. One mechanism it already has at its disposal is the *Venture Capital Action Plan* (VCAP), which uses a fund-of-funds approach to leverage private-sector knowledge and capital with government investments. We recommend that in Budget 2017 the federal government allocate additional funds to the VCAP. Furthermore, we feel the results of the program can be strengthened by implementing the following three recommendations from the auditor general's 2016 report on the program:<sup>41</sup>

1. When making investments that are similar to those of the Venture Capital Action Plan, the Department of Finance Canada and Innovation, Science and Economic Development Canada should fully respect the values of fairness, openness, and transparency while meeting the purposes of the investment. Respecting these values will maintain the venture capital industry's confidence in selection processes run by the Government of Canada.
2. To appropriately assess the performance of the Venture Capital Action Plan and inform decision making, the Department of Finance Canada and Innovation, Science and Economic Development Canada should expand the Action Plan's Performance Measurement Framework by considering the inclusion of performance metrics, such as exit performance of recipient companies, recipient companies' export growth and their financial performance, new patents and patent citations, and the number of new or additional key investment personnel and lead investors. To increase transparency, the two departments should report publicly relevant information about Action Plan activities and performance.
3. In formulating future interventions such as the Venture Capital Action Plan, the Department of Finance Canada and Innovation, Science and Economic Development Canada should allow for an early exit of the public-sector partners.

<sup>40</sup> On August 26, 2016, the yield on a 10-year bond was 1.090 per cent, whereas the yield on a 30-year bond was 1.687 per cent, *Market data*, (Financial Post, 2016).

<sup>41</sup> Office of the Auditor General of Canada, *2016 Spring Reports of the Auditor General of Canada, Report 1 – Venture Capital Action Plan* (2016).

Finally, we believe firm financing should not just be top-down by large financial institutions or governments, but that community investors have a role to play. The State of California created a useful piece of legislation to give residents more autonomy when making investment decisions. AB 2751, also known as the “California Local Economies Securities Act” (CLESAs), has the express goal of making it “easier for small businesses, farms, and renewable energy projects to raise money from local investors and to enable California residents to move their money from Wall Street to their local community.”<sup>42</sup> In our view, the most valuable change the bill offers is to make it easier for citizens to invest in local start-ups. CLESAs allows start-ups to sell equity stakes without permit requirements, provided they meet the following conditions: “The business provides basic offering and business information to the public, the total amount raised during the offering does not exceed \$500,000, and no individual non-accredited investor invests more than \$1,000. Accredited investors would be limited to investing no more than 5 per cent of their net worth.”<sup>43</sup> The California state legislature has not passed CLESAs, so there is no data on its effectiveness. We believe, however, it still provides a model worth investigating.

**Recommendation:** *The Cooperative Capital Markets Regulatory System (CCMRS) or provincial governments should adopt the “small investments” exemption in the California Local Economies Securities Act (CLESAs).*

We recognize that many individuals would not have the ability to make direct investments in firms, but would appreciate the ability to invest in local businesses in a broad sense, which leads us to our final firm-financing recommendation:

**Recommendation:** *The federal government should work with financial institutions such as credit unions and social finance organizations to create investment vehicles through which individuals could invest in funds that finance local businesses.*

Next, we believe the federal government can improve how it finances infrastructure investments. The prime minister’s mandate letter to the minister of Infrastructure and Communities contains the following priority:<sup>44</sup>

Work with the Minister of Finance to establish the Canada Infrastructure Bank to provide low-cost financing (including loan guarantees) for new municipal infrastructure projects in our priority investment areas. This new institution will work in partnership with other orders of governments and Canada’s financial community, so that the federal government can use its strong credit rating and lending authority to make it easier — and more affordable — for municipalities to finance the broad range of infrastructure projects their communities need. This should include preparing for the launch of a new Canadian Green Bond that can enable additional investments when a lack of capital represents a barrier to projects.

<sup>42</sup> Sustainable Economies Law Centre, *California Local Economies Securities Act* (2016).

<sup>43</sup> Sustainable Economies Law Centre, *California Local Economies Securities Act* (2016).

<sup>44</sup> Office of the Prime Minister, *Minister of Infrastructure and Communities Mandate Letter* (2015).

We would expand this proposal and create a Canadian Infrastructure Investment Bank (CIIB) that would be responsible for federal funding of infrastructure projects. We would suggest that the U.S. model created by Korin Davis and William A. Galston in *Setting Priorities, Meeting Needs: The Case for a National Infrastructure Bank*, be adapted to Canada, with a focus on adapting the following items:

- Establish the bank as an independent government-owned corporation (GOC) outside of any governmental agency. This would endow the NIB with greater budgetary flexibility and not unnecessarily narrow the scope of infrastructure projects it could support.
- The bank's leadership structure should feature a CEO and board of directors, some nominated by the president, others by the leaders of the two parties, confirmed by the Senate, serving staggered terms of about six years. Such a leadership model would give Congress some oversight authority but would sufficiently insulate its operations from political whims and create enough of a buffer so that elected officials would neither determine strategic choices or project selection nor be called on the carpet for unpopular or controversial decisions.
- Create a division of the bank responsible both for analyzing the viability of proposed projects and for advising those seeking support. A strong and permanent professional staff would provide financial and technical advice to further improve resource allocation.
- To achieve leverage, the new entity would have to attract private investor-depositors as well. Its authorizing legislation should be drafted to permit such offerings, subject to the bank's meeting specific quantitative tests.
- Do not limit the bank's lending to specific categories of infrastructure, such as transportation. Instead, the bank should be free to invest in a wide array of infrastructure projects, including technology, environmental and energy projects, public utilities, or the renovation of schools and hospitals.<sup>45</sup>

**Recommendation:** Canada should create a “Canadian Infrastructure Investment Bank” (CIIB) tasked with providing financing for infrastructure projects.

**Recommendation:** Like the Bank of Canada, the CIIB should be at arms-length from the government. The CIIB should be given a five-year mandate by the government, but be free to pursue that mandate in the manner they best see fit, so that projects are chosen on their merits rather than on political considerations.

<sup>45</sup> Korin Davis and William A. Galston, *Setting Priorities, Meeting Needs: The Case for a National Infrastructure Bank* (Governance Studies at Brookings, 2012).

## - 5.4.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

The FinMatch portals and Canadianized versions of CLESA will be created by the federal Cooperative Capital Markets Regulatory System (CCMRS) and by each province that is not a member of the CCMRS. The creation of the CIIB and increased funding for the Venture Capital Action Plan (VCAP) will come from the federal government.

## - 5.4.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

**FinMatch:** One of the potential benefits of FinMatch is that it would allow the government to keep track of the performance of companies. This data could be incredibly useful for the designing of economic policy. As well, we would recommend that the government set goals for the performance of the portal (companies signed up, deals completed, etc.) and report once a year on the performance of the portal relative to those goals.

**VCAP:** We advise the government to put into place the three recommendations from the auditor general's report.

**CLESA:** We would recommend that the program be examined once a year by provincial auditors general.

**CIIB:** We believe the Bank of Canada provides a useful framework that allows the CIIB to operate at arms-length but still be ultimately accountable to the federal government.

## - 5.4.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

Our re-invention of firm and infrastructure funding is attempting to solve some failures, including the following:

**Information Asymmetries:** An obvious question to ask about the creation of an online financing portal is, “If it’s such a good idea, why hasn’t the private sector done it already?” In some cases, they have, as for the buying and selling of companies at sites such as mybizon.com and successionmatching.com. Private-sector solutions, however, suffer from an information asymmetry problem, where the owners have a great deal of information about the value of the investment that the buyer does not. The buyer can obtain much of this information through the negotiation process, but this imposes significant transactions costs. The proposed portal’s listing and reporting requirements would ensure that potential investors quickly have access to the information they need to make an informed decision, similar to disclosure requirements for publicly traded companies. It is certainly possible that government could simply establish the reporting requirements and that private-sector companies would set up portals. While we prefer this option over nothing, we believe this is an appropriate area for government because of data security concerns and the fact that **network externalities and co-ordination effects** make having multiple portals inefficient.

**Externalities and Tech Spillovers:** Governments have a role to play in the financing of knowledge-creating companies, as these firms generate positive externalities through knowledge spillovers (and, as such, will be undersupplied by the market). FinMatch and increased VCAP assist in addressing this externality.

**Risk Aversion:** Companies at Level 1 of FinMatch can enter the system and determine if there is an appetite for their ideas by potential sources of funding before they have committed too much of their own time and capital. We believe that if FinMatch leads to more high-growth firms in Canada, this will incent others to take the risks of entrepreneurship.

**Thin Markets:** Making it easier for firms to be matched with suppliers of funding should lead to the creation of more firms (and more opportunities for the creation of new firms), thus thickening markets.

**Regulatory Failure:** The CIIB is designed, in part, to address the issues of infrastructure projects being chosen on political considerations rather than on their merits. A successful CIIB creates experience in financing and evaluating infrastructure projects on which companies and other levels of government can draw.

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### 5.4.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** By making it easier to match sources of capital with investment opportunities (be they investments in firms or infrastructure), on both sides of the transaction, investors get more for their investments, and companies can grow faster and increase trade, benefitting the Canadian economy.

**Costs and Risks:** Any time individuals are granted more ways to invest their money, we risk opening them up to fraud. As well, government digital programs like FinMatch come with potentials for cost overruns and data breaches.

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### 5.4.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** One of the goals of a reinvention of firm financing is to make it easier for people with great ideas but not a lot of capital to obtain funding. Obtaining superior value along with leveraging private-sector funds when financing infrastructure projects allows the government to build more infrastructure per dollar spent, benefitting all Canadians.

**Autonomy:** By allowing individuals to invest in their local communities, we are giving them the opportunity to regain economic autonomy. This increase in autonomy helps “solve” the ketchup problem, where individuals are desperately looking for an outlet to assist in the economic development of their communities. Furthermore, by making it easier for people to start new businesses, we are giving them additional options.

# 5.5 BIG IDEA 5 - CREATE FINANCIAL REGULATORY SANBOXES

## 5.5.1 WHAT IS THE IDEA?

A common theme that emerged during the roundtables was that Canada's "one-size-fits-all" approach to financial regulations works reasonably well for large financial companies, but unnecessarily inhibits the creation of innovative fintech companies. We believe Canada needs to create safe spaces for businesses to test financial innovations without incurring regulatory consequences that are inappropriate for the scale at which those companies are operating.

**Recommendation:** *The Office of the Superintendent of Financial Institutions (OSFI) should spearhead an initiative to create and administer the financial regulatory sandbox where eligible small and emerging companies can operate in a well-defined space and for a limited duration while offering financial products and services to Canadian consumers.*

This financial regulatory sandbox would be similar to the regulatory sandboxes developed by the Financial Conduct Authority (FCA) in the United Kingdom,<sup>46</sup> the Australian government and the Monetary Authority of Singapore (MAS).<sup>47</sup> These financial regulatory sandboxes allow businesses to test their ideas and reduce the cost of getting innovative ideas to market, yet ensure that consumers are still protected. The sandbox would encourage and support the design and delivery of new financial products and services that benefit consumers and businesses.<sup>48</sup>

The following criteria for choosing participating projects for the sandbox are developed from the frameworks developed by both the FCA<sup>49</sup> and MAS<sup>50</sup>:

<sup>46</sup> Financial Conduct Authority, *Regulatory sandbox* (2015).

<sup>47</sup> Monetary Authority of Singapore, *MAS Proposes a "Regulatory Sandbox" for FinTech Experiments* (2016).

<sup>48</sup> Government of Australia, *Backing Australian FinTech* (2016).

<sup>49</sup> Financial Conduct Authority, *Regulatory sandbox* (2015).

<sup>50</sup> Monetary Authority of Singapore, *MAS Proposes a "Regulatory Sandbox" for FinTech Experiments* (2016).

1. Is the new solution novel or significantly different from existing offerings?
2. Does the innovation offer an identifiable benefit to customers?
3. Does the business have a genuine need for testing within the sandbox framework?
4. Has the business invested appropriate resources in developing the new solutions, understanding the applicable regulations and mitigating the risks?
5. Does the business have the intention and ability to deploy the solution in Canada on a broader scale?

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### 5.5.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

Because of Canada's complicated financial regulatory structure, federal and provincial regulators will have to work together to create and administer the financial regulatory sandbox.

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### 5.5.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

The projects will be monitored throughout their time in the financial sandbox. While specific regulatory requirements will be relaxed in the financial sandbox, the regulators will work with innovators to ensure that appropriate safeguards are built into their new products and services before these reach a mass market. Firms participating in the sandbox will have to report on agreed milestones, findings and risk management.

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### 5.5.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Regulatory Failure:** Typical financial regulations are designed, in part, to limit systemic risk. However, these regulations can also limit innovation. Thus, the overarching goal of the financial regulatory sandbox will be to ensure that regulations intended to protect Canadians from massive failures in the financial industry are not applied to smaller companies in a way that will needlessly stifle innovation.

**Inequality of Opportunity:** The financial regulatory sandbox will increase the economic inclusion of low-income households and under-serviced communities in Canada by providing them with financial products and services that the big banks may not consider valuable enough to create.

**Market Power:** Competition will be increased in a sector that is currently dominated by a few large players.

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### - 5.5.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** Fintech focuses on creating technological innovation to make financial markets and systems more efficient and consumer focused. By reducing barriers, companies can create financial innovations that are smaller and can benefit communities, such as First Nations, the working poor and new Canadians, who often lack access to affordable financial tools.

**Costs and Risks:** There is an increased potential for fraud as well as failure of new products and services. Also, there is the potential risk, identified at the roundtables, that the financial regulatory sandbox will create a wall for firm growth. Firms may limit their growth so they can continue to operate without regulations, or potential funders may be reluctant to invest in companies if they are uncertain those companies will be able to exit the sandbox. Or as one roundtable participant described it, "We need to ensure the sandbox does not create walls to growth."

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### - 5.5.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** By creating sandboxes and giving businesses a safe space to test innovative ideas without incurring all of the regulatory consequences, we can ensure that regulations are not stopping companies from taking advantage of economic opportunities because they lack the resources to meet regulatory requirements designed for large financial firms. The reduced set of requirements benefits small businesses that do not have the resources to navigate the financial regulatory environment. Furthermore, we expect many fintech start-ups will focus on providing enhanced access to lower-cost services, which disproportionately benefits Canadians of limited means.

**Autonomy:** Financial start-ups that make it easier for low-income individuals to obtain capital give them more options to start businesses, invest in skills training and fully participate in a modern economy.

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# 5.6 BIG IDEA 6 - CREATE A SET OF “CANADA 150 GOALS” AND “CANADA 150 PRIZES”

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### 5.6.1 WHAT IS THE IDEA?

Canada needs innovative thinking to solve some of the more difficult social and economic problems the country faces, such as:

- A lack of safe drinking water and substandard housing on First Nations reserves.
- A persistently large gender wage gap.
- Growing rates of fentanyl and other opioid addiction.

To tackle these problems, we recommend the use of goals and prizes, which we have adapted from both the XPrize Foundation and the United Nations Millennium Development Goals.

**Recommendation:** *The federal government should identify a set of measurable national goals, the Canada 150 Goals.<sup>51</sup>*

Canada has already set some of these goals. Canada's commitment to reduce greenhouse gas emissions by 30 per cent below 2005 levels by 2030 certainly counts as a measurable national goal,<sup>52</sup> as does the prime minister's commitment to "end boil-water advisories on First Nations reserves within five years."<sup>53</sup> Canada's goals should follow the SMART criteria:<sup>54</sup>

- **S**pecific
- **M**easurable
- **A**chievable
- **R**elevant
- **T**ime-based

<sup>51</sup> Canada 150 is in reference to 2017 being the 150<sup>th</sup> anniversary of Confederation.

<sup>52</sup> Margo McDiarmid, "Canada sets carbon emissions reduction target of 30% by 2030," CBC News, May 15, 2015.

<sup>53</sup> "Justin Trudeau vows to end First Nations reserve boil-water advisories within 5 years," Canadian Press, December 18, 2015.

<sup>54</sup> Robert L. Bogue, "Use S.M.A.R.T. goals to launch management by objectives plan," TechRepublic, April 25, 2005.

Some of the UN Millennium Development Goals have been criticized for being unachievable or lacking measurability; the Canada 150 Goals must avoid such goals.

**Recommendation:** *The federal government should create a set of Canada 150 Prizes, with large cash prizes for projects that will help meet these goals.*

The prizes are different from the goals, but they should be related to them. One such example is Canada's emissions goal, and the NRG COSIA Carbon XPRIZE:<sup>55</sup>

**Goal:** Reduce greenhouse gas emissions by 30 per cent below 2005 levels by 2030.

**Prize:** "The \$20M NRG COSIA Carbon XPRIZE will challenge the world to reimagine what we can do with CO<sub>2</sub> emissions by incentivizing and accelerating the development of technologies that convert CO<sub>2</sub> into valuable products. These technologies have the potential to transform how the world approaches CO<sub>2</sub> mitigation, and reduce the cost of managing CO<sub>2</sub>."

In this way, the prizes assist Canada in achieving the final goals. Canada's boil-water advisory goal could be matched with a prize for new water-treatment technologies, and the goal of reducing opioid addiction could be matched with a prize for treatment programs that prove to reduce addictions by a measurable amount.

These prizes would encourage investment of time and capital in finding innovative solutions to our goals and would incentivize Canadians to use their skills and imagination to solve some of the more difficult social and economic problems the country faces.

**Recommendation:** *The federal government should ensure that Canada 150 Prize competitions are open to all Canadians.*

## 5.6.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

The Minister of Innovation, Science and Economic Development will be responsible for administering the Canada 150 prizes and identifying the formidable problems to be solved.

**Recommendation:** *The federal government should hold open consultations with Canadians to determine the list of Canada 150 Goals and Canada 150 Prizes.*

<sup>55</sup> NRG COSIA Carbon XPRIZE, *NRG COSIA Carbon XPRIZE Overview* (NRG COSIA Carbon XPRIZE, 2016).

### - 5.6.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

One of the benefits of using a prize-based approach is that projects are only funded if they are successful, creating an automatic layer of accountability. The federal government must ensure that both the goals and the prizes have measurable criteria.

### - 5.6.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Regulatory Failure:** A common theme that came up repeatedly in our roundtable was that governments were trying to do too much and were spreading innovation dollars around too thinly, rather than focusing on a few areas where it can realistically expect to succeed. There was a consensus that Canadian governments are too afraid to try to “pick winners,” and this aversion leads to a suboptimal use of resources. The Canada 150 Goals and Prizes are designed to “focus the mind” on a few key areas where Canada has the potential to be a world leader. By choosing specific problems to solve, we allow the government, firms and individuals to focus on developing and showcasing specific core competencies.

**Risk Aversion:** The Canadian government’s approach to risk aversion in the innovation sphere is to try to “de-risk” the space, by transferring risk from firms to governments. While appropriate in some circumstances, this approach does not teach Canadians how to take risks. Attaching large financial prizes to problems rewards risk-takers and creates an environment in which taking chances is more socially acceptable.

**Evangelism:** Canada currently has the world’s attention thanks, in part, to the international popularity of Prime Minister Justin Trudeau. By choosing specific problems to solve and by having large prizes attached to solving them, the prime minister can use his star power to highlight our innovative clusters to the world and make Canada “the place to be” for innovation.

**Inequality of Opportunity:** A large segment of Canada’s population is left out of government programs on innovation because they do not know how to navigate a complex regulatory environment. Using prizes that anyone can access opens up government-driven innovation to all Canadians.

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## - 5.6.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** The approach of goals and prizes forces the government to focus on a few key priority areas. Furthermore, since prizes are only awarded for success, there is little financial risk for the government. If no innovation occurs, no prizes are awarded.

**Costs and Risks:** As with most, if not all, innovation programs, the government could end up paying for innovations that would have happened without the program. Furthermore, the government may choose the wrong areas as “winning” ones and fail to incent innovation in areas with a greater chance for success.

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## - 5.6.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** Since many of the goals will be around assisting vulnerable populations, successful completion of these goals will lead to an improved quality of life, a lower cost of living and higher incomes for those in need.

**Autonomy:** We would recommend that when choosing the Canada 150 Goals, the government try to have at least one or two that would be autonomy-increasing if successful.

## 5.7 BIG IDEA 7 - A CANADA-WIDE TRANSFORMATION OF NUMERACY SKILLS

### 5.7.1 WHAT IS THE IDEA?

Numeracy skills affect an individual's economic and social well-being. Inadequate numeracy skills can negatively impact an individual's ability get a job and feel engaged and valued in society. Inadequate numeracy skills when possessed by larger groups can "hurt the economy through missed opportunities for innovation and productivity."<sup>56</sup>

In 2012, the Conference Board of Canada found that 55 per cent of Canadian adults had inadequate numeracy skills. Also, inadequate numeracy skills are higher in marginalized groups, such as Aboriginal people in Canada and immigrants. A person with inadequate numeracy skills may be unable to function well in an innovative Canada as low numeracy skills are linked to "unemployment, low wages and poor health."<sup>57</sup> Thus, poor numeracy is a massive challenge for Canada's innovation agenda and our goal of encouraging economically inclusive innovations.

The goal for this big idea is to build on measures proposed and/or put in place by other countries struggling with the same numeracy issues in order to eradicate inadequate numeracy among adults and children, and to create more positive attitudes towards numeracy in Canadian society.

#### **Part 1. Introduce numeracy skills in early childhood (before children are in formal education)**

Numeracy skills must be introduced early in childhood for two reasons. First, it is important to promote the development of numeracy skills in early childhood to naturalize mathematical thinking and to identify students that are struggling as early as possible so that their acquisition of mathematical knowledge in school is not hampered. According to the Encyclopedia on Early Childhood Development, "1 in 10 children will be diagnosed with a learning disorder related to mathematics during their education."<sup>58</sup>

<sup>56</sup> Conference Board of Canada, "Adults with Inadequate Numeracy Skills," Conference Board of Canada Website (2014).

<sup>57</sup> National Numeracy, *Manifesto for a numerate UK* (2014).

<sup>58</sup> Jeff Bisanz, "Numeracy: How important is it?" *Encyclopedia on Early Childhood Development*, (2011).

Just as language skills are stressed early in a child's life and any struggles are quickly identified and interventions implemented, we must do the same for numeracy skills. This leads to a series of sub-recommendations:

**Recommendation:** Provincial governments should share best practices on effective early childhood numeracy curricula.

**Recommendation:** Where needed, provincial governments should create an effective early childhood numeracy curriculum.

To ensure a child has numeracy skills, early childhood professionals need to be provided with evidence-based effective numeracy strategies, curricula and assessment tools. While there are suitable numeracy techniques for teaching children of this age, early childhood educators do not universally use them.<sup>59</sup> By creating a curriculum, and ensuring it is used in early childhood education, we can ensure that all children benefit from these techniques and are not left behind their peers.

**Recommendation:** Provincial governments should work together to create numeracy tools for parents to encourage engagement.

National Numeracy, a not-for-profit organization in the U.K., created a parental tool kit and website to encourage parental engagement in numeracy.<sup>60</sup> These brought together best practices and current materials for parents to use. Additionally, they created a tool kit that would help parents and schools provide positive messages about numeracy, opportunities and activities related to numeracy, and school tools to help schools develop parental engagement.

We propose developing a similar Canada-wide set of tools that can help break down the barriers to numeracy.

**Recommendation:** Provincial governments should fund research into early screening measures and interventions and supports for problems in numeracy.

Dr. Daniel Ansari, the Canada Research Chair in Developmental Cognitive Neuroscience, reported that one of the main concerns in math education is that while we have reliable and valid early childhood screening measures for problems in language development and effective interventions and supports to deal with these problems, we have not developed the same screening measures and interventions and supports for problems in numeracy. Screening tools for identifying foundational numeracy competencies in preschool and kindergarten need to be developed and validated for use in schools, clinics and other educational settings. Interventions for children with, or who are at risk of, mathematics learning difficulties should be devised and evaluated through randomized controlled studies.<sup>61</sup>

<sup>59</sup> Jenni Connor, "Being Numerate," *The Early Years Learning Framework - Professional Learning Program* (2011).

<sup>60</sup> National Numeracy, *Final Report: Parental Engagement Project* (2015).

<sup>61</sup> Nancy C. Jordan, "Early Predictors of Mathematics Achievement and Mathematics Learning Difficulties," *Encyclopedia on Early Childhood Development* (2010).

## **Part 2. Create a system-wide numeracy culture within the education system<sup>62</sup>**

Every teacher from early childhood educators to university lecturers must become a teacher of numeracy. That does not mean that every teacher must hold a math degree and be a math teacher but that numeracy — just like literacy — must be recognized as an intrinsic part of every subject. This goal will take ongoing work to ensure that education systems in Canada have a cross-curricular approach to numeracy.<sup>63</sup> Many schools already recognize this and strive to achieve it, but the approach must become universal in Canada.

This leads to a series of sub-recommendations:

***Recommendation: Expand the teaching of numeracy in bachelor of education programs***

Researchers into math education have identified the need for more time to be spent in bachelor of education programs on numeracy teaching approaches, identification of children struggling and numeracy interventions. By including more work on numeracy, the programs will help new teachers incorporate numeracy into all subjects. This recommendation echoes a similar call for more teacher education in numeracy teaching approaches by the OECD in their 2004 report on the role of math education in innovative societies.<sup>64</sup>

***Recommendation: School boards should allocate more professional development time for practicing teachers to focus on numeracy teaching approaches, identification of children struggling and numeracy interventions.***

## **Part 3. Create a new adult numeracy core curriculum**

***Recommendation: Provincial governments should create an adult numeracy curriculum that will be disseminated through local health units and other appropriate places such as public libraries and job placement offices.***

The goal of this is to ensure that adults have opportunities to develop and refresh their numeracy skills.

It will include numeracy programs in: further and adult education; the workplace and programs for the unemployed; prisons; and community-based and family numeracy programs. It will assist teachers to meet the individual needs of adults through the selection and teaching of skills appropriate to those adults' needs.

Good numeracy is essential for parents to help their children learn, to understand health information and to make informed decisions throughout our lives. Research in the U.K. has shown that improving adult numeracy directly contributes to an increase in the personal and social confidence of the people with improved numeracy.<sup>65</sup>

<sup>62</sup> Ontario Ministry of Education, *Supporting Numeracy* (2012).

<sup>63</sup> Ontario Ministry of Education, *Supporting Numeracy* (2012).

<sup>64</sup> Zemira Mevarech and Bracha Kramarski, *Critical Maths for Innovative Societies*, OECD (2014).

<sup>65</sup> National Numeracy, *Why is numeracy important?* (2016).

#### **Part 4. Data collection and evaluating numeracy approaches**

**Recommendation:** Provincial governments should require the collection and sharing of depersonalized data to evaluate testing, intervention and instruction approaches for numeracy education throughout childhood.

Given the decentralized nature of our education system, there is no single agency or institution responsible for evaluating instruction approaches. In most Canadian provinces and territories, schools can set their own policies for student assessment and most principals use student assessment data for making decisions about students, monitoring their school's progress or identifying aspects of instruction or the curriculum that could be improved. With some variation across the provinces and territories, students in Canada take provincial or territorial standardized summative examinations at key stages of their education, especially at the end of secondary education.<sup>66</sup> Different school boards and specialists use different measurement tools to identify children presenting numeracy problems and use different interventions based on these different tools.

Dr. Ansari noted in his interview that the schools are very good at collecting data, but the use of a large number of different instruments and a lack of access to the data means that researchers are unable to compare instruction and intervention approaches. This lack of standardization results in a lack of evidence-based interventions.

This lack of comprehensive and comparable data to evaluate instruction and intervention approaches can hinder policy development and analysis and is a barrier to improving Canadian students' math skills. Using the data will help in three ways: to develop and identify appropriate measurement tools and interventions for numeracy problems, to measure the success rate of various interventions and to develop a consistent and evidence-driven program.

<sup>66</sup> OECD, *Education Policy Outlook: Canada* (2015).

## - **5.7.2 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?**

In 2012, Canadian students did reasonably well on the *Programme for International Student Assessment* (PISA) math test. Students' math skills were assessed on a six-level scale, with level 6 being the strongest skills and level 1 the weakest. In 2012, 35 per cent of Canadian 15-year-olds scored at a level 2 or lower. Based on the results, the Canadian Conference Board assigned Canada a grade of B with only four countries (Japan, Switzerland, the Netherlands and Finland) receiving an A grade.

However, when this data was broken down, researchers highlighted some concerning trends. First, there is a growing number of Canadian students with "inadequate" math skills. In 2012, this number was 34 per cent, up more than four per cent from three years previous. Second, there is a growing achievement gap, with more students scoring in the lowest levels and fewer students scoring in the top levels. Third, when this data is examined at the provincial level, there are alarming provincial differences. Quebec earned an A+, British Columbia earned an A, Ontario, Alberta and Saskatchewan earned a B, New Brunswick, Nova Scotia and Newfoundland earned a C and Manitoba and Prince Edward Island earned a D."

Canada will continue to participate in these tests, and implementing our recommendations will help reverse these concerning trends.

Also, part of the mandate for this idea will be to create robust measurement tools for both early childhood numeracy and adult numeracy.

### 5.7.3 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Thin Markets:** By ensuring that Canadian adults have “the ability to access, use, interpret and communicate mathematical information and ideas to engage in and manage the mathematical demands of a range of situations in adult life,”<sup>67</sup> this big idea will ensure that there is more talent available to the cluster. The increased pool of talent will make each cluster both stronger and bigger.

**Inequality of Opportunity:** Large groups of Canadians are being denied opportunities because they do not have the math skills needed to compete in the 21st-century economy. Specifically, this idea will help to address the inequality of opportunity for marginalized groups, such as new immigrants and Aboriginal Canadians. Both groups have been identified specifically by the Conference Board of Canada as having inadequate numeracy skills, which may negatively impact their participation in innovation.<sup>68</sup>

### 5.7.4 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** In its 2004 report on the role of math education in innovative societies, the OECD notes that one of the main goals of math education is to empower people with the ability to “pose, solve and interpret mathematical problems in a variety of situations,”<sup>69</sup> with the goal of applying these skills in innovation. Without citizens with strong math skills, the OECD argues that innovation will lag behind as people struggle to understand and incorporate numerical information. These strong math skills start with a strong numeracy foundation.<sup>70</sup>

Transforming Canada’s numeracy skills will help to solve the labour shortage failure Canada is experiencing. At the moment there are jobs that need to be filled and people who need jobs, but the people don’t have the right skills. By transforming Canada’s numeracy skills, we can fill these jobs and have people ready to fill new jobs as they are created.

<sup>67</sup> OECD, *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills* (2013).

<sup>68</sup> Conference Board of Canada, *Adults with Inadequate Numeracy Skills* (2014).

<sup>69</sup> Zemira Mevarech and Bracha Kramarski, *Critical Maths for Innovative Societies*, OECD (2014).

<sup>70</sup> National Numeracy, *Why is numeracy important?* (2016).

**Costs and Risks:** There is a risk that the provinces and school boards do not participate in the goal to transform numeracy. A lack of political support for this goal would make the goal much more challenging to achieve.

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## 5.7.5 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** The Conference Board of Canada reports that "Inadequate numeracy skills hurt individuals' potential for landing jobs and promotions and hurt the economy through missed opportunities for innovation and productivity."<sup>71</sup> By transforming Canada's numeracy skills, individuals will be able to participate in the economy.

**Autonomy:** Low levels of numeracy are linked to unemployment, lower wages and poor health. By transforming Canada's numeracy skills, individuals will be able to improve their quality of life and make well-informed personal choices.

<sup>71</sup> Conference Board of Canada, *Adults with Inadequate Numeracy Skills* (2014).

# 5.8 BIG IDEA 8 - CREATION OF A NETWORK OF CLUSTER RESEARCH CENTRES

## 5.8.1 WHAT IS THE IDEA?

Clusters are beneficial because they allow for economies of scale, and access to skilled labour and innovation largely happens in geographic clusters of interrelated companies and institutions. In his 2014 report, Spencer<sup>72</sup> identified 230 separate geographic clusters in 21 different industries in Canada. This included a higher education cluster in Charlottetown that employed 2,066 people in 2011, the aluminum cluster in Saguenay that employed 3,687 people and the food and beverage cluster in London that employed 6,972 people. Firms in these clusters benefit from being in the same geographic region with shared local knowledge and a shared pool of talented workers.

However, there are large information gaps at the local cluster level, as clusters have very different needs and are facing very different challenges regarding innovation. Through the creation of cluster research centres, gaps in the cluster's ecosystem will be identified, idea sharing will be increased, data will be collected and shared and regulatory failures will be identified.

**Recommendation:** *The federal government should fund the creation of a network of cluster research centres across the country at universities within the geographic area of the cluster that would be required to provide a yearly set of deliverables to maintain their funding.*

The deliverables for each cluster research centre would include the following:

**Recommendation:** *Each cluster research centre must convene a minimum of one meeting per year with local stakeholders, including industry, academia and government, to network and share information and aid in the creation of reports and white papers on the challenges the cluster is facing.*

**Recommendation:** *Each cluster research centre must ensure they collect data, both qualitative and quantitative, about the cluster.*

<sup>72</sup> Spencer, 2014

**Recommendation:** *Each cluster research centre must, once per year, update (or create) a publicly available map of their local cluster ecosystem.*

**Recommendation:** *Each cluster research centre must, once per year, release a white paper with policy recommendations for governments.*

**Recommendation:** *Each cluster research centre must, once per year, report on the state of the cluster and identify possible gaps in the local ecosystem.*

**Recommendation:** *Each cluster research centre must, once per year, report on the local cluster's best practices and those from other clusters.*

**Recommendation:** *Each cluster research centre must, once per year, report on what initiatives, if any, companies in the cluster have undertaken to increase the hiring of underrepresented groups, including women, visible minorities and Aboriginal Canadians.*

**Recommendation:** *Each cluster research centre must, once per year, report on the labour needs of the cluster, identify any skills training gaps in the sector and provide curriculum and co-operative education recommendations to universities, colleges and other educational institutions.*

**Recommendation:** *Each cluster research centre must, once per year, award up-and-coming young innovators in the local ecosystem.*

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## 5.8.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

The development and ongoing administration of the cluster research centres will be the responsibility of the Minister of Innovation, Science and Economic Development and the universities and colleges where the centres are located. In his 2015 mandate letter to the Minister of Innovation, Science and Economic Development, the prime minister mandated the development of an Innovation Agenda that included expanding effective support for “the emerging national network for business innovation and cluster support.”<sup>73</sup>

<sup>73</sup> Office of the Prime Minister, Minister of Innovation, Science and Economic Development Mandate Letter (2015).

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### 5.8.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

The requirement for a yearly set of deliverables to maintain funding provides accountability. Checks and balances must be put in place by the ministry to ensure the delivered materials are of acceptable quality. These deliverables will be made public to disseminate information and to ensure quality.

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### 5.8.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

The cluster research centres are designed to address, either directly or indirectly, a wide array of market and regulatory failures that can occur in a cluster.

**Thin Markets:** Cluster markets are thickened by more workers and more firms. The research centres help increase the supply of labour through their recommendations to address skills training gaps, as well as sharing of best practices to tap into historically excluded sources of labour. More firms can be created through the centres better matching start-ups with sources of capital to obtain funding. Both sides of the market can also be thickened through the advice the centers provide to governments on skills and funding gaps.

**Externalities and Knowledge Spillovers:** Knowledge spillovers will be created through the meetings assembled by the centre and by increasing “collisions” through the other activities of the centres. The centres will disseminate best practices and other forms of knowledge that can be adopted by other firms.

**Network Externalities and Co-ordination Failures:** The cluster research centres create a geographic space for people in the cluster to meet, share ideas and develop new approaches.<sup>74</sup>

**Evangelism Externalities:** The cluster research centres act, in part, as a champion for the local cluster and should serve to promote the values of the cluster to other Canadians, enhancing the reputation of the cluster.

<sup>74</sup> This is referred to in economics literature on co-ordination failures as a “Schelling point.”

**Regulatory Failure:** One of the responsibilities of the centres is to address regulatory failures by providing regulators and lawmakers more local knowledge of and feedback about the cluster. A common complaint we heard from regulators in our roundtable was this: “We hear from 40 different cluster stakeholders about 40 different issues; we don’t know which problems are the most important.” Cluster research centres can provide “triage” guidance to regulators, so the most pressing priorities are addressed first.

**Risk Aversion:** One of the tasks of the centre is to provide awards to innovators and other successful risk takers, thereby creating role models and encouraging others to do the same.

**Inequality of Opportunity:** The cluster research centres will directly reduce inequality of opportunity by looking for bottlenecks that are excluding people from the local market. Additionally, these centres will look for ways promote companies that seek ways to diversify their hiring.

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### 5.8.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** These centres will help address skills shortages, and gets universities and the private sector used to working with each other. If these centres create stronger clusters, it not only benefits the workers and companies within the cluster but creates spin-off employment and prosperity in other local industries.

**Costs and Risks:** There is a financial cost to setting up and running these centres will cost money. Industry Canada recently funded a similar research centre at Western University with \$1 million a year for five years. We estimate that each cluster research centre would cost between \$500,000 and \$1 million a year to run.

Firms may resist participating in centres or may see them as a way to ensure the government enacts policies and approaches that benefit the industry but not the overall goal of the research centre. There is also the possibility of political interference with the work of the cluster research centres or in choosing which research centres get funded. The centres will need to have a level of independence to ensure this does not happen.

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### 5.8.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** Economic inclusion is a primary goal of the research centres as they focus on increasing inclusion in the cluster. Many of the clusters face skills shortages, yet many people in excluded groups are unable to participate in the cluster.

**Autonomy:** These research centres will help entrepreneurs start new businesses within the cluster. By helping match people with good ideas to sources of funds, individuals are given more options in how to participate in the local economy.

## 5.9 BIG IDEA 9 - REFORM IMMIGRATION WITH A FOCUS ON TRADABLE SECTORS

### 5.9.1 WHAT IS THE IDEA?

Canada's immigration system is incredibly complex, with more than 60 different programs that admit non-Canadians to the country. A detailed description of each is well beyond the scope of this report, so our recommendations will be at a high level. Our immigration recommendations revolve around one core point: the system as a whole needs to make a larger distinction between tradable and non-tradable sectors of the economy, and focus on bringing in workers with skills valued in tradable sectors.

**Recommendation:** *Canada's economic immigrant programs, for both permanent and non-permanent immigrants, should have the expressed mandate of raising wages and economic opportunities for Canadians, which they can accomplish through a focus on tradable sectors.*

To explain the idea, we first need to understand what tradable sectors are and, secondly, we need to understand why the distinction matters. To address the first issue, we will use the Australian Bureau of Statistics definition of tradable sectors.

**Tradable sector:** "A domestically produced good or service is defined as tradable if it is actually traded internationally, or it could be traded at some plausible variation in relative prices — this includes domestically produced goods and services which replace imports in the domestic market."<sup>75</sup>

Illustrating the importance of the distinction between tradable and non-tradable when examining employment dynamics in a local economy is best done through the use of examples from the services industry.

<sup>75</sup> Australian Bureau of Statistics, *Australia's Tradable Sector* (1996).

First, consider Saskatoon's technology sector, specifically companies that program applications or design video games. Because their products are purchased by users all over the world, these companies are competing against companies from Bangalore to Helsinki; their competition is not other companies in Saskatoon. As such, the size of Saskatoon's tech cluster can grow arbitrarily large because the market is worldwide and the success of one local company does not come at the expense of another. Because the industry can grow arbitrarily large, it can absorb additional workers without any downward pressure on wages, and may even raise wages in the sector as a thicker labour market attracts tech companies to Saskatoon. Furthermore, the success of a local tech company brings in outside capital and creates employment opportunities in other industries. In *The New Geography of Jobs*,<sup>76</sup> economist Enrico Moretti found that one additional job in the tech sector creates five additional jobs in the economy at a variety of different skill levels. Moretti defended the five-to-one ratio in an interview with Stanford's Kathleen O'Toole:<sup>77</sup>

The way to interpret the multiplier is to imagine dropping 1,000 innovation jobs in one city but not in another, and then going back 10 years later to measure how many additional local service jobs there are in the city that experienced that innovation-sector drop of jobs. So it's a long-run effect, but it's not impossible for three reasons.

One is that the average high-tech worker tends to do very, very well, and people who are wealthy tend to spend a large fraction of their salary on personal and local services. They tend to go to restaurants and movies, and to use taxis and therapists and doctors on average more than people who are paid less.

The second reason is high-tech companies themselves employ a lot of local services; everything from security guards to IP lawyers, from the janitor to the very specialized consultant. High-tech companies tend to use more services than manufacturing companies.

The third reason is the clustering effect. Once you attract one of those high-tech workers, then in the medium to long run, you're going to be attracting even more of those high-tech workers and companies, which will further increase your multiplier. So it's a long-run number, measured over a 10-year period.

Contrast this with the market for brick-and-mortar drugstore pharmacists in Saskatoon. Pharmacists at brick-and-mortar drugstores provide a non-tradable service, as their customers are local in nature.

<sup>76</sup> Enrico Moretti, *The New Geography of Jobs* (Houghton Mifflin Harcourt, 2012).

<sup>77</sup> Kathleen O'Toole, "Enrico Moretti: The Geography of Jobs," *Insights by Stanford Business*, (2013).

While the number of pharmacists in Saskatoon is not fixed, it can only grow so large, as there is a limit to how many pharmacists the local market can reasonably absorb. As such, firms in the market grow and increase revenue more by seizing market share from their competitors than from growing the overall size of the local market. Due to these constraints, a sudden and significant influx of pharmacists to the Saskatoon market would drive down wages and increase unemployment as the local market would not be able to fully absorb the increase due to the non-tradable nature of brick-and-mortar pharmacy services.

Beyond Moretti's findings, there is empirical evidence to support the wage effects of immigration on tradable and non-tradable sectors. While there is a substantial body of literature showing that, in many cases, higher levels of immigration do not lead to lower wages on average,<sup>78</sup> this does not necessarily mean that the effect of higher levels of immigration is identical across industries. A recent study by the Bank of England found that the impact of immigration differs across industries, and that "the biggest effect is in the semi/unskilled services sector, where a 10 percentage point rise in the proportion of immigrants is associated with a 2 percent reduction in pay."<sup>79</sup> The fact that these people disproportionately work in non-tradable sectors supports the theory of the differing effect of immigration on employment and wages between the sectors.<sup>80</sup>

Canada requires high levels of immigration to address demographic challenges and ensure that it has the skilled workers necessary to compete globally in tradable sectors. If it brings in too many workers from non-tradable sectors and drives down wages and opportunities in some industries, it risks a public backlash that puts Canada's immigration goals in jeopardy. We need only look at Brexit and the backlash against "Polish plumbers" to see how antipathy towards immigration is often related to employment in non-tradable sectors.

There are Canadian examples of the immigration system being used to prevent wages from rising in non-tradable sectors. The Temporary Foreign Worker program is a prime example. Through an Access to Information request, the Alberta Federation of Labour found that "between April 25 and December 18, 2012, more than 2,400 ALMO [Accelerated Labour Market Opinion] guest-worker permits — which are supposed to be reserved for highly skilled employment — have been granted to fast-food restaurants, convenience stores and gas stations."<sup>81</sup> By bringing in these workers, Canada is holding down wage increases to low-income workers. While it is possible that some of these jobs could be uneconomical at higher wages, these are not the type of jobs that create spin-off jobs through increased flows of foreign capital.

<sup>78</sup> A useful discussion of the literature appears in "Immigration, Wages and Compositional Amenities," David Card, Christian Dustmann and Ian Preston, *Journal of European Economic Association* (2011).

<sup>79</sup> Stephen Nickell and Jumana Saleheen, "The impact of immigration on occupational wages: evidence from Britain," Bank of England: Staff Working Paper No. 574 (2015).

<sup>80</sup> For the purposes of their paper, Nickell & Saleheen, (2015) define the semi/unskilled services sector as including child-minders, early childhood educators, animal care assistants, housekeepers, travel agentsassistants, caretakers, sales assistants, check-out staff, call centre staff, postmen, shelf fillers, car park attenders, cleaners, road sweepers, bar staff, porters and waiters. These jobs are largely non-tradable in nature, with some exceptions such as call centre staff.

<sup>81</sup> Alberta Federation of Labour, *List of 'accelerated' TFW approvals reveals widespread abuse of program* (2013).

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In a 2014 Toronto Star editorial,<sup>82</sup> Liberal Leader Justin Trudeau suggested some reforms to the Temporary Foreign Worker Program to deal with the economic effects it has on Canadian workers as well as the possibility of exploitation of guest workers; two of those recommendations continue to have value today.

**Recommendation:** *The auditor general should conduct a full review of the Temporary Foreign Worker Program.*

**Recommendation:** *Transparency of the Temporary Foreign Worker Program should be increased, with public disclosure of applications and approval data.*

When implementing policy, one must worry about unintended consequences. One way firms could deal with restrictions on temporary foreign workers is to turn those positions into unpaid internships. These internships are problematic from an equality of opportunity perspective, as the opportunities created can only be obtained by those who can afford to work for free. Because of this, unpaid internships are illegal in Ontario unless a very restrictive set of conditions is met.<sup>83</sup> In some other provinces, regulations are vague about the legality of unpaid internships.<sup>84</sup> This leads us to the following recommendation:

**Recommendation:** *Provincial governments should explicitly ban unpaid internships and increase their enforcement of existing regulations in the area. The federal government should do likewise for federally regulated industries.*

Meanwhile, while fast-food companies and gas stations were able to bring in temporary foreign workers, export-oriented high-growth companies were unable to obtain and retain the workers they needed. Companies that have hired foreign graduates of Canadian schools under the Post Graduation Work Permit Program are seeing these workers deported as companies struggle to navigate a byzantine set of rules.<sup>85</sup> Tech companies in London, Ont., report they have opened offices in the United States since they have found regulatory barriers make it too difficult to bring talent north of the border.<sup>86</sup> Other companies at our tech roundtable have moved operations outside of Canada, and taken Canadian workers with them, to be able to access the talent they need. The tax revenue these companies generate and the spin-off jobs they create could be going to Ontario but are instead going to California, simply for regulatory reasons. This needs to stop.

**Recommendation:** *Immigration, Refugees and Citizenship Canada should streamline the process for companies in export-oriented goods and service industries wishing to recruit or retain skilled workers.*

<sup>82</sup> Justin Trudeau, "How to fix the broken temporary foreign worker program," *The Toronto Star*, May 5, 2014.

<sup>83</sup> Ontario Ministry of Labour, "Are Unpaid Internships Legal in Ontario?" Ontario Ministry of Labour website (2011).

<sup>84</sup> Canadian Intern Association, *What is the law?* (2016).

<sup>85</sup> Ronalee Carey, "Express Entry and International Students, Is there a Disadvantage?" Ronalee Carey Law (2015).

<sup>86</sup> Michael P. Moffatt and Rachel Parker, "We asked a group of tech executives: 'What does it take to grow in London, Ontario?'" Mowat Centre (2015).

By focusing our immigration system on tradable sectors and away from non-tradable sectors, we can attract and retain talent in Canada, increase the competitiveness of our export industries and increase wages and job opportunities for Canadians.

Although our focus to this point has been on wages, reforming our immigration system with a focus on tradable sectors creates an environment for innovation, as described by the Expert Panel on Business Innovation in 2009:

Canada's domestic market is relatively small and geographically fragmented. Small markets are less conducive to innovation than large markets (like the United States) because

- i. they offer lower potential reward for undertaking the risk of innovation, and
- ii. they tend to attract fewer competitors and thus provide less incentive for a business to innovate in order to survive. (The Canadian domestic market is relatively "cushioned" and pre-tax business profitability, as a percentage of GDP, has exceeded that of the United States in most years since 1961.)

The innovation success of countries like Finland and Sweden shows, on the other hand, that the disadvantage of a small domestic market can be offset by a strong orientation toward innovation-intensive exports.<sup>87</sup>

Canadians need higher wages and more opportunities and Canada needs to be more innovative. Through restructuring Canadian immigration programs, we can simultaneously accomplish both.

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## 5.9.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

Immigration is a federal responsibility, with the exception of Provincial Nominee Programs and the Canada-Quebec accord. Immigration falls under the jurisdiction of Immigration, Refugees and Citizenship Canada with some exceptions, such as the Temporary Foreign Worker Program, which is jointly administered by Immigration, Refugees and Citizenship Canada and Employment and Social Development Canada..

<sup>87</sup> Expert Panel on Business Innovation. Council of Canadian Academies, *Innovation and Business Strategy: Why Canada Falls Short* (2009).

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### 5.9.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

Beyond the recommendations given earlier on accountability measures that should be put in place for the Temporary Foreign Worker Program, we recommend the following:

**Recommendation:** *The federal government should conduct a study on the impact of immigration on Canadian occupational wages, similar to the Bank of England study.*

**Recommendation:** *The Office of the Parliamentary Coherence Officer, after it is created, should conduct a thorough review of the coherence of Canada's immigration sector as it relates to the mandate of raising wages and economic opportunities for Canadians.*

**Recommendation:** *Statistics Canada should strengthen its collection of labour market data, with a focus on labour market outcomes by industry for immigrants and non-immigrants.*

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### 5.9.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Thin Markets:** A shortage of skilled workers limits the growth of innovative companies in fast-growing clusters such as the Kitchener-Waterloo tech sector. The complexity of regulations along with processing times cause issues for companies, a point Immigration Minister John McCallum recognized in a *Globe and Mail* interview when he stated: "Tech firms' idea of a quick immigration processing time is more like six days rather than six months ... for us six days would be a stretch... but at the same time ... we want to open our doors to the best and the brightest ... so, obviously, I will be working very hard to try to accommodate their needs as best I can."<sup>88</sup> These problems hit clusters in small and mid-sized cities particularly hard, as they do not have large local networks of immigration lawyers and experts from which to draw experience. One advantage that clusters in mid-sized Canadian cities should have is the significant number of international students that study in their colleges and universities. However, companies report that it is difficult to retain these individuals after the expiry of their Post-Graduation Work Permits.<sup>89</sup>

<sup>88</sup> Sean Silcoff and Michelle Zilio, "Ottawa vows to cut wait times for foreign workers joining tech firm," *Globe and Mail*, Tuesday, June 14, 2016.

<sup>89</sup> This is discussed in detail in "Canada's hardest-hit economies need immigration to thrive again," Mike Moffatt, *Canadian Business*, February 16, 2016.

**Inequality of Opportunity:** The poor design of some immigration programs, most notably the Temporary Foreign Worker Program, prevents wages from rising in non-tradable sectors and limits job opportunities for low-income Canadians. Well-designed immigration reforms will disproportionately benefit workers who are the most marginally attached to the labour force.

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### 5.9.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** A successful reform of Canada's immigration systems to focus on tradable sectors has three big benefits:

1. Industry clusters that grow faster export more and create additional wealth.
2. Spin-off wealth and prosperity in non-tradable sectors that support those clusters.
3. Increased wages and job opportunities for Canadians in non-tradable sectors due to reduced competition for these positions.

**Costs and Risks:** If the plan works as intended, wages should increase in the non-tradable sector. Of course, this also likely means that the price of goods and services will rise accordingly. Furthermore, it could cause skills shortages in certain non-tradable sectors.

The largest issue is that this plan could fail or have unintended consequences for a variety of different reasons. Changes to immigration policies are tricky, and there is no guarantee that governments get it right. The biggest potential roadblock is that the plan requires governments to be able to distinguish between job types that are largely in the tradable sector and those that are not.

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### 5.9.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** By refocusing our immigration policies to tradable sectors, we can ensure that government policies are not reducing wages and limiting economic opportunities for Canadians. Furthermore, due to the positive employment spillovers created by high-skilled immigrants in tradable sectors, wages and employment opportunities are increased for everyone from lawyers to barbers to construction workers. Our immigration system should have as an explicitly stated core goal of increasing wages and job opportunities for Canadians.

**Autonomy:** At first glance, there appears to be little relationship between the proposed immigration changes and the level of personal autonomy for Canadians. However, a booming tradables sector creates job opportunities and business opportunities for current Canadians in non-tradable sectors. These opportunities could be amplified with enhanced non-tradable sector skills training for individuals that are unemployed or out of the labour force.

## 5.10 BIG IDEA 10 - CREATION OF SECTOR SPECIFIC INNOVATION ACCORDS

### 5.10.1 WHAT IS THE IDEA?

The goal for this big idea is to ensure each sector in Canada has a coherent strategy to support innovation and that the federal government supports and participates in this strategy.

**Recommendation:** *An innovation accord for key sectors of the Canadian economy should be created. These accords would promote a new relationship with the federal government and the particular sector and would facilitate policy coherence between levels of government and across departments, convening diverse stakeholders and leveraging funding. Additionally, an innovation accord would provide priorities, goals and measurements to determine sector success in innovation that results in economic inclusion and an enhancement of autonomy.*

These innovation accords will focus on outcomes and practical commitments and consider areas such as policy design, funding arrangements and strengthening innovation within the sector. The implementation of the innovation accords will be overseen by Innovation, Science and Economic Development Canada (ISED).

Each innovation accord will:

1. Identify common objectives in an innovation strategy.
2. Develop action-oriented plans for both parties to the accord.
3. Measure progress appropriately for both parties to the accord.
4. Leverage funding from all levels of government to maximize support.
5. Foster healthy competition among provinces while being flexible/asymmetrical to fit provincial innovation strengths and needs.
6. Accelerate the federal goal of driving inclusive innovation.

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At a minimum, we would recommend that the following sectors work with the federal government to create innovation accords:

- Life Sciences and Health Care
- Arts and Culture
- Manufacturing
- Agri-Food
- Finance
- Oil and Gas

Each accord represents a public commitment to be more open, transparent, consistent and collaborative in innovation. We believe that these accords will move the government and the sector towards greater mutual understanding and provide a framework within which innovation can be developed.

**Recommendation:** *A working group should write each innovation accord with individuals from the Government of Canada and the sector. The members should be selected to reflect a cross-section of federal government departments and the sector. To ensure that a broad range of viewpoints within the sector are heard, consultations should be held.*

These innovation accords will not compel the Government of Canada or the associated sector to work together; rather, they outline the values and principles that will govern the relationship when they choose to work together.

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## 5.10.2 WHO WILL BE RESPONSIBLE FOR ADMINISTERING THE IDEA?

The implementation of the innovation accords will be overseen by Innovation, Science and Economic Development Canada (ISED).

### - 5.10.3 WHAT MECHANISMS FOR ACCOUNTABILITY OR MEASUREMENT CAN BE PUT IN PLACE FOR THE IDEA?

These innovation accords will focus on measurable outcomes and practical commitments and consider areas such as policy design, funding arrangements and strengthening innovation within the sector. The development of measurements and accountability mechanisms will be a part of each accord.

### - 5.10.4 WHAT FAILURES IS THE IDEA TRYING TO SOLVE?

**Regulatory Failure:** From an innovation perspective, the overarching goal of the innovation accords is to ensure that policy objectives of both the government and the industry sectors avoid conflicting priorities as much as possible and encourage the design of policies that encourage positive consequences for innovation. These accords will allow stakeholders in each sector and the government to work through regulatory failures stemming from a lack of coherence.

### - 5.10.5 WHAT ARE THE POTENTIAL BENEFITS OF THE IDEA AND WHAT ARE THE COSTS?

**Benefits:** Coherence would be created in Canada's overall approach to innovation within each sector. This increased coherence allows Canada to compete globally in innovation in key sectors by creating a sense of stability and attainable goals.

**Costs and Risks:** A risk with these innovation accords is that industries could see them as a way to ensure the government enacts policies and approaches that allow the industry to make more profits without actually creating innovations, or creating innovation that decreases economic inclusion and autonomy. These risks can be avoided if there is careful consideration in the creation of the responsibilities for both sides of the accord and that overall progress is measured. Another risk is that these accords are simply words on a piece of paper and never meaningfully put into practice.

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### 5.10.6 WILL THE IDEA INCREASE ECONOMIC INCLUSION AND/OR ENHANCE AUTONOMY? IF SO, HOW?

**Economic Inclusion:** Economic inclusion should be an expressed goal of each accord. The accords should contain a section on how both the government and the industry will create wealth and employment opportunities for marginalized Canadians.

**Autonomy:** Where possible, the accords should consider finding ways to increase the control individuals and communities have over their economic outcomes, though in most cases we anticipate there is little the accords can do to address the issue.

# CONCLUSION



## THE CANADA 2020 INNOVATION PROJECT BEGAN ON JUNE 15, 2016,

with a day-long summit in Ottawa, which brought together many of Canada's leading experts on innovation. We asked our participants what the country would look like 15 years from now if Canada fails to become a nation of innovation. The answers were bleak. Stagnant GDP growth. An economy that could not generate enough tax revenues to provide a quickly growing elderly population with adequate health care. A growing divide between haves and have-nots as the economy fails to provide employment opportunities for all. The rise of American- and British-style populism, as income growth and opportunities are limited to the well-connected, shutting out everyone from the city kid growing up in Toronto to the farm girl from Whalen Corners. While Canada has had poor innovation performance for some time, a quadrupling of oil prices between 2002 and 2008 generated enough economic growth to paper over the effects of Canada's mediocre-at-best innovation record. We should not count on this happening again.

Alternatively, we also need to consider what will happen to Canada if this project is a success. In a very real way, we will be swapping one set of problems for another. An innovative Canada will be one of unlimited opportunities, high wages, continued growth in large urban centres, escalating real-estate values and rapid change. These will come with the very real challenges of a lack of affordable housing, overstretched infrastructure and public transit, income inequality and feelings of alienation. One need only look at the public policy challenges that San Francisco is currently facing around these issues. All levels of government should have sustainable long-term plans to address these challenges, lest they become victims of innovation's success.

Finally, failure is a necessary part of the innovation process. While we believe in the efficacy of the ideas presented in the report, we recognize that the probability that every single one will be effective is quite low. Governments must have the courage to attempt new approaches. They must be able to define the outcomes of a successful policy and collect the data necessary to ensure that the policy is meeting those goals. Finally, they must have the courage to improve policies that are performing sub-optimally and concede defeat on policies that worked well in theory but failed in practice.

Early on in this project, we identified two unique goals that we felt Canada's innovation agenda should achieve. First, the economic benefits of innovation should not go disproportionately to an elite "one per cent." Canada's innovation needs to be economically inclusive with a combination of increased access to high-quality goods and services, higher wages and expanded job market opportunities for both the middle class and the poor. Additionally, Canada's innovation must enhance autonomy and must translate into greater choice and more opportunities for individuals, families and local communities to develop and follow their economic and social goals. Increased autonomy strengthens the causal links between the choices made by citizens and the economic successes of their communities, addressing the feelings of a "lack of control" felt by too many Canadians. We focused on these two goals throughout the development of the 10 Big Ideas and their recommendations.

Our hope is that these ideas will be seen as both the starting point of a larger conversation around innovation and an opportunity to think big about the ways we can make Canada a more innovative country.

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