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Developing an Inclusive Innovation Agenda for Canada

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Abstract

Inclusive innovation requires that opportunities for participation in innovation be broadly available and that the benefits of innovation be broadly shared. This report considers a number of innovation policy reforms through the lens of this dual emphasis. For policies that would facilitate both innovation and inclusiveness, there is a strong case for implementation. Policies that might promote innovation at the expense of inclusiveness would require that the trade-off be managed or mitigated.

Education and training is a potential area of complementarity between inclusiveness and innovation because a highly skilled population is an important facilitator of both. Clusters pose a potential trade-off between the goals of innovation and inclusion, which must be taken into account in the context of policies aimed at supporting their development. There is no strong case for subsidizing small businesses generally. Instead, targeted support should be provided to help *growth-oriented* small firms to grow. The scope for further regulatory improvement to enhance innovation may be limited, given what Canada has already done in recent decades. But room for improvement still exists in terms of foreign investment barriers and the speediness and accessibility of the legal system. Government investment can play a productive role in an inclusive innovation system; the government should increase direct funding for basic research, especially in clean energy technology.

Developing an Inclusive Innovation Agenda for Canada

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Executive Summary

In June 2016, the Government of Canada initiated a consultation process in order to develop an inclusive innovation agenda. The desired outcome is a policy framework that promotes innovation, entrepreneurship and business growth while ensuring that all Canadians share in both economic opportunity and the gains from economic growth.

The aim of this report is to contribute to this process by analyzing evidence-based innovation policies through the lens of inclusive innovation. What is a sensible way to think about making innovation "inclusive" in a country like Canada? Why is it important that innovation and economic growth be inclusive? In which policy areas are there complementarities between inclusiveness and innovation? In what areas are there trade-offs and how should they be managed? In what specific ways does inclusiveness bear on the six areas for action in the Government's inclusive innovation agenda? These are the questions that motivate the analysis in this report.

These consultations come at an important time because, by historical standards, Canada's economic inequality is high and its productivity growth is low. These facts suggest that Canada's economy is neither as innovative nor as inclusive as it has been in the past. An inclusive innovation agenda should tackle both of these issues.

The structure of the report is as follows. Section I is an introduction. In Section II, we discuss notions of inclusive innovation and inclusive growth from the economics literature and settle on a working definition of inclusive innovation that is appropriate for Canada. We survey the evidence on the importance of innovation and inclusiveness for widespread prosperity, sustainability, and social stability and cohesion. As stated by Stiglitz in the epigraph at the top of this report, recent research suggests that, under prevailing conditions, inclusiveness and economic growth can be complements rather than substitutes. Section III presents indicators relevant to inclusive growth and innovation in Canada. In Section IV, we examine a number of policy and institutional reforms through the lens of inclusive innovation. We highlight areas in which inclusiveness and innovation are complements and areas in which there are trade-offs to be managed. Section V contains concluding remarks.

What is Inclusive Innovation?

We take the view that the purpose of innovation, from a societal perspective, is to generate rising living standards for as broad a segment of society as possible. We therefore find it useful to begin with the concept of inclusive growth. The OECD (2014a) defines inclusive growth as

> economic growth that creates opportunity for all segments of the population and distributes the dividends of increased prosperity, both in monetary and non-monetary terms, fairly across society.

This definition does not abandon the traditional emphasis on economic growth (i.e. rising per capita income), but it augments it with a focus on distribution. An inclusive growth process is a process of economic growth that is broad-based along at least two dimensions. First, opportunities to participate in the economy are broadly accessible. Second, the benefits of economic growth are broadly shared. This dual emphasis on equity in participation and in outcomes is the key aspect of the inclusive growth framework that we will adopt in our thinking about innovation.

Innovation -- the development and implementation of ideas for new or improved products, services, production technologies or organizational arrangements -- is the fundamental driver of long-run economic growth. A country's innovation system is the constellation of agents who participate in innovation (workers, entrepreneurs, inventors, scientists and engineers, etc.), together with the environment within which they interact (policy framework, legal system, social norms and institutions, etc.). In parallel with the OECD's notion of an *inclusive growth* process, we adopt the following definition of an *inclusive innovation system*:

> An *inclusive innovation system* is an innovation system in which opportunities to participate in innovation are broadly available to all and the dividends of innovation are broadly shared by all.

This definition maintains the traditional emphasis on the overall rate of innovation but augments it with a focus on distribution. The emphasis on distribution is applied to both the inputs and the outputs of the innovation process. Both opportunities to participate in innovation and the ex-post benefits of innovation must be equitably distributed. We envision a tight connection between inclusive innovation and inclusive growth.

Is Inclusive Innovation a Useful Concept?

Is inclusive innovation a useful concept for designing an innovation agenda aimed at inclusive growth? We think that it is for several reasons. First, an inclusive innovation framework reinforces the view that inclusive growth is the end goal of innovation policy. It guides us to develop an innovation policy framework that promotes inclusive growth by conforming, so far as possible, to the dual emphasis on equity in participation and in benefits. Second, it leads us to look for complementarities between inclusiveness, innovation and growth when designing policy. It underscores the importance of ensuring that all people have the skills, resources and infrastructure to participate in innovation, since this should engender both a high rate of innovation and an equitable distribution of the benefits. It leads us to take seriously the ways in which economic and social inequalities may damage our innovation performance by limiting opportunities or engendering political opposition to technical change. Finally, in policy areas where there may in fact be trade-offs between innovation and equality, inclusive innovation calls on us to take mitigating steps to avoid the negative effects of inequality on innovativeness.

Measuring Inclusive Growth and Innovation

The economist Joseph Stiglitz observes, "If we use the wrong metrics, we will strive for the wrong things." Our view is that inclusive growth is the proper end goal of innovation policy, so we need to measure inclusive growth.

In this report, we present two measures of inclusive growth:

1. **The OECD Inclusive Growth Measure:** A measure of average household income adjusted to reflect cross-country differences in unemployment, life expectancy and income inequality using an equivalent-income approach.

2. **The CSLS Index of Economic Well-being (IEWB):** A composite index that combines indicators in four domains: per capita consumption, per capita wealth, economic equality, and economic security.

Key results drawn from these measures include the following:

- In 2011, Canada ranked third among fourteen selected OECD countries according to the OECD Inclusive Growth Measure, up from seventh in 2001. Only Norway and Australia did better.

- In Canada (and in most other countries), growth in the OECD measure was driven by rising household income and life expectancy. Changes in unemployment and income inequality played a comparatively small role.

- According to the IEWB, Canada ranked a disappointing eleventh among the fourteen countries in 2014. This represents an improvement of one place in the ranking from twelfth in 1980. Norway topped the ranking in 2014.

- Canada's poor showing in the overall IEWB ranking is driven by the equality and economic security components. The discrepancy between the OECD measure and the IEWB in terms of Canada's ranking is attributable to the measures' different treatment of equality and economic security.

The report also examines some narrower measures of the extent to which the gains from innovation and growth are being shared. In particular:

- In 2014, 27.6 per cent of workers aged 20-64 earned low wages, defined as wages below two thirds of the median. This is essentially unchanged from 27.9 per cent in 1997. However, the incidence of low-wage jobs increased over that time period within all levels of educational attainment. The constant overall incidence was due to a composition effect from rising educational attainment.

- In particular, the incidence of low-wage jobs increased from 7.7 per cent to 12.4 per cent over the period among Canadians with Master's or doctoral degrees. This is

worrying from an inclusive innovation perspective because it suggests that Canada's investments in education at the highest levels are growing less likely to lead students into high-productivity jobs.

- Between 1976 and 2014, labour productivity grew by 1.12 per cent per year while median real annual earnings *declined* by 0.13 per cent per year. Thus, the gap between productivity growth and wage growth was 1.25 per cent per year.

- Of this gap, 0.53 percentage points were attributable to rising inequality, as captured by the gap between the median and mean real wage.

Policy and Inclusive Innovation

Inclusive innovation requires that opportunities for participation in innovation be broadly available and that the benefits of innovation be broadly shared. This report considers a number of innovation policy reforms through the lens of this dual emphasis. For policies that would facilitate both innovation and inclusiveness, there is a strong case for implementation. Policies that might promote innovation at the expense of inclusiveness would require that the trade-off be managed or mitigated.

Education and Training

Education and training is a potential area of complementarity between inclusiveness and innovation because a highly skilled population is an important facilitator of both. The development of the skills a person needs in order to exploit innovative opportunities and to share in the benefits of innovation must begin early in life and continue throughout life. Policies to promote lifelong learning must ensure equality of access for all segments of society.

- A successful innovation system requires people with a wide variety of skills and competencies:
    - Technical skills: science, technology, engineering and math (STEM);
    - Generic skills: creativity, problem solving, and critical thinking;
    - Soft skills: conscientiousness, work ethic, and relationship-building;
    - Management skills: risk assessment, human resource practices, capital-raising, and implementation skills;

- Early childhood education can have high social rates of return, with the benefits accruing disproportionately to children from disadvantaged backgrounds. However, low-quality programs have zero or even negative effects on children's skill development. It is crucial that policymakers avoid sacrificing quality in order to save money up front.

- Primary and secondary education systems must play a dual role in an inclusive innovation system: developing the fundamental skills of all students (with a focus on helping poor performers) while supporting the flourishing of top performers. Schools should make it a priority to identify underperforming groups and develop evidence-

based interventions to improve their outcomes. They should identify high-ability students and ensure that they receive the support and resources they need to realize their potential. The potential of such supports to exacerbate educational inequality can be mitigated by applying universal screening procedures rather than relying on teacher referrals to identify top-performing students.

- Evidence does not suggest that there is a shortage of STEM skills in the Canadian labour market, but there is room to improve the inclusiveness of STEM and other innovation-related professions. There remain barriers to the participation of women and underrepresented minorities in STEM fields and research workplaces. Educational institutions and workplaces should prioritize the removal of these barriers.

- The accessibility of the post-secondary education system can be enhanced by providing more student aid in the form of grants and less in the form of loans. Evidence suggests that this would improve educational outcomes for recipients of need-based aid.

Policy and Innovative Clusters

Clusters pose a potential trade-off between the goals of innovation and inclusion. On one hand, a cluster in an innovative sector like software development can deliver a high rate of innovation as the firms in the cluster benefit from the spillover benefits of knowledge sharing. On the other hand, the geographic concentration of the successful cluster implies an increase in economic inequality across cities or regions.

- It is unclear whether place-based policies can enhance aggregate welfare through an agglomeration channel. Leading experts summarize the state of the evidence as follows: "[At] this time, economists do not have enough information to reliably suggest strategies that can raise aggregate welfare via agglomeration forces."

- If an innovative cluster does emerge, its inequality-increasing effects can be mitigated by means of non-restrictive zoning regulations to facilitate the expansion of local housing supply; significant investment in public transit to allow low-income neighbourhoods access to the spillover benefits of the cluster; and tax and transfer policy.

- Government can help create the preconditions for the development of high tech clusters: firm-building capabilities, managerial skills, a skilled workforce (including 'star scientists'), and connection to markets.

Support for Entrepreneurship and Firm Growth

There is no strong case for subsidizing small businesses on the basis of their smallness *per se*. Instead, targeted support should be provided to help *growth-oriented* small firms to grow. An emerging view advocates such targeted support on the basis of its benefits for innovation and

productivity growth, but it can enhance economic inclusiveness as well because growth-oriented firms create a disproportionate share of new jobs.

- Venture capital (VC) as a share of GDP in Canada is the highest in the OECD when two extreme outliers -- Israel and the United States -- are excluded. Other indicators reinforce the conclusion that entrepreneurs in Canada do not have an unusually hard time acquiring financing.

- Available evidence suggests that women, minorities and the socioeconomically disadvantaged may face barriers to entrepreneurship. To the extent that this reflects differences in skills, it underscores the need to promote the development of skills for participation in innovation among all groups. To the extent that it reflects biases in the innovation system, policy should seek to counter them.

- Aspects of the federal and provincial tax systems (including the R&D support system) that advantage small firms should be reformed. Redirecting support toward growth-oriented firms could pay dividends in both innovation and job creation.

Regulation, Institutions and Competition

One of the most important contributions policy can make in fostering inclusive growth is to set up 'rules of the game' that ensure that markets are competitive and that firms' incentives are aligned in the direction of socially valuable innovation. Canada has already gone a long way down this road, so the scope for further improvement to enhance innovation may be limited. Nevertheless, we identify a few remaining areas in which further improvement is possible.

- Relative to its OECD peers, Canada imposes stricter than average barriers to trade and investment in certain sectors and protects incumbents through antitrust exemptions and barriers in network sectors. Removal of these barriers could generate non-negligible improvements in the affordability of telecommunications services such as broadband internet.

- Relative to OECD peers, Canada's legal system ranks poorly according to indicators of speediness, freedom from discrimination, and accessibility and affordability. Fair and accessible legal institutions are an important underpinning of inclusive growth.

- Simplifying import-export regulation and customs rules would facilitate Canada's integration into global value chains.

- When it comes to clean energy regulation, evidence suggests that market-based approaches (such as carbon taxes or cap-and-trade systems) have a better track record than command-and-control regulations in promoting clean technology innovation. This is of particular importance from an inclusiveness perspective because the costs of climate change are expected to fall disproportionately upon the world's most economically disadvantaged people.

Public Investment

In terms of inclusiveness, public investment in innovation can play two roles. First, economic inclusiveness will be promoted to the extent that the technologies supported by the government themselves facilitate economic inclusion. Second, government investment can facilitate marginalized persons' access to new technologies directly.

- There are sound reasons to believe that government investment can play a productive role in the innovation system:
    - The public sector can be more patient than the private sector;
    - The public sector has greater risk-bearing capacity than the private sector and can borrow at lower rates;
    - Government investment can overcome 'chicken-and-egg' problems in technology adoption;
    - Government commitments can reduce private investors' uncertainty about the path of future technological development.

- The widespread adoption of clean energy technology is unlikely to occur until the technology is cost-competitive with fossil fuels. Government should increase direct funding for research in clean energy technology.

- The case for government funding for basic scientific research is especially strong because basic science involves long time horizons and a high degree of uncertainty about its ultimate economic value. Government support for basic science is a strength of Canada. To maintain this strength, governments should find an appropriate balance between funding for basic science and for commercialization and applied research.

- Governments and civil society organizations can work together with universities to host inclusive innovation competitions offering rewards for innovative ideas that serve the public interest in areas such as health, education, and labour market matching.

- Government should explore the potential to enhance the quality of public infrastructure (roads, waterways, the electrical grid, etc.) through investments in 'digital infrastructure'; that is, infrastructure that uses digital technology to enhance productivity.

Macroeconomic Underpinnings of Inclusive Growth

A stable, predictable macroeconomic environment is one of the key underpinnings of innovation and growth, and stabilization policy facilitates inclusiveness by dampening the impact of macroeconomic shocks that often have their largest effects on the households least able to deal with them. While related to innovation only indirectly, income redistribution policies play an important role in facilitating inclusive growth by spreading the gains from growth throughout the population.

- Macroeconomic stabilization should be the main role of monetary policy in an inclusive innovation system. It creates a stable environment for investment and protects low-income households whose employment situations are likely to be more sensitive to macroeconomic fluctuations. We therefore do not advocate changes in Canada's monetary policy. However, a few aspects of monetary policy that are relevant for inclusiveness and that have been the subject of recent research are worth keeping in mind:
    - Monetary policy has direct implications for the distributions of income and wealth through its effect on asset prices and economic activity. These effects are only beginning to be understood in quantitative terms.
    - The events of the past decade have raised the question of whether central banks should increase their inflation targets in order to reduce the likelihood of running up against the lower bound on nominal interest rates in the future. Such a change would have benefits and costs in terms of inclusiveness. Further research is warranted.

- OECD evidence suggests that, at prevailing levels of economic inequality, income redistribution would not harm economic growth and might increase it. "Passive" transfers of money are less likely to be beneficial than "active" social spending through programs such the Working Income Tax Benefit and job search assistance programs. Such policies are an area of potential complementarity between inclusiveness and growth.

Summing Up

This report sets out a definition of inclusive innovation for Canada and provides indicators of inclusive growth which can be used to benchmark Canada's performance against peer countries and to measure progress over time. The policy discussion aims to demonstrate how policies for innovation can be analyzed through the lens of economic inclusiveness without sacrificing the goal of promoting innovation.

On the basis of our analysis, we draw the following conclusions:

- Education and training policy is fundamental to an inclusive innovation agenda, since equal opportunity for participation is one half of our notion of inclusive innovation. Advanced skills in STEM fields (valuable though they may be) are not the only skills required in a successful innovation system. This is reassuring from the perspective of inclusive innovation.

- The cultivation of global science excellence is an area that is fundamental to innovation performance but in which there are trade-offs in terms of inclusiveness. An inclusive innovation system must include measures to address the trade-offs. First, social policy can ensure that the benefits of excellence are shared by everyone in the society. Second, schools and other institutions must take concrete steps to ensure that opportunities for the cultivation of excellence are available to everybody, not just to the privileged.

- There is limited evidence that government policy can create innovative clusters or that it would necessarily be desirable to do so if it were possible. A better approach is to create a general policy environment that is conducive to innovation and productivity growth.

- Government should stop giving preferential tax and subsidy treatment to small firms *per se* and should instead seek to identify and support the small firms that are growth-oriented. This may be a policy area in which the goals of innovation and inclusiveness are aligned because it is the growth-oriented firms that create jobs as they grow large.

- The widespread adoption of clean energy technology is unlikely to occur until clean energy is cost-competitive with fossil fuel energy, so a top priority for now should be innovation in clean energy technology. We suggest a policy mix that combines carbon taxation and robust government funding for clean energy research.

- Government should ensure equal access to digital networks and digital skills for all Canadians. Everyone should have access to high-quality broadband internet. The market may deliver this for most people, though there may be a role for government in ensuring connectivity for certain hard-to-reach populations. Moreover, schools should provide students with the opportunity to receive high-quality training in digital technology skills through computer science curricula.

- We suggest a number of regulatory policy improvements: a speedier and more accessible legal system; greater competition in network sectors; simpler import-export regulation; and market-based environmental policies such as carbon taxes. All of these might yield some benefits in terms of innovation and productivity growth, and we argued that some of them (especially the legal and environmental reforms) would enhance economic inclusiveness. However, the experience of recent decades leads us to think that the impact of further regulatory reform on innovation and growth is likely to be small.

List of Tables, Charts and Exhibits

Tables

Charts

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Developing an Inclusive Innovation Agenda for Canada

> *We used to think of there being a trade-off: we could achieve more equality, but only at the expense of overall economic performance. It is now clear that, given the extremes of inequality being reached in many rich countries and the manner in which they have been generated, greater equality and improved economic performance are complements.*
>
> *Joseph Stiglitz (Stiglitz, 2016)*

> *[Trying] to separate out issues of efficiency and productivity from issues of distribution and how people experience their own lives and their ability to take care of their families, I think, is a bad recipe. It's not an either/or situation. It's a both/and situation.*
>
> *President Barack Obama (Business Week, 2016)*

I. Introduction[1]

In June 2016, the Government of Canada initiated a consultation process in order to develop an inclusive innovation agenda. The Government summarized its goals for this agenda as follows:

> The country is at its most prosperous when everyone has a fair chance at success.
>
> Innovation is the path to inclusive growth. It fosters a thriving middle class and opens the country to new economic, social and environmental possibilities. It is essential in shaping our future.
>
> That's why Canada needs an inclusive plan to foster a confident nation of innovators -- one that is globally competitive in promoting research, translating ideas into new products and services, accelerating business growth and propelling entrepreneurs from the start-up phase to international success. (Government of Canada, 2016a)

The desired outcome is a policy framework that promotes innovation, entrepreneurship and business growth while ensuring that all Canadians share in both economic opportunity and the gains from economic growth. To this end, the Government has identified six areas for action:

1. developing an entrepreneurial and creative society,
2. promoting global science excellence,

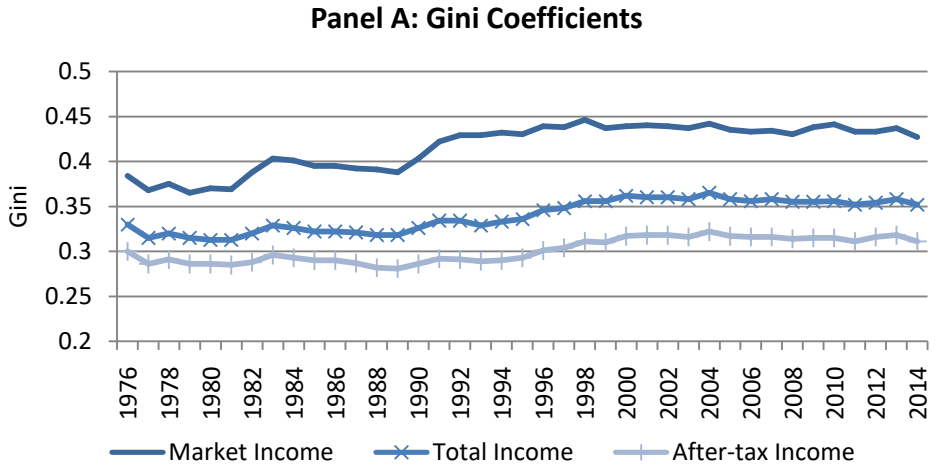
[1] This report was prepared for Innovation, Science and Economic Development Canada (ISED) and was written by CSLS economist Alexander Murray under the supervision of CSLS Executive Director Andrew Sharpe. The author thanks Don Drummond, Bert Waslander and ISED officials for comments.

3. developing world-leading clusters and partnerships,
4. growing companies and accelerating clean growth,
5. competing in a digital world, and
6. increasing the ease of doing business.

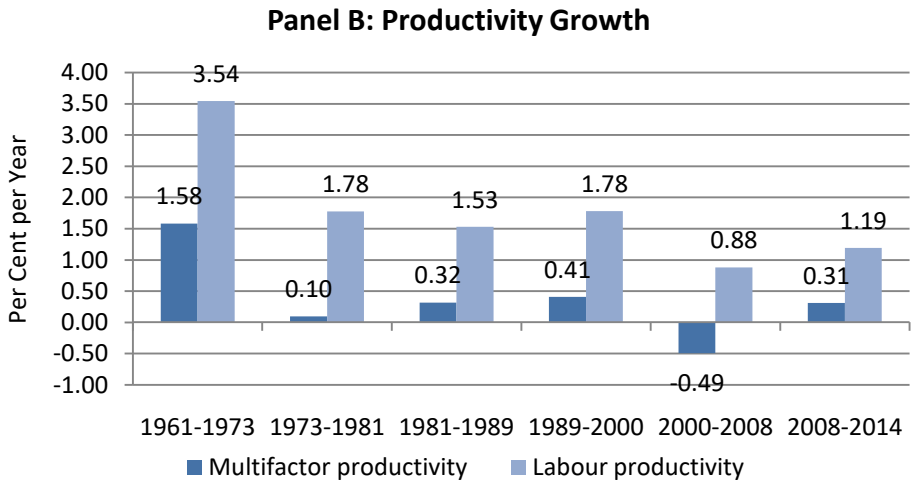
The aim of this report is to contribute to this process by analyzing innovation policies through the lens of inclusive innovation.

Chart 1 helps to characterize the context within which this project is being undertaken. First, economic inequality in Canada is high by post-war standards. Panel A shows that the Gini

Chart 1: Measures of Economic Inequality and Productivity Growth, Canada, 1976-2014



Source: Statistics Canada, CANSIM Table 206-0033.



Source: CANSIM Table 383-0021.

index of income inequality, whether measured in terms of income before or after taxes and transfers, has increased since the 1970s (although the increase occurred entirely before 2000, which may run contrary to popular perception).[2] Second, the rate of productivity growth in Canada in recent decades has been low by post-war standards and by international standards. Panel B shows that labour productivity growth has averaged around one per cent per year since 2000 -- a mediocre record -- and has never reached two per cent per year in any sub-period since the mid 1970s. Growth of multifactor productivity (MFP) has been worse still; the total *cumulative* growth of MFP between 1974 and 2014 was a mere 7.2 per cent.

By historical standards, Canada's economic inequality is high and its productivity growth is low. These facts constitute *prima facie* evidence that Canada's economy is neither as innovative nor as inclusive as it has been in the past. An inclusive innovation agenda should tackle both of these issues. A policy environment conducive to innovation should boost productivity growth and hence average living standards, while a focus on inclusiveness should ensure that the opportunities and benefits afforded by an innovative economy are broadly shared. The need for such an agenda has already been acknowledged by policymakers in other jurisdictions, as evidenced by the epigraph by U.S. President Barack Obama at the beginning of this report.

Canada's poor record on innovation and productivity growth has been a subject of study and a target of policy reform for a long time. Most recently, the expert panel of Jenkins *et al*. (2011) conducted a comprehensive review of Canada' s R&D support system at the behest of the federal government. That report made six major recommendations and a number of sub-recommendations. Sulzenko (2016) provides an overview of the history of Canadian innovation policy and finds that most of the Jenkins recommendations have been implemented at least in part. It remains to be seen what long-term impact they will have. Other major studies of Canadian innovation, productivity and economic growth conducted recently include Phillipson *et al*. (2012), Sendall *et al*. (2013), and Drummond *et al*. (2015).

Rather than retread old ground in this report, we opt instead to emphasize the *inclusiveness* aspect of an inclusive innovation agenda. What is a sensible way to think about making innovation "inclusive" in a country like Canada? Why is it important that innovation and economic growth be inclusive? In which policy areas are there complementarities between inclusiveness and innovation? In what areas are there trade-offs and how should they be managed? In what specific ways does inclusiveness bear on the six areas for action in the Government's inclusive innovation agenda? These are some of the questions that motivate the analysis in this report.

The remainder of the report is structured around these questions. In Section II, we discuss notions of inclusive innovation and inclusive growth from the economics literature and settle on a working definition of inclusive innovation that is appropriate for Canada. We survey the evidence on the importance of innovation and inclusiveness for widespread prosperity, sustainability, and social stability and cohesion. As stated by Stiglitz in the epigraph at the top of

[2] The Gini index ranges from 0 to 1, where 0 indicates a perfectly equal distribution of income (i.e. everyone has the same income) and 1 indicates a maximally unequal distribution (i.e. one person receives all the income and everyone else receives none).

this report, recent research suggests that, under prevailing conditions, inclusiveness and economic growth can be complements rather than substitutes. Section III presents indicators relevant to inclusive growth and innovation in Canada. In Section IV, we examine a number of policy and institutional reforms through the lens of inclusive innovation. We highlight areas in which inclusiveness and innovation are complements and areas in which there are trade-offs to be managed. Section V contains concluding remarks.

II. Inclusiveness, Innovation and Growth

Emerging bodies of scholarship focus on two distinct but related concepts: inclusive growth and inclusive innovation. We bring these concepts together and consider the role they should play in the development of innovation policies in Canada. We take the view that broad-based growth of living standards is the purpose of innovation from a societal perspective. Inclusive growth should therefore be the end goal of an innovation policy. Inclusive innovation, a narrower concept, may have a role to play in an innovation system aimed at inclusive growth. However, policies may involve either conflicts or complementarities between inclusive innovation and inclusive growth.

In the first part of this section, we define inclusive growth and inclusive innovation and situate our definitions in the context of the existing research. In the second part, we survey the evidence on the importance of innovation and inclusiveness for widespread prosperity, sustainability, and social stability and cohesion. This evidence informs our later policy discussion because it points to ways in which inclusiveness, innovation and growth can be complementary rather than in conflict.

A. Defining Inclusive Growth and Inclusive Innovation

Inclusive Growth

We take the view that growth of living standards is the purpose of innovation from a societal perspective, so we find it useful to begin with the concept of inclusive growth. The OECD (2014a) defines inclusive growth as

> economic growth that creates opportunity for all segments of the population and distributes the dividends of increased prosperity, both in monetary and non-monetary terms, fairly across society.

This definition does not abandon the traditional emphasis on economic growth (i.e. rising per capita income), but it augments it with a focus on distribution. An inclusive growth process is a process of economic growth that is broad-based along at least two dimensions. First, opportunities to participate in the economy are broadly accessible. Second, the benefits of economic growth are broadly shared. This dual emphasis on equity in participation and in outcomes is the key aspect of the inclusive growth framework that we will adopt in our thinking about innovation.

In addition, it is worth noting that this notion of growth is inclusive in another sense: the benefits include not only income but also non-monetary benefits that people have reason to value (e.g. health, employment, or education).

Inclusive Innovation

Innovation -- the development and implementation of ideas for new or improved products, services, production technologies or organizational arrangements -- is the fundamental driver of long-run economic growth. A country's innovation system is the constellation of agents who participate in innovation (workers, entrepreneurs, inventors, scientists and engineers, etc.), together with the environment within which they interact (policy framework, legal system, social norms and institutions, etc.). The traditional goal of innovation policy has been to create a policy environment conducive to a high rate of innovation as reflected in, say, national productivity growth statistics.

How should the notion of innovation be modified so that it reflects concerns about inclusiveness? For Canada, we think a reasonable definition of inclusive innovation is as follows:

> An *inclusive innovation system* is an innovation system in which opportunities to participate in innovation are broadly available and substantively accessible by all, and the dividends of innovation are broadly shared by all.

There are several points worth making about this definition. First, it is in keeping with the OECD's notion of inclusive growth. It maintains the traditional emphasis on the overall rate of innovation but augments it with a focus on distribution. The emphasis on distribution is applied to both the inputs and the outputs of the innovation process. Both opportunities to participate in innovation and the ex-post benefits of innovation must be equitably distributed. We envision a tight connection between inclusive innovation and inclusive growth. It is not enough simply to promote innovation among a privileged few and then redistribute the gains from growth *ex post*. An economy that exhibits inclusive growth will exhibit *both* an equitable distribution of the resources that facilitate participation in innovation *and* an equitable distribution of the gains from that innovation. Thus, an economy that exhibits inclusive growth is likely also to feature an inclusive innovation system, while an economy that does not have an inclusive innovation system probably does not exhibit inclusive growth either.

Second, we use the word "opportunity" here in a substantive sense. When a person discovers a productive investment, it does not qualify as an "opportunity" in our sense unless the person actually possesses the means to take advantage of it. Thus, throughout this report, our use of the word "opportunity" should be taken to mean something like the notion of "capability" in the work of Amartya Sen (e.g. Sen, 1999).

A third point, and a somewhat subtle one, is that our definition emphasizes the inclusiveness of the innovation system as a whole.[3] We do not seek to label particular ideas or

[3] A substantial literature analyzes countries' innovation performances through the comprehensive evaluation of their innovation systems. This approach, advocated by the Science, Technology and Innovation Council (2010), emphasizes an economy's human capital, basic research, knowledge transfer systems, institutions for creating

inventions as "inclusive" or "not inclusive." As a general matter, an inclusive innovation system should facilitate the diffusion of new technologies to as broad a user base as possible, and the more important the technology, the more accessible it should be to everyone. But we do not require that a given invention be specifically aimed at marginalized people in order to be called "inclusive."[4]

A fourth point is that the definition is broad and flexible. Like the OECD definition of inclusive growth, our definition of inclusive innovation allows for both monetary and non-monetary factors to be included in the dividends. Indicators of inclusion in the innovation system might be developed for specific groups that face barriers: the poor, Indigenous people, other racial and ethnic minorities, women, persons with disabilities, and so on. Regional inclusiveness can be considered within this framework, as can intergenerational inclusiveness. Different notions of "participation" in innovative activity are admissible (e.g. consultation in market research vs. participation as a technician implementing R&D vs. active participation in the conception and commercialization of an idea through entrepreneurship).

Relationship to Existing Literature

The phrase "inclusive growth" has been gaining currency among international organizations interested in fostering broad-based prosperity. Exhibit 1 presents a number of definitions of inclusive growth that have been proposed in the literature.[5] The definitions share two important characteristics in common. First, they do not abandon the traditional emphasis on economic growth (i.e. rising per capita income), but they augment it with a focus on distribution. Second, they focus on the distribution of both opportunities and the benefits of growth.

Thus, an inclusive growth process is a process of economic growth that is broad-based along at least two dimensions. First, opportunities to participate in the economy are broadly accessible. Second, the benefits of economic growth are broadly shared. This *dual emphasis* is fundamental to the concept of inclusive growth.

The OECD (2014a) definition of inclusive growth captures the spirit of all the definitions in Exhibit 1 and is flexible enough to encompass the points emphasized in the other definitions. Moreover, much of the leading work on defining and measuring inclusive growth is being done by the OECD as part of its ongoing Inclusive Growth Project.[6] For these reasons, we adopt the OECD (2014a) definition as our own in this report.

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economic value from basic knowledge. See Sharpe and Long (2012) for a system-based analysis of innovation in Canada's natural resource industries.

[4] Some of the development literature on inclusive innovation does require this. Heeks *et al*. (2014) are explicit in contrasting inclusive innovation with "mainstream innovation," which they characterize as being "aimed at middle- and high-income consumers, producing new goods and services that improve the welfare of those consumers and/or producing new processes that improve the productivity of formal producers." We think such a requirement would be inappropriate for an economy like Canada, which does not have masses of impoverished people and which aims to engage in frontier, 'high tech' innovation. An innovation system can be inclusive overall even if not every technology is aimed at the marginalized, though we reiterate that the diffusion of technologies to a broad user base is one important consideration.

[5] Ranieri and Ramos (2013) provide a more comprehensive review of efforts to define and measure inclusive growth.

[6] We discuss this work in more detail in Section III.

Aside from the dual emphasis, the definitions differ somewhat in their points of emphasis. Issues stressed by one or more definition include poverty alleviation; labour market outcomes and skill development; regional or sectoral equity; the long-run sustainability of growth; and the inclusion of non-monetary aspects of welfare in addition to monetary ones. All these aspects of inclusiveness are consistent with the OECD definition and are worth keeping in mind.

While the OECD's work on inclusive growth encompasses countries at various levels of economic development, the concept of "inclusive innovation" emerged in the economic development literature and has been discussed only in the low-income country context. Exhibit 2 summarizes notions of inclusive innovation that have been proposed in the literature.

Exhibit 1: Summary of Definitions of Inclusive Growth

Source	Definition of Inclusive Growth
OECD (2014a)	Economic growth that creates opportunity for all segments of the population and distributes the dividends of increased prosperity, both in monetary and non-monetary terms, fairly across society.
World Bank (2009)	Rapid and sustained poverty reduction requires inclusive growth that allows people to contribute to and benefit from economic growth. Rapid pace of growth is unquestionably necessary for substantial poverty reduction, but for this growth to be sustainable in the long run, it should be broad-based across sectors, and inclusive of the large part of the country's labour force.
Ali and Hwa Son (2007)	Growth that not only creates new economic opportunities, but also one that ensures equal access to the opportunities created for all segments of society, particularly for the poor.
UNDP (n.d.)	Inclusive Growth comprises both outcomes and processes, involving participation and benefit-sharing. ... Inclusive growth allows opportunities for everyone to participate in the growth process while making sure that benefits are shared.
African Development Bank (2012)	Economic growth that results in a wider access to sustainable socio-economic opportunities for a broader number of people, regions or countries, while protecting the vulnerable, all being done in an environment of fairness, equal justice, and political plurality.
European Commission (2010)	Inclusive growth means empowering people through high levels of employment, investing in skills, fighting poverty and modernising labour markets, training and social protection systems so as to help people anticipate and manage change, and build a cohesive society. It is also essential that the benefits of economic growth spread to all parts of the Union, including its outermost regions, thus strengthening territorial cohesion.

The existing body of research on the topic is small but growing. Because of the literature's focus on developing economies, there is a strong emphasis on including the informal sector, the agricultural sector, and the extremely impoverished in the innovation system. These priorities reflect the important early contribution of Utz and Dahlman (2007), who note that innovation researchers' typical focus on formal research and development (R&D) ignores the vast informal sectors in which poor people live and work. Focusing on India, they outline strategies for promoting innovation efforts that improve the productivity and livelihoods of poor people in informal, largely agricultural work. The strategies include using policy to redirect

Exhibit 2: Summary of Definitions of Inclusive Innovation

Source	Definition of Inclusive Innovation
Utz and Dahlman (2007)	Innovation efforts that can help improve the productivity and livelihoods of people in India's vast informal economy. [Such efforts can] benefit from harnessing collaborative efforts of formal creation efforts for the poor.
Berdegué (2005)	[A] multi-stakeholder social learning process that generates and puts to use new knowledge and which expands the capabilities and opportunities of the poor.
Cozzens and Sutz (2012)	[Innovation] needs to be 'inclusive' in at least two ways: inclusive in terms of the process by which it is achieved and inclusive in terms of the problems and the solutions it is related to.
Johnson and Andersen (2012)	[Inclusive innovation] is supposed to incorporate innovation for the poor as well as innovation by the poor. … Policies for inclusive innovation thus encompass both the directing of innovation efforts toward the [poor] and the promotion of innovation capabilities of grass root entrepreneurs and firms.
George et al. (2012)	Innovative initiatives that target individuals in disenfranchised sectors of society as well as, at the same time, a characteristic of the processes by which such innovative initiatives occur.
Chataway et al. (2013)	[Inclusive innovation] needs to be understood and developed in the context of a holistic conception of the innovation cycle … and the roles played by the poor as both producer and consumer.
Foster and Heeks (2013)	Inclusive innovation can be seen as having two aspects: inclusivity of process (e.g. the involvement of poor community members in design and development) and inclusivity of output (e.g. the development, production and delivery of goods and services that are appropriate to the development needs of the poor).
OECD (2015)	`Inclusive innovation' projects are initiatives that directly serve the welfare of lower-income and excluded groups. Inclusive innovations often modify existing technologies, products or services to better meet the needs of those groups. … [Successful inclusive innovation] requires … participation by lower-income and excluded groups.

formal R&D efforts toward the development of pro-poor technologies; supporting the diffusion of innovations by grassroots entrepreneurs within the informal sector; and helping informal businesses to adopt existing best-practice technologies.

The common thread connecting all the definitions of inclusive innovation in Exhibit 2 is the idea that inclusive innovation must reflect both participation by the poor and benefits for the poor. Recall that the definitions of inclusive growth in Exhibit 1 shared this dual emphasis. This creates a natural conceptual link between inclusive innovation and inclusive growth. We exploit this link in our definition of inclusive innovation for Canada. We drop the literature's focus on informality and the subsistence agriculture sector since those points of emphasis are not appropriate for a country like Canada.

Like us, Johnson and Andersen (2012) distinguish between inclusive innovation and an inclusive innovation *system*. However, they begin with a concept of inclusive innovation and define an inclusive system as the part of an overall innovation system that directs innovative efforts toward inclusive innovation. Our definition focuses directly on the inclusiveness of the innovation system rather than on the inclusiveness or non-inclusiveness of specific innovations.

Heeks *et al.* (2013) begin with a broad definition of inclusive innovation as "the inclusion within some aspect of innovation of groups who are currently marginalized," then provide a typology of interpretations of this definition. Their 'ladder of inclusive innovation' is outlined in Exhibit 3.[7] The authors regard each step as a generalization of the previous one in the sense that the extent of inclusion of the marginalized group is expanded or deepened from one step to the next. Our definition fits into Level 5 in the Heeks *et al*. typology. Most of the definitions listed in Exhibit 2 seem to fit into Level 4. A number of other definitions in the literature require only that an innovation benefit the poor in order to be classified as inclusive (e.g. Dutz, 2007; World Bank, 2013). Such definitions would fit into Level 3.

Innovation Policy for Inclusive Growth: What Role for Inclusive Innovation?

We defined inclusive growth and claimed that it is the appropriate end goal of innovation policy. We then defined another concept -- inclusive innovation -- which shares the dual emphasis of inclusive growth on equity in participation and in benefits but which focuses narrowly on the innovation system rather than on the economic growth process as a whole. The question is: Is inclusive innovation a useful concept for designing an innovation agenda aimed at inclusive growth?

[7] Level 6 in the ladder of inclusive innovation is abstract relative to the others. One might claim, for example, that typical notions of innovation are circumscribed by (or only intelligible within) Western ideas about progress; the material bases of well-being; property and ownership (including the ownership of ideas); the moral status of market exchanges between 'free' individuals; and so on. Level 6 inclusiveness might require that innovations be developed in the context of values or ideas different from these, to the extent that the marginalized do not share these hegemonic values and ideas.

Exhibit 3: Ladder of Inclusive Innovation

Level	Definition
Level 1: Intention	An inclusive innovation is an innovation intended to address the needs or wants of the marginalized.
Level 2: Consumption	An inclusive innovation is an innovation that is adopted and used by the marginalized.
Level 3: Impact	An inclusive innovation is an innovation that improves the livelihoods of the marginalized.
Level 4: Process	An inclusive innovation is an innovation that was developed with the participation of the marginalized.
Level 5: Structure	An inclusive innovation is an innovation that was created within a structure that is itself inclusive.
Level 6: Post-structure	An inclusive innovation is an innovation that was created within a frame of knowledge and discourse that is itself inclusive.
Source: Heeks *et al*. (2013).	

We think that it is useful for several reasons. First, it reinforces the view that inclusive growth is the end goal of innovation policy. It guides us to develop an innovation policy framework that promotes inclusive growth by conforming, so far as possible, to the dual emphasis on equity in participation and in benefits. Second, it leads us to look for complementarities between inclusiveness, innovation and growth when designing policy. It underscores the importance of ensuring that all people have the skills, resources and infrastructure to participate in innovation, since this should engender both a high rate of innovation and an equitable distribution of the benefits. It leads us to take seriously the ways in which economic and social inequalities may damage our innovation performance by limiting opportunities or engendering political opposition to technical change. Finally, in policy areas where there may in fact be trade-offs between innovation and equality, inclusive innovation calls on us to take mitigating steps to avoid the negative effects of innovation policy on economic equality or vice versa. The key is to strike an appropriate balance between the two goals.

An increase in the rate of innovation may raise the rate of economic growth as traditionally construed; that is, the growth rate of per capita income. Concern about inclusiveness complicates the picture. The relationship between innovation and economic inclusiveness is complex. On one hand, steady technological progress is the reason for the mass prosperity and poverty alleviation that has emerged in Western economies since the Industrial Revolution, and differences in technology adoption explain a substantial part of cross-country income differences today.[8] On the other hand, technological changes have profound impacts on the distribution of

[8] Growth accounting exercises find that measured inputs (labour, human capital and physical capital, adjusted for quality to the degree possible) account for just 30 to 50 per cent of cross-country income differences, with differences in total factor productivity (TFP) accounting for 50 to 70 per cent. Hsieh and Klenow (2010) provide a recent survey of this evidence. TFP is a rough indicator of a country's level of technological sophistication, although

opportunities and incomes. Skill-biased technological change, together with the failure of skill development to keep pace with rising demand for skills, has been a major driver of the rising inequality of pre-tax incomes in advanced countries in recent decades (Goldin and Katz, 2008).[9] Lack of access to new technologies may exacerbate the marginalization of excluded populations. Labour-replacing machines may enhance the wages and employment prospects of a few high-skill workers while damaging those of many (perhaps most) others.[10] Even if these changes improve the welfare of everyone in the long run, it may take a long time for labour and education markets to adjust to them.

A government concerned about inclusiveness must grapple with these issues as part of its innovation agenda. There are many policy instruments with which a government can address inequalities of opportunity and of income (or other outcomes). It would be useful if innovation itself could be harnessed to promote inclusiveness. Is this possible? To what extent does inclusiveness facilitate further innovation? To the extent that an aspect of innovation policy engenders inequality, are there mitigating policies that can be implemented without harming innovation? An inclusive innovation framework leads us to ask questions such as these.

Creating an inclusive innovation system in an advanced economy requires managing trade-offs between frontier innovation and inclusive growth. Innovation involves 'creative destruction' and therefore generates winners and losers. A successful innovation can earn enormous financial and social rewards for its creators, particularly in a digital or knowledge-based economy in which one successful idea can come to dominate an entire market at low marginal cost (OECD, 2015b). At the same time, innovation can destroy incumbent businesses and reduce the employability of many workers. The role of policy is to manage these benefits and costs by supporting the capability of all members of society to participate in the innovation system and by mitigating the inequalities that result from creative destruction (OECD, 2014b).

B. Evidence on the Importance of Inclusive Innovation and Growth

This subsection surveys empirical evidence pertaining to the importance of inclusive innovation and growth for broad-based prosperity, sustainability, and social stability.

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it also reflects other factors such as allocative efficiency. Comin and Hobijn (2010) estimate that cross-country differences in diffusion rates for new technologies account for 25 per cent of income differences.

[9] Other major factors include increased trade with low-wage countries and institutional changes such as declining union coverage and changes in real minimum wages. The relative sizes of these effects are matters of debate and differ across time and across countries. See Fortin *et al*. (2012) for a summary of recent Canadian evidence.

[10] Recent research on 'job polarization' suggests that technological progress in software and robotics may be leading to a hollowing out of jobs in the middle of the wage distribution. Traditionally, these have been jobs in which workers performed routine tasks that can easily be performed by a computer algorithm. See Autor *et al*. (2006), Autor and Dorn (2013), and Jaimovich and Siu (2012), among others. Under certain theoretical assumptions, it is possible for labour-replacing technology to lead to a permanent decline in living standards from generation to generation as technological unemployment destroys workers' ability to invest in physical and human capital (Sachs and Kotlikoff, 2013; Benzell et al., 2015).

The Importance of Innovation and Growth

The importance of innovation and growth *per se* is widely recognized. Theory and evidence suggest that innovation is the long-run driver of growth in average living standards (Romer, 1990; Hall and Mohnen, 2013). Growth of per capita income is closely related to growth of labour productivity (i.e. output per hour worked), which in turn reflects total factor productivity (TFP) growth, growth of capital per hour worked, and labour quality (i.e. skill) growth. Over the long term, TFP growth is driven by the spillover of new technological and organizational ideas across firms, regions, countries, or other production units. Growth of physical capital per unit of labour is itself driven by technological change in the long run, since it reflects the introduction of new varieties of capital (Gordon, 2003).[11] Thus, innovation makes increases in broad-based material prosperity possible. Material prosperity (as measured by per capita income) is in turn a strong correlate of measures of average subjective life satisfaction in a population (Deaton, 2007; 2012).[12]

Through its effects on income growth and well-being, innovation can be an important contributor to social stability. On the basis of historical evidence from around the world, Friedman (2005) argues that economic growth has desirable moral consequences for a society. In particular, economic growth is associated with increased toleration of diversity; greater opportunity and social mobility; a broad commitment to fairness and generosity toward the marginalized; and dedication to democracy. These values are threatened when living standards are not rising and people feel that they are not 'getting ahead,' and this can lead to social instability. Friedman (2014) notes a recent resurgence of xenophobia and intolerance in European politics and attributes it to the region's chronically slow economic growth. Evidence from the United States suggests that the perceived stagnation of living standards is associated with increases in organized racist activity (McVeigh, 2004) and support for anti-immigrant legislation (Goldin, 1994).

Economic growth is therefore important, but there is increasing concern that economic growth is environmentally unsustainable because of the strain it places upon the natural environment. The primary environmental problem associated with growth is global climate change arising from the emission of greenhouse gases into the earth's atmosphere. The continuation of economic growth into the future in a form compatible with environmental sustainability will require substantial technological innovation (OECD, 2011a). The Center for Science, Policy and Outcomes and the Clean Air Task Force (2009) identify three broad categories of innovation along these lines: innovations that reduce emissions at the source either by reducing energy consumption or by carbon capture and storage; innovations that facilitate the removal of existing greenhouse gases from the atmosphere; and innovations that directly regulate

[11] In the absence of technological change, capital accumulation would mean buying more and more copies of the same machines, equipment, buildings, etc. For a given quantity of labour input, the principle of diminishing returns implies that such capital accumulation would eventually become uneconomical and would therefore cease. Only technological progress (in the form of either TFP growth or the invention of new and better types of capital) allows for capital deepening to continue in the long run.

[12] Pennock (2016) provides a comprehensive survey of evidence on the relationship between average income and average subjective well-being. Per capita GDP can diverge from median household purchasing power for reasons including relative price changes, rising inequality, changing household size, measurement discrepancies across data sources. See Uguccioni (forthcoming) and Nolan *et al*. (2016).

the earth's temperature irrespective of greenhouse gas levels (i.e. geo-engineering). A fourth category includes innovations that facilitate adaptation to a changing climate.

Substantial technological change along these dimensions is already taking place. Holding constant other characteristics (e.g. weight and engine power), the fuel economy of American automobiles improved by 60 per cent between 1980 and 2006 (Knittel, 2011). In the agriculture sector, there is a long history of technological innovation aimed at adapting crops and farming methods to local climatic conditions. Smithers and Blay-Palmer (2001) provide a survey of this history and an in-depth analysis of climate change adaptation technologies in the Ontario soybean industry.

These sorts of innovation will have to continue if economic growth is to be compatible with environmental sustainability in the future. In a review of the literature on environmental innovation and technology diffusion, Popp (2010) writes that meeting greenhouse gas emission reduction targets "will not be possible without major changes in the way that energy is produced and consumed." Wilson *et al*. (2012) argue that innovations that increase the energy efficiency of end-use technologies may be more important than innovations in energy production, but that innovation policy has tended to ignore the former and focus on the latter. Policymakers agree with this academic perspective; according to U.S. Secretary of Energy Ernest Moniz, "There is no question that the world now understands that innovation is the core to meet [international greenhouse gas emission reduction goals]" (Biello, 2015).

Innovation is a key to ensuring the sustainability of growth, but causality can also run backward from concerns about sustainability to innovative activity. Policies designed to promote environmental sustainability, if appropriately designed, can generate innovation areas such as energy efficiency and pollution abatement. In OECD countries, changes in fuel efficiency standards or gasoline taxes, for example, are associated with significant increases in the patenting of inventions related to electric and hybrid automobiles (OECD, 2013a). Gans (2012) provides a detailed theoretical analysis of the impact of environmental policy (specifically, a cap-and-trade scheme) on innovation in various types of environmentally friendly technology. His findings suggest that environmental policy is likely to promote innovation in technologies that directly offset emissions, but may inhibit innovation in technologies that augment fossil fuels (e.g. fuel-efficient cars).

A final point is that economic growth facilitates the implementation of policies that promote social inclusion. If inclusiveness is important (as will be argued momentarily), then economic growth matters all the more. The provision of income transfers, in-kind benefits and other programs and services for the poor and marginalized requires that governments raise revenues. Robust economic growth allows this to be done without raising tax rates to levels that would be highly distortionary and politically unpopular. In this way, economic growth contributes to social stability and to fiscal sustainability. Drummond and Capeluck (2015) and Drummond *et al*. (2015) make this point with force.

The Importance of Inclusiveness

Our notion of inclusiveness refers to the distribution of both opportunities for participation in innovation and the economic and social benefits of innovation. Both aspects of inclusiveness are important and there are interactions between the two. The most common measures of economic inclusiveness (or non-inclusiveness) are measures of economic inequality. In what follows, we survey theory and evidence on the effect of economic inequality on economic growth. We then discuss evidence on the implications of economic inequality for other social outcomes such as social stability.

Economic theorists have long recognized that inequality exerts both positive and negative forces on growth. Some degree of wealth or income inequality is desirable because it provides incentives for workers and investors to exert effort, make investments, and take risks in the pursuit of rewards. In addition, as Drummond *et al*. (2015) point out, a traditional view was that a high concentration of income in the hands of the rich would raise the national savings rate (because the rich have a higher propensity to save) and thereby increase capital formation and economic growth.

On the other hand, a high level of economic inequality may reduce growth via a number of channels. There are two main categories of theory in this vein: political economy models and models with financial market imperfections.

Political economy theories emphasize the point that inequality may reduce public confidence in the market-based economic institutions that facilitate growth, leading voters to support damaging policy reforms (Alesina and Rodrik, 1994). It may eventually lead to the breakdown of public confidence in political and social institutions, resulting in social unrest and instability (Alesina and Perotti, 1996; Benhabib and Rustichini, 1992, 1996; Keefer and Knack, 2002).

In the presence of financial market imperfections that restrict their access to credit, people with low levels of income and wealth may be unable to make productive investments in the human capital of themselves or their children. This leads to a low level of aggregate human capital, and hence to a low rate of economic growth. Inequality in the initial distribution of wealth tends to be perpetuated over generations, so this problem never corrects itself. The rate of economic growth is permanently low.[13]

The net effect of all these forces on economic growth is an empirical question. Over the years, the evidence has been mixed. Recent evidence, however, strongly suggests that excessive levels of economic inequality can inhibit economic growth. OECD (2015c) and Cingano (2014) provide comprehensive, up-to-date surveys of the evidence on the effects of inequality. A key finding is that the increase in income inequality between 1985 and 2005 reduced cumulative

[13] A seminal article on financial market imperfections and the transmission of inequality via intergenerational transfers is Loury (1981). Important early papers that connected this phenomenon with economic growth include Galor and Ziera (1993), Torvik (1993), and Banerjee and Newman (1994). See Osberg (1995) and Aghion *et al*. (1999) for reviews of this literature.

economic growth between 1990 and 2010 by 4.7 percentage points (or 0.24 per cent per year) on average across OECD countries (OECD, 2015c).

Summarizing its findings, OECD (2015c) says that "the dominant mechanism through which inequality seems to affect growth is by curbing opportunities for the poor and lower middle classes." In particular, the evidence is consistent with the theoretical view that income inequality makes it difficult for people to invest in education and skill development, to engage in entrepreneurship, or to pursue other economic opportunities. (Wealth is even more unequally distributed than income, and those with little wealth are similarly constrained in their capacity to seize investment opportunities.) Across OECD countries, a higher Gini coefficient is associated with lower educational attainment, lower scores on tests of numeracy and literacy, and worse employment outcomes for people from low socioeconomic backgrounds.

The form of inequality driving these effects is not the super rich (i.e. top one per cent) pulling ahead of the rest, nor the very poor (i.e. bottom ten per cent) falling behind. Rather, what matters is the growing gap between low- and lower-middle income households (i.e. the bottom 40 per cent) and upper-middle and high-income households. The failure of the economy to provide equal opportunity to a broad group of people with below-average income levels acts as a drag on aggregate economic growth.

These findings imply that when inequality is at a high level, the overall rate of growth and the inclusiveness of growth should not be analyzed as separate issues. Growth that is not inclusive generates inequality in economic outcomes, which translates into inequality in economic opportunities and, hence, slower growth. Policies that reduce inequality of outcomes have the effect of reducing inequality of opportunity, allowing the poor and marginalized to participate in the growth and innovation process. This should be beneficial for overall growth.

One way of achieving this is by redistributing income using taxes and transfers. OECD (2015c) and Ostry *et al*. (2014) provide evidence that such policies do not inhibit growth. On the contrary, Ostry *et al*. find that such redistribution, if not too extreme in size, can lead to faster and more sustained growth. This is consistent with earlier research showing a strong medium-term relationship between equality and the sustainability of growth (Berg and Ostry, 2011).Bergh and Henrekson (2011) find that larger government (measured using total tax revenues or expenditures as a share of GDP) is associated with slower growth in a sample of high income countries, but they also note that this trade-off seems to be avoidable if countries compensate for high taxes by implementing market-friendly policies otherwise. They cite the Scandinavian economies as examples of this. Similarly, Arjona *et al*. (2003) distinguish between "active" and "passive" social spending by governments and find that the former promotes faster growth while the latter reduces growth.[14] Using data from Canada's provinces, Dahlby and Ferede (2013) find some weak evidence that fiscally-neutral income redistribution might increase per capita GDP

[14] "Active" spending is spending intended to affect the distribution of market income by, for example, promoting labour market participation. "Passive" spending includes simple redistributive expenditures such as unemployment benefits.

growth.[15] Thus, taxation and social spending are not necessarily harmful to growth, and can be beneficial, but the policy details matter.[16]

Economic inequality is related to a broad set of social outcomes aside from economic growth. Intergenerational mobility is an important indicator of equality of opportunity, and Chetty *et al*. (2014) find that income inequality is negatively associated with intergenerational income mobility across regions within the United States. D'Addio (2007) and Corak (2013a) present similar results for OECD countries. There is a steep socioeconomic gradient in a wide variety of physical and mental health outcomes, and these outcomes are tied both to productivity and to general quality of life (Sharpe and Murray, 2011a). High levels of income inequality, especially at the high end of the distribution, may allow the rich to exercise undue control of political institutions. This undermines democratic principles and can lead to the entrenchment of a powerful elite able to reshape political and economic institutions in its own favour (Acemoglu and Johnson, 2012; Hacker and Pierson, 2010; Zingales, 2012). High levels of economic inequality are associated with lower levels of interpersonal trust, social capital and social cohesion (Putnam, 2000; Albrekt Larsen, 2013). Wilkinson and Pickett (2010) provide a comprehensive overview of social ills that have been shown to be positively correlated with measures of economic inequality across regions and over time.

In addition, simple measures of economic inequality are not the only indicators of inclusiveness about which we might be concerned. Structural barriers that exclude particular groups from full participation in the economy lead to an underutilization of societal resources. In their analysis of policies to increase economic growth in Canada, Drummond *et al*. (2015) give special attention to policies that might raise the labour force participation rates of traditionally marginalized groups whose labour force participation is relatively low: women, older workers, persons with disabilities, Aboriginal people, and immigrants. Senate of Canada (2013) focuses on these groups in its report on economic inclusiveness.

Economic inclusiveness across ethnic and cultural lines may be of particular importance for the maintenance of social cohesion in a society. In addition to its inherent value as a societal outcome, social cohesion contributes to the sustainability of long-term economic growth (OECD, 2012). A large body of evidence shows that ethnic, linguistic and religious diversity poses a potential threat to social trust and cohesion (Alesina and La Ferrara, 2000 and 2002; Delhey and

[15] They find no evidence that the level of income inequality affects per capita GDP growth positively or negatively.

[16] It is tempting to contrast the recent research findings on inequality and growth with the traditional view that there is an equality-efficiency trade-off. According to that view, income redistribution must be financed by taxes that distort the choices of workers and investors, and hence any reduction of economic inequality via redistributive policy would come at the cost of reduced economic efficiency. See Osberg (1995) for a comprehensive discussion. Clearly, the traditional view presupposes that the *laissez faire* outcomes are themselves efficient, so that any departure from those outcomes (caused by the taxes) would be efficiency-reducing. This would not be the case in a framework with financial market imperfections, for example; in such a model, any efficiency losses from distorting taxes might be more than offset by the relaxation of the financial constraints on poor households. More fundamentally, the concept of efficiency is very different from the concept of economic growth. (It is not necessarily the case that faster growth always corresponds to greater efficiency.) Our discussion has been about the relationship between equality and growth; the relationship between equality and efficiency would require an entirely different (and more theoretically subtle) discussion.

Newton, 2005; Putnam, 2007).[17] However, other evidence suggests that this effect may be a reflection of social and economic inequalities between groups in diverse societies (Gijsberts *et al*., 2012; Letki, 2008; Pervaiz *et al*., 2013). According to this view, social cohesion is damaged not by diversity *per se* but by the economic and social marginalization some groups may experience in a diverse society. The weight of the evidence suggests that both socioeconomic marginalization and intergroup tensions reduce social cohesion in diverse societies.[18] Still, to the extent that policy can reduce such marginalization and ensure that all members of the society are able to participate fully in the economy, the harmful effects of diversity on social cohesion may be avoidable to a large extent. This is a strong argument in favour of economic inclusiveness.

III. Measuring Inclusive Innovation and Growth

This section presents indicators useful for assessing inclusive innovation and growth in Canada. This is important because, as pointed out by Stiglitz (2016), "If we use the wrong metrics, we will strive for the wrong things." Our view is that inclusive growth is the proper end goal of innovation policy, so we need to measure inclusive growth.

Much of the leading work on the conceptualization and measurement of inclusive growth is being done by the OECD as part of its inclusive growth research agenda, and our notion of an inclusive innovation system is closely related to the OECD's definition of inclusive growth. For this reason, this section begins with an overview of the OECD's inclusive growth framework. We then present estimates of the OECD inclusive growth measure for Canada and a group of OECD countries. We also provide another measure of inclusive living standards: the Index of Economic Well-being (IEWB), produced by the Centre for the Study of Living Standards (CSLS). What these indices have in common is that they combine measures of average living standards with measures that emphasize distribution and marginalization (e.g. indicators of poverty, inequality, economic security, social capital, and so on) in a single summative measure.

In the second part of this section, we present some narrower indicators of inclusiveness focusing on particular groups or particular dimensions of inclusion and exclusion.

[17] A noteworthy piece of contrary evidence is provided by Kazemipur (2006), who finds a positive relationship between ethnic diversity and social trust in Canadian cities. Kazemipur's study is entitled "A Canadian Exceptionalism?" to reflect the unusual nature of the finding. Some other studies using Canadian data find the usual negative relationship between diversity and measures of social cohesion (e.g. Stolle *et al.*, 2008).

[18] In U.S. data, Alesina and La Ferrara (2002) find that two of the strongest predictors of individual-level distrust of others are belonging to a group that has historically felt discriminated against (i.e. socially marginalized people) and having low income or educational attainment (i.e. being economically marginalized). They also find that living in a racially heterogeneous community has an independent negative effect on trust, but that this effect is strongest among persons who express strong feelings against racial integration.

A. Measures of Inclusive Growth

i. OECD Inclusive Growth Framework

Recall that the OECD (2014a) defines inclusive growth as "economic growth that creates opportunity for all segments of the population and distributes the dividends of increased prosperity, both in monetary and non-monetary terms, fairly across society." The OECD's Inclusive Growth Project is an ongoing effort to create a measure of social welfare that is consistent with this definition.

The OECD's method of measuring inclusive growth is developed in Boarini *et al*. (2014) and Boarini *et al*. (2015). The measure combines information on four outcomes: household income, life expectancy, unemployment and inequality. The first three components are combined using an equivalent income approach rooted in economic theory, with the weights derived from the statistical relationship between the variables and a measure of subjective well-being. The equivalent income measure is then adjusted *ex post* to account for inequality. Appendix A provides a more detailed description of the method.

Table 1: OECD Inclusive Growth Measure, Selected OECD Countries, 2000-2011

	Level		Growth Rate	Rank		Rank Change
	2000	2011	2000-2011	2000	2011	2000-2011
Norway	13,433	21,822	4.51	2	1	+1
Australia	11,741	18,855	4.4	6	2	+4
Canada	11,602	16,975	3.52	7	3	+4
Germany	12,732	16,759	2.53	3	4	-1
Sweden	11,959	16,343	2.88	5	5	--
France	11,585	16,191	3.09	8	6	+2
Netherlands	12,445	16,103	2.37	4	7	-3
United States	14,422	15,657	0.75	1	8	-7
Belgium	11,355	15,418	2.82	9	9	--
United Kingdom	10,601	14,487	2.88	10	10	--
Finland	8,428	13,910	4.66	13	11	+2
Denmark	10,249	13,275	2.38	12	12	--
Italy	10,593	12,696	1.66	11	13	-2
Spain	7,928	9,349	1.51	14	14	--

Note: Levels are in 2005 USD PPP. Growth rates are in per cent per year.
Source: Calver (2016), based on results of ongoing research provided by the OECD.

Table 1 presents estimates of the OECD inclusive growth measure for Canada and a set of other OECD countries between 2000 and 2011. In 2011, Canada ranked third among the fourteen selected countries with an equality-adjusted equivalent income level of $16,975. Only Norway and Australia did better according to this measure. This rank in 2011 was the result of robust growth of 3.52 per cent per year between 2000 and 2011, the fourth highest inclusive growth rate among the fourteen countries. This growth allowed Canada to rise four places in the ranking of countries, from seventh in 2000 to third in 2011. Canada tied with Australia for the largest increase in rank over the period. The United States exhibited by far the largest deterioration in its relative position among the countries; it fell seven places from first in 2000 to eighth in 2011. This was the result of a growth rate of a mere 0.75 per cent per year in equality-adjusted equivalent income over the period, the lowest growth rate among the countries.

For each country, we decompose the average annual growth rate of the inclusive growth measure between 2000 and 2011 into the contributions of changes in the four components: household income, life expectancy, the unemployment rate, and inequality. The results of this decomposition are presented in Table 2. Inclusive growth in Canada was driven by household income growth and life expectancy improvement, which contributed 2.15 and 1.45 percentage points of growth in living standards, respectively. Together, these components accounted for more than 100 per cent of Canada' s growth. A small decrease in inequality made a positive contribution of 0.05 percentage points to growth, while an increase in unemployment reduced living standards by 0.13 per cent per year.

Across the fourteen countries, household income and life expectancy tended to account for the bulk of growth in living standards.[19] Spain and the United States experienced large negative contributions from the unemployment rate relative to the other countries.

Across countries, the contributions of inequality tended to be small. The major exception is the United States. The marked increase in inequality in the United States over the period contributed -0.63 percentage points to growth in American living standards. Still, while this is significant, it was the smallest in absolute value among the four component contributions for the United States.

For Canada, the small contribution of inequality reflects the fact that the time series begins in 2000. A longer time series would show a larger contribution from inequality in Canada. Recall from Chart 1 that Canada's economic inequality increased in the 1980s and 1990s, but has been stable since 2000.

[19] A noteworthy exception is Italy, where household income actually exhibited a small decline over the period.

Table 2: Decomposition of OECD Inclusive Growth Measure, Selected OECD Countries, 2000-2011

	Total	Percentage-point Contributions to Total				Per Cent Contributions to Total			
	Inclusive Growth Measure	Household Income	Life Expectancy	Unemployment Rate	Inequality	Household Income	Life Expectancy	Unemployment Rate	Inequality
Finland	4.66	2.58	1.77	0.41	-0.10	55.4	38.0	8.8	-2.1
Norway	4.51	3.05	1.39	0.02	0.05	67.6	30.8	0.4	1.1
Australia	4.40	2.81	1.51	0.22	-0.14	63.9	34.3	5.0	-3.2
Canada	3.52	2.15	1.45	-0.13	0.05	61.1	41.2	-3.7	1.4
France	3.09	1.24	1.83	0.20	-0.18	40.1	59.2	6.5	-5.8
United Kingdom	2.88	1.47	1.79	-0.50	0.13	51.0	62.2	-17.4	4.5
Sweden	2.88	2.36	1.25	-0.39	-0.35	81.9	43.4	-13.5	-12.2
Belgium	2.82	0.77	1.68	-0.12	0.49	27.3	59.6	-4.3	17.4
Germany	2.53	0.87	1.51	0.37	-0.23	34.4	59.7	14.6	-9.1
Denmark	2.38	1.62	1.71	-0.70	-0.25	68.1	71.8	-29.4	-10.5
Netherlands	2.37	0.97	1.67	-0.27	0.01	40.9	70.5	-11.4	0.4
Italy	1.66	-0.15	1.45	0.40	-0.04	-9.0	87.3	24.1	-2.4
Spain	1.51	0.99	2.27	-1.50	-0.26	65.6	150.3	-99.3	-17.2
United States	0.75	1.38	1.16	-1.15	-0.63	184.0	154.7	-153.3	-84.0

Source: Calver (2016), based on results of ongoing research provided by the OECD. Figures in the Total and Percentage-point Contributions columns are in per cent per year. Figures in the Per Cent Contributions are in per cent.

Veneri and Murtin (2016) study variation in the inclusive growth measure across regions within and across OECD countries.[20] In Canada, two provinces -- Alberta and Saskatchewan -- had inequality-adjusted equivalent incomes in the top quartile of OECD regions in 2011. Most of the other provinces fell into the third quartile (i.e. 50th to 75th percentiles), while Newfoundland and Labrador, Nova Scotia and Prince Edward Island were in the second quartile. The territories are not included in the study. Canada fell in the middle of the pack in terms of regional disparities in living standards according to the Inclusive Growth Measure. In Canada (and in most countries), regional disparities in inequality-adjusted equivalent income exceeded regional disparities in household income alone.

Veneri and Murtin note that most provinces exhibited increases in inequality-adjusted equivalent income over the 2004-2011 period, driven mainly by rising household income.

ii. The Index of Economic Well-being

The Index of Economic Well-being (IEWB) was developed by Osberg and Sharpe (1998; 2002; 2005) based on the conceptual framework of Osberg (1985). The IEWB is a composite index that combines indicators related to four domains of economic well-being: per capita consumption, per capita wealth, economic inequality, and economic security. Each domain is broad in its coverage. For example, per capita consumption includes estimates of household production, while per capita wealth includes estimates of human capital and natural capital, as well as an adjustment for the costs of environmental degradation arising from greenhouse gas emissions. The economic inequality domain includes indicators of poverty (both incidence and average depth) and income inequality, with the poverty component receiving three times the weight of the income inequality component. The economic security domain combines indicators of several important economic risks -- single-parent poverty, unemployment, illness, and poverty in old age -- with each risk weighted by the relative size of the population deemed most susceptible to it. The four component sub-indexes are scaled into comparable units and additively combined using arbitrary weights. Baseline results weight the four domains equally, though in principle each data user can specify his or her own weights. See Osberg and Sharpe (2009a) for a detailed description of the method and the underlying data.

Thomas and Uguccioni (2016a; 2016b) provide the most recent estimates of the IEWB for Canada and the provinces and for selected OECD countries. Table 3 presents the estimates for Canada and the provinces for 1981 and 2014. In Canada, the IEWB increased by 0.74 per cent per year over the period.[21] By comparison, real per-capita GDP in Canada increased by 1.30 per cent per year over the same period (Thomas and Uguccioni, 2016a). Thus, comprehensive well-being as measured by the IEWB grew more slowly than per capita income in Canada over the period.

[20] They use a different set of countries than we examine in Tables 1 and 2. Their study includes Belgium, Canada, Chile, the Czech Republic, Estonia, Finland, France, Greece, Italy, Korea, Luxembourg, Mexico, Spain, the United Kingdom, and the United States.

[21] The linear scaling of the components of the IEWB makes growth rates difficult to interpret intuitively. For further discussion of the scaling procedure, see Sharpe and Salzman (2003).

Table 3: Index of Economic Well-being, Canada and the Provinces, 1981-2014

	Level		Growth Rate	Rank		Rank Change
	1981	2014	1981-2014	1981	2014	1981-2014
Canada	0.437	0.558	0.74	--	--	--
Alberta	0.588	0.754	0.75	1	1	--
Saskatchewan	0.405	0.590	1.15	4	2	+2
Newfoundland and Labrador	0.265	0.588	2.45	10	3	+7
Manitoba	0.391	0.545	1.01	5	4	+1
British Columbia	0.466	0.545	0.48	3	5	-2
Quebec	0.378	0.523	0.99	6	6	--
Ontario	0.476	0.517	0.25	2	7	-5
Nova Scotia	0.364	0.517	1.07	7	8	-1
New Brunswick	0.289	0.507	1.72	9	9	--
Prince Edward Island	0.290	0.494	1.63	8	10	-2

Note: The levels are unit-free index numbers. See Osberg and Sharpe (2009a) for details on the scaling procedure used to construct the index. Growth rates are in per cent per year.
Source: Thomas and Uguccioni (2016a).

Among the provinces, Alberta ranked first in economic well-being in both 1981 and 2014. The three Maritime provinces are chronic poor performers, placing at or near the bottom of the ranking in both 1981 and 2014. The greatest improvement, in terms of both average annual growth and rank improvement, was exhibited by Newfoundland and Labrador; that province jumped seven places from tenth to third over the period thanks to 2.45 per cent annual growth. At the other end of the spectrum, Ontario fell five spots -- from second to seventh -- as well-being grew by a mere 0.25 per cent per year. The high well-being and excellent growth performance of Alberta and Saskatchewan is consistent with the findings of Veneri and Murtin (2016) using the OECD inclusive growth measure.

Estimates of the four component sub-indexes of the IEWB are presented in Table 4. For Canada, it is noteworthy that the two components that reflect 'conventional' aspects of economic well-being – the per-capita consumption and per-capita wealth components – exhibited positive growth rates over the 1981-2014 period while the two components related to inequality and marginalization – the equality and economic security components – both declined over the period. Canada has grown richer in terms of average consumption and wealth, but the benefits of growth are being distributed in a manner that is increasingly unequal and less conducive to economic security.

Trends in economic equality differ across provinces. In general, economic equality declined in provinces that were very equal in 1981 and increased in provinces that were very unequal in 1981. Economic security declined over the period in every province except for Newfoundland and Labrador and Prince Edward Island.

Table 4: The Four Domains of the Index of Economic Well-being, Canada and the Provinces, 1981-2014

	Consumption			Wealth			Equality			Economic Security		
	Level		Growth Rate	Level		Growth Rate	Level		Growth Rate	Level		Growth Rate
	1981	2014	1981-2014	1981	2014	1981-2014	1981	2014	1981-2014	1981	2014	1981-2014
Canada	0.250	0.795	3.57	0.229	0.416	1.83	0.621	0.470	-0.84	0.646	0.549	-0.49
Alberta	0.392	0.910	2.58	0.550	0.710	0.77	0.691	0.697	0.03	0.720	0.697	-0.10
Saskatchewan	0.265	0.629	2.66	0.281	0.529	1.93	0.349	0.537	1.32	0.723	0.664	-0.26
Newfoundland and Labrador	0.083	0.772	6.98	0.138	0.420	3.42	0.378	0.577	1.29	0.461	0.585	0.72
Manitoba	0.216	0.745	3.82	0.237	0.387	1.49	0.478	0.488	0.06	0.632	0.562	-0.36
British Columbia	0.321	0.818	2.88	0.267	0.421	1.39	0.664	0.362	-1.82	0.611	0.579	-0.16
Quebec	0.177	0.702	4.26	0.176	0.353	2.13	0.580	0.510	-0.39	0.580	0.527	-0.29
Ontario	0.252	0.784	3.50	0.208	0.368	1.75	0.745	0.431	-1.65	0.698	0.487	-1.09
Nova Scotia	0.253	0.860	3.77	0.117	0.285	2.73	0.518	0.485	-0.20	0.569	0.439	-0.79
New Brunswick	0.123	0.702	5.43	0.174	0.333	1.99	0.329	0.529	1.45	0.532	0.466	-0.40
Prince Edward Island	0.183	0.675	4.04	0.083	0.292	3.88	0.418	0.531	0.73	0.476	0.477	0.00

Note: The levels are unit-free index numbers. See Osberg and Sharpe (2009a) for details on the scaling procedure used to construct the index. Growth rates are in per cent per year.

Source: Thomas and Uguccioni (2016a).

Table 5: Index of Economic Well-being, Selected OECD Countries, 1980-2014

	Level		Growth Rate	Rank		Rank Change
	1980	2014	1980-2014	1980	2014	1980-2014
Norway	0.481	0.817	1.57	4	1	+3
Netherlands	0.486	0.669	0.94	2	2	--
Belgium	0.494	0.656	0.84	1	3	-2
Australia	0.368	0.637	1.62	11	4	+7
Finland	0.460	0.635	0.95	6	5	+1
France	0.369	0.625	1.56	10	6	+4
Denmark	0.407	0.621	1.26	9	7	+2
Germany	0.468	0.608	0.77	5	8	-3
Sweden	0.484	0.585	0.56	3	9	-6
United Kingdom	0.409	0.572	0.99	8	10	-2
Canada	0.362	0.568	1.33	12	11	+1
United States	0.305	0.496	1.44	14	12	+2
Italy	0.429	0.487	0.37	7	13	-6
Spain	0.356	0.406	0.39	13	14	-1

Note: The levels are unit-free index numbers. See Osberg and Sharpe (2009a) for details on the scaling procedure used to construct the index. Growth rates are in per cent per year.
Source: Thomas and Uguccioni (2016b).

Thomas and Uguccioni (2016b) produce estimates of the IEWB for Canada and selected OECD countries for the period 1980-2014. Results are presented in Table 5.[22] Canada ranked a disappointing eleventh among the fourteen countries in 2014. This represents an improvement of one place in the ranking from twelfth in 1980. Norway topped the ranking in 2014, while Italy and Spain occupied the bottom spots.

The breakdown of the IEWB into its four component sub-indexes for OECD countries is presented in Table 6. The table reveals that Canada's poor showing in the overall IEWB ranking is driven by the equality and economic security components. In 2014, Canada ranked fifth and third among the fourteen OECD countries in terms of per capita consumption and per capita wealth, respectively. However, Canada ranked eleventh out of fourteen in both equality and economic security.

Comparing the IEWB scores for 2014 in Table 5 with the OECD Inclusive Growth scores for 2011 in Table 1 reveals that Canada is the country for which the two well-being measures yield the largest difference in terms of country ranking; Canada ranked third according to the OECD measure, compared to eleventh according to the IEWB. This is attributable to differences in the manner in which the two indexes account for economic inequality and security. The

[22] Scores for Canada in Table 5 are not comparable to those in Table 3 because of data differences between the two sets of estimates and because the scaling of the index components depends on the maximum and minimum values in the dataset being used. See Thomas and Uguccioni (2016a; 2016b) for details.

Table 6: The Four Domains of the Index of Economic Well-being, Selected OECD Countries, 1980-2014

	Consumption			Wealth			Equality			Economic Security		
	Level		Growth Rate	Level		Growth Rate	Level		Growth Rate	Level		Growth Rate
	1980	2014	1980-2014	1980	2014	1980-2014	1980	2014	1980-2014	1980	2014	1980-2014
Norway	0.201	0.782	4.08	0.173	0.917	5.02	0.689	0.737	0.20	0.862	0.833	-0.10
Netherlands	0.372	0.624	1.53	0.192	0.468	2.65	0.643	0.782	0.58	0.735	0.800	0.25
Belgium	0.287	0.582	2.10	0.141	0.518	3.90	0.792	0.765	-0.10	0.758	0.759	0.01
Australia	0.172	0.652	3.99	0.159	0.641	4.17	0.547	0.557	0.05	0.595	0.699	0.48
Finland	0.083	0.480	5.29	0.174	0.481	3.03	0.823	0.808	-0.05	0.759	0.769	0.04
France	0.219	0.611	3.06	0.174	0.380	2.33	0.363	0.758	2.19	0.722	0.753	0.12
Denmark	0.210	0.540	2.82	0.123	0.483	4.10	0.549	0.656	0.52	0.744	0.807	0.24
Germany	0.222	0.610	3.01	0.186	0.442	2.58	0.762	0.620	-0.61	0.704	0.760	0.23
Sweden	0.220	0.531	2.63	0.122	0.327	2.94	0.739	0.706	-0.13	0.854	0.776	-0.28
United Kingdom	0.102	0.570	5.18	0.122	0.309	2.77	0.630	0.626	-0.01	0.783	0.784	0.00
Canada	0.261	0.618	2.57	0.116	0.569	4.78	0.452	0.377	-0.54	0.619	0.708	0.40
United States	0.371	0.917	2.69	0.256	0.423	1.49	0.295	0.165	-1.69	0.297	0.479	1.42
Italy	0.265	0.495	1.86	0.140	0.383	3.01	0.570	0.358	-1.36	0.741	0.710	-0.12
Spain	0.147	0.380	2.82	0.083	0.403	4.75	0.474	0.250	-1.87	0.719	0.590	-0.58

Note: The levels are unit-free index numbers. See Osberg and Sharpe (2009a) for details on the scaling procedure used to construct the index. Growth rates are in per cent per year.
Source: Thomas and Uguccioni (2016b).

OECD measure does not take explicit account of economic security at all, and its adjustment for income inequality ignores poverty. On the other hand, the weight assigned to the equality and security domains of the IEWB are left to the subjective choice of the data user. We assigned the same weight to all four domains of the index, but users who believe the weight on equality and security should be small would arrive at different conclusions about Canada's relative performance. By contrast, the weights of the components of the OECD measure are based on their estimated relationships with subjective well-being, and hence might be regarded as less arbitrary than the IEWB weights.[23]

The evidence surveyed in Section II suggests that the weight on the equality domain should not be too small even for an analyst who cares mainly about growing per capita consumption and wealth. Economic inclusiveness is an important determinant of innovation and inclusive growth. In particular, the IEWB's equality component places a high weight on measures of poverty, which is an especially extreme form of economic exclusion. In general, we think it is valuable to consider a variety of inclusive growth measures based on a variety of methodologies. The differences between alternative measures highlight the importance of specific variables or methodological assumptions in driving the measurement results.

B. Other Indicators of Economic Inclusiveness

This section compiles a number of selected indicators relevant to the inclusiveness of Canada's inclusive growth performance.

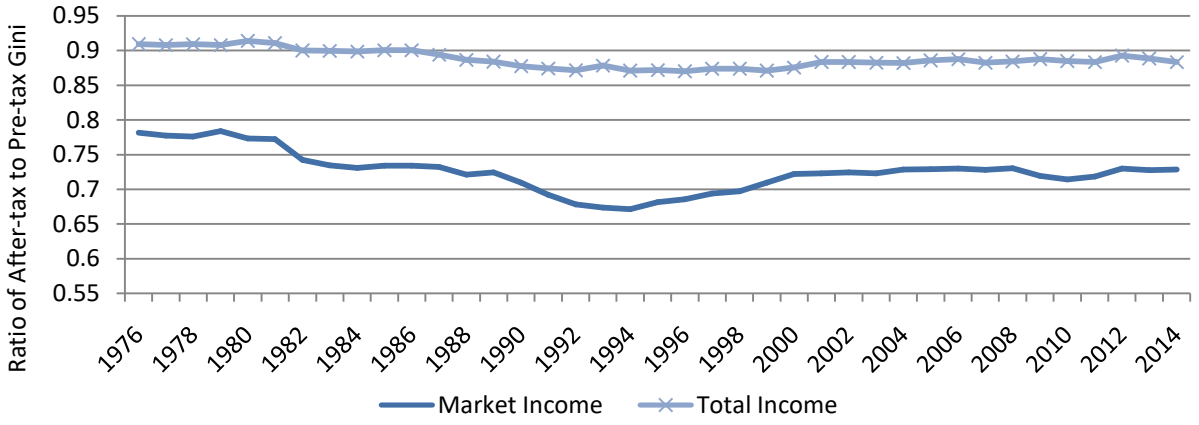
i. Income Inequality

The most straightforward indicators of economic inclusiveness are measures of income inequality. In Canada, the Gini coefficient for household market income increased by twenty per cent between 1981 and 1998 (from 0.369 to 0.446), and has remained stable since then (recall Chart 1, Panel A). Rising inequality indicates that the gains from economic growth were not being shared equally throughout the income distribution during the 1980s and 1990s.

The tax and transfer system equalizes the income distribution through downward redistribution, so the after-tax Gini lies below the market and total income Ginis. The degree to which redistribution reduced inequality changed over the period. Chart 3 shows that the tax and transfer system became less redistributive throughout the period from 1976 to the mid-1990s, the period during which most of the increase in economic inequality occurred. After the mid-1990s, the system became more redistributive again as the ratio of after-tax income to pre-tax income increased. However, the tax and transfer system remained less redistributive in 2014 than it had been in the late 1970s. See Sharpe and Capeluck (2012) for a comprehensive analysis of the impact of Canada's tax and transfer system on income inequality in recent decades.

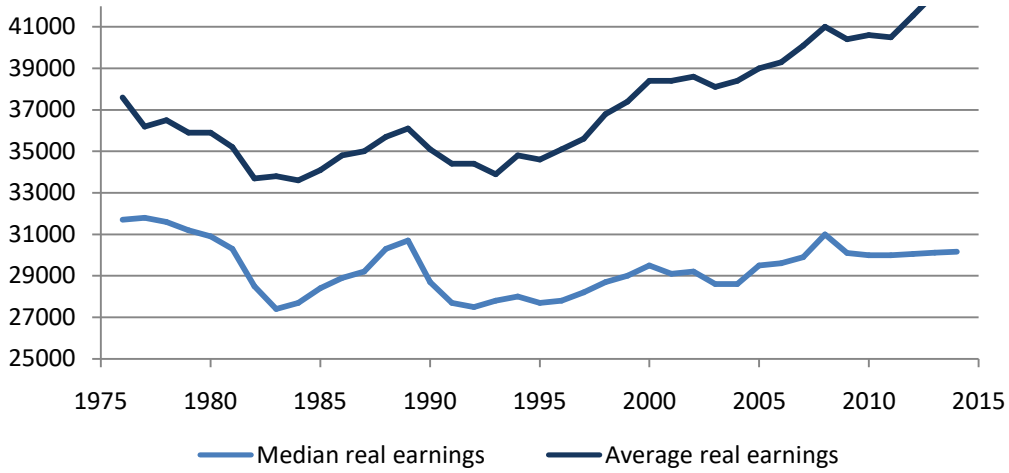
[23] Sharpe and Andrews (2012) discuss various approaches to the selection of weights for the components of composite indicators, with a special focus on the IEWB.

Chart 2: Ratio of Gini for After-tax Income to Those of Selected Pre-tax Income Measures, Canada, 1976-2014



Source: Statistics Canada, CANSIM Table 206-0033.

Chart 3: Median and Mean Annual Earnings, Canada, $2011, 1976-2014



Source: Uguccioni (forthcoming).

OECD evidence surveyed in the previous section indicated that high levels of economic inequality hamper economic growth by impeding the ability of those at the bottom of the distribution to make productive investments. The most important aspect of inequality for this result was the pulling away of the upper part of the income distribution from the bottom 40 per cent or so. Chart 3 shows that mean real annual earnings have pulled away from median real annual earnings over recent decades, including since 2000. Uguccioni (forthcoming) shows that real wage growth since 2000 has been strongest at the top and at the bottom of the income distribution, with the slowest wage growth occurring in the middle. That phenomenon may help

explain the seeming inconsistency between the growing earnings gap in Chart 3 and the stable Gini coefficient depicted in Panel A ofChart 1Chart 2.

ii. Low-wage Jobs

The OECD inclusive growth framework emphasizes labour market outcomes as a key dimension of economic inclusiveness. One way to examine the degree to which the gains from productivity growth are being shared among Canadians is to measure the share of workers who work in low-wage jobs. Thomas (2016) defines a low-wage job as a job that pays below two thirds of the median wage for full-time workers aged 20-64.This low-wage cut-off was $16.01 per hour in 2014. In that year, 27.6 per cent of workers aged 20-64 earned low wages (Chart 4). This is essentially unchanged from 27.9 per cent in 1997. However, that result masks substantial variation in the incidence of low-wage jobs over the period. The low-wage jobs rate reached a low of 24.5 per cent in 2008. Following the recession of 2008 and 2009, the low-wage job rate increased again, wiping out the gains of the previous decade. Women are significantly more likely than men to occupy low-wage jobs (Chart 5). To the extent that this reflects gender-based barriers to women's participation in high-productivity jobs, a policy agenda aimed at economic inclusiveness should seek to remedy it.

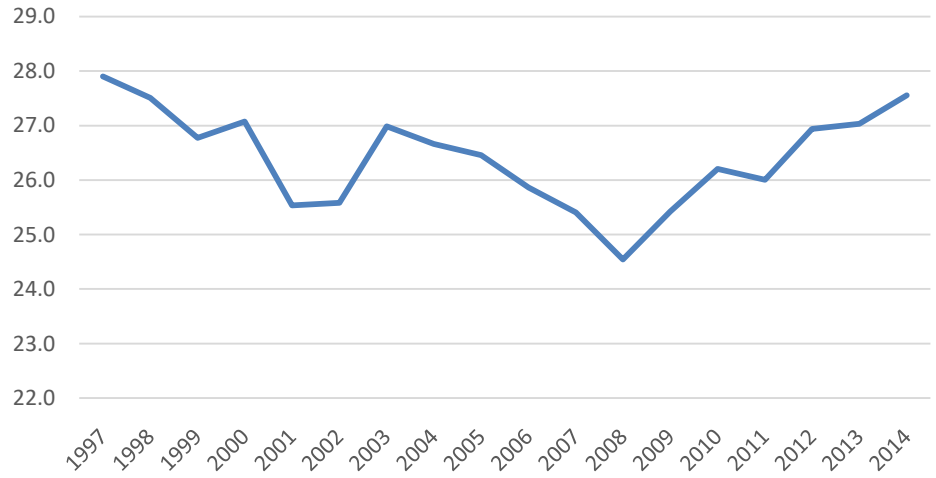
Table 7 displays the incidence of low-wage jobs by level of educational attainment in 1997, 2008 and 2014. The low-wage job rate increased between 1997 and 2014 at all levels of education.[24] From an inclusiveness perspective, the declining fortunes of those with the lowest levels of education is worrying. From an innovation perspective, it is the rising rate of low-wage jobs among university graduates that poses the gravest concern. In particular, the incidence of low-wage jobs increased from 7.7 per cent to 12.4 per cent over the period among Canadians with Master's or doctoral degrees. This suggests that Canada's investments in education at the highest levels are growing less likely to lead students into high-productivity jobs.

One potential explanation for this phenomenon is that Canada's labour market is failing to match skilled workers with the jobs that would best utilize their skills. This 'skill mismatch' hypothesis has received substantial attention in media commentary in recent years. However, the best available evidence suggests that this simple story is incomplete and misleading. McGowan and Andrews (2015) distinguish between skill mismatch and qualification mismatch; the former reflects the difference between a worker's scores on skill assessment tests and the usual skill requirements for his job, while the latter reflects the difference between a worker's educational credentials and the usual educational requirements for his job. They find that Canada does have a high degree of qualification mismatch; nearly 50 per cent of Canadian workers were either under- or over-qualified for their jobs in 2012. Among the 22 OECD countries in their sample, only Ireland had a greater degree of qualification mismatch. However, when mismatch is assessed using measured skills rather than credentials, Canada has among the lowest rates of mismatch; only 19 per cent of Canadian workers were over- or under-skilled for their jobs in

[24] This is not inconsistent with the slight decline in the overall incidence of low-wage jobs because of a composition effect. While the incidence of low-wage jobs increased within every education category, rising educational attainment among Canadians moved a larger share of the population into the higher educational attainment categories, which have lower rates of low-wage jobs.

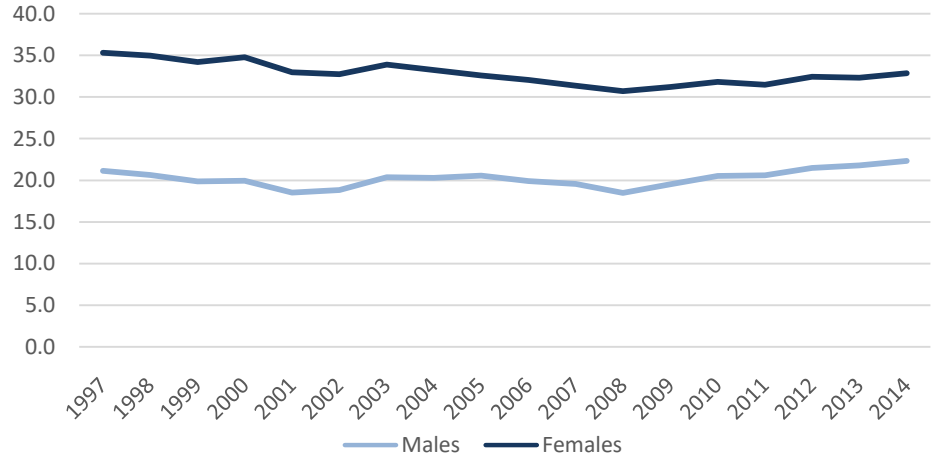
2012.[25] Among the 22 OECD countries, only Poland had a (slightly) lower rate of mismatch. As a result, McGowan and Andrews estimate that the productivity impact of reducing Canadian labour skill mismatch to the level of the best-performer would be quite small.

Chart 4: Incidence of Low-wage Jobs, Canada, Per Cent, 1997-2014



Source: Thomas (2016).

Chart 5: Incidence of Low-wage Jobs by Gender, Canada, Per Cent, 1997-2014



Source: Thomas (2016).

[25] McGowan and Andrews (2015) label a worker under-skilled if his score on a skill assessment test (the OECD Survey of Adult Skills) is below the 10th percentile of scores of workers in his occupation and country. The worker is labeled over-skilled if his score is above the 90th percentile of scores for workers in his occupation and country.

Table 7: Incidence of Low-wage Jobs by Education Level, Canada, Per Cent, 1997-2014

	Low-wage Job Incidence			Total Percentage-point Change
	1997	2008	2014	1997-2014
Total, All Education Levels	27.9	24.5	27.6	-0.3
0 to 8 years	44.6	46.8	50.7	6.1
Some secondary	40.5	40.3	43.4	2.9
Grade 11-13, Graduate	33.5	32.7	38.7	5.2
Some postsecondary	40.9	37.9	46.2	5.2
Postsecondary certificate or diploma	23.4	20.8	24.1	0.7
University: BA	14.7	14.0	17.6	2.9
University: MA or Doctorate	7.7	10.3	12.4	4.6

Source: Thomas (2016).

An alternative explanation consistent with both these mismatch facts and the rising share of graduate degree-holders in low-wage jobs is that, as educational attainment rises in general, students with poor fundamental skills are graduating from advanced degree programs. Hango and Larochelle-Cote (2016) find that university graduates who are overqualified for their jobs (i.e. who occupy jobs that do not require a university degree) are disproportionately likely to have low literacy skills.

iii. The Gap between Wages and Labour Productivity

Another perspective on the inclusiveness of Canadian innovation and growth is provided by examining the extent to which labour productivity growth translates into wage growth. Uguccioni (forthcoming) computes the gap between labour productivity growth and median wage growth in Canada over the 1976-2014 period and decomposes it into four components: wage inequality, changes in labour's share of aggregate income, changes in labour's terms of trade (i.e. the growth of consumer prices relative to the GDP deflator), and measurement discrepancies between data sources.

Between 1976 and 2014, labour productivity grew by 1.12 per cent per year while median real annual earnings *declined* by 0.13 per cent per year (Table 8). Thus, the gap was 1.25 per cent per year. Of this gap, 0.53 percentage points were attributable to rising inequality, as captured by the gap between the median and mean real wage. A decline in labour's share of aggregate income accounted for a further 0.31 percentage-points of the gap, and a deterioration of labour's terms of trade for another 0.2 percentage points. Measurement discrepancies accounted for the remainder.

Table 8: Decomposition of the Productivity-Wage Growth Gap, Canada, 1976-2014

	Labour Productivity	Median Annual Real Earnings	Gap	Measurement	Inequality	Labour Share	Labour's Terms of Trade
	Per cent per year			Percentage-point contribution to the gap			
1976-2014	1.12	-0.13	1.25	0.22	0.53	0.31	0.2
1976-1981	0.9	-0.9	1.8	0.62	-0.41	0.76	0.92
1981-1989	0.94	0.16	0.78	-0.03	0.15	0.19	0.48
1989-2000	1.51	-0.36	1.87	0.23	0.92	0.48	0.24
2000-2008	0.89	0.62	0.27	0.32	0.2	0.29	-0.55
2008-2014	1.12	-0.45	1.57	0.07	1.52	-0.2	0.18

Source: Uguccioni (forthcoming).

The period since 2008 has been characterized by a large gap of 1.57 per cent per year between labour productivity growth and median real annual earnings growth, driven almost entirely by rising inequality.

IV. The Role of the Policy Environment in Inclusive Innovation

In this section, we discuss the role of the policy environment in facilitating robust and inclusive innovation. We do not provide an exhaustive analysis of Canada's current performance in the policy domains relevant to inclusive innovation.[26] Instead, we adopt a narrow focus on the potential role of policy reform in facilitating inclusive innovation along lines consistent with the Government of Canada (2016) areas for action.

Inclusive innovation requires that opportunities for participation in innovation be broadly available and that the benefits of innovation be broadly shared. We consider a number of innovation policy reforms through the lens of this dual emphasis. Policies that would facilitate both innovation and inclusiveness have a strong case for implementation. Policies that might promote innovation at the expense of inclusiveness would require that the trade-off be managed or mitigated.

We first consider three categories of supply-side innovation policy: education and training; place-based policies to promote industrial clusters; and financing and support for entrepreneurs and small businesses. We then touch upon regulatory and competition policy and public investment. The section ends with a brief and more general discussion of the macroeconomic underpinnings of inclusive innovation and growth, including macroeconomic stabilization policy and the tax and transfer system.

[26] A recent CSLS report by Drummond *et al.* (2015) offers exhaustive analysis of Canada's recent performance in many policy areas related to inclusive economic growth such as public investment, infrastructure, R&D, education, and labour market policy. That report makes a large number of policy recommendations intended to facilitate inclusive economic growth, many of them tied, directly or indirectly, to innovation and technical change.

A. Education and Training

The skill bias of technical change in recent decades has increased economic inequality between skilled and unskilled workers, and therefore increased the importance of skill upgrading for economic inclusiveness (Goldin and Katz, 2008). This pattern is likely to accelerate in the future with the advent of 'smart' technologies that will displace human labour in increasingly complex tasks (Autor and Dorn, 2013; Brynjolfsson and McAfee, 2012).[27] In this context, inclusive growth will require increasing the skills of Canadians, especially those who are now in the lower part of the skill distribution.

Fortunately, there is no necessary trade-off between inclusiveness and innovation when it comes to education and training policy. A highly skilled population is an important facilitator of both inclusiveness and innovation. Although there is surprisingly little empirical evidence establishing a direct link, few doubt that innovation is more likely to occur when the labour force is highly skilled.[28] Moreover, a wide variety of skills are necessary for a well-functioning inclusive innovation system. That is the key point we make in this section.[29]

What Skills Do We Need?

Much of the discussion about the role of education in the innovation system has emphasized the need to increase the number of students who obtain STEM degrees and PhDs. These forms of training are positively associated with measures of innovative activity across advanced economies, and Canada performs poorly along both dimensions.[30] Nevertheless, evidence does not support making this a top policy priority. In a recent and comprehensive report on STEM skills in Canada, Dodge *et al*. (2015) found no evidence for an imbalance between supply and demand in the Canadian market for STEM skills.

From an inclusiveness perspective, however, there is room to remove barriers that may impede the success of persons from marginalized groups in STEM and PhD degree programs and post-degree career paths. A recent expert panel of the Council of Canadian Academies identified barriers to the success of women as research scientists. These included socialization and

[27] The replacement of human labour by machines is not a new phenomenon. Indeed, the gradual escape from toil by means of labour-saving technology, as manifested by rising labour productivity, has been the quintessence of humanity's material progress. In the past, the labour freed up by technological change has tended (in the long term) to find alternative uses at higher productivity levels, so that living standards have generally risen. History suggests that this pattern may continue, but there is no guarantee -- especially as technology takes over highly complex tasks, such as driving, medical diagnostics and speech recognition, once thought to be beyond the capabilities of machines. Brynjolfsson and McAfee (2012) point out that the horse once had enormous economic value, until the internal combustion engine rendered it obsolete. With the spread of cars and tractors, the competitive wage of the horse fell below the cost of subsistence and the population of horses plummeted. For humans, continuous skill upgrading has been a key to avoiding a similar fate. But as Goldin and Katz (2008) point out, we are at risk of falling behind in the 'race between education and technology.'

[28] In part, this reflects measurement difficulties. More research on the measurement of skills and innovative outputs (as opposed to inputs, such as R&D spending), and on establishing the connection between them, is warranted.

[29] In Appendix B, we provide a more detailed discussion of the education system through the lens of inclusive innovation.

[30] Among 17 advanced economies in 2011, Canada ranked tenth in the share of STEM graduates in total university graduates and 17th (i.e. dead last) in PhDs per capita (Conference Board of Canada, 2011).

stereotypes during youth, a lack of role models and mentors, subtle biases in university institutional practices, a salary gap (especially among non-white female researchers), and the difficulty of balancing work and family life while trying to make tenure (Marsden *et al*., 2012). A Council of Graduate Schools report on PhD completion by underrepresented minorities in the United States identified a lack of preparedness, insufficient support from dissertation advisors, and a lack of cultural sensitivity and inclusiveness in academic departments as barriers (Sowell *et al*., 2015). University administrators (and the K-12 education system, to be discussed below) should take steps to remove these and other barriers.

It is important to remember that people with advanced STEM skills are not the only people who can contribute to an innovation process. Even within formal R&D labs, technicians and tradespersons play a role on the development side (Toner, 2011). In 2011, the share of R&D-performing firms that employed technicians or technologists for in-house R&D tasks was 52 per cent, not drastically lower than the shares that employed non-PhD graduate degree holders or undergraduate degree holders (59 per cent and 62 per cent, respectively) (Jenkins *et al*., 2011).

Beyond formal R&D, a wide range of skills play a role in innovation. A list of innovation-relevant skills provided by OECD (2011c) includes basic literacy and numeracy skills, technical skills, generic skills (e.g. problem solving, creativity, or critical thinking), management skills, entrepreneurial skills, and soft skills (e.g. conscientiousness, work ethic, or emotional intelligence). To this list, the Conference Board of Canada (n.d.) adds risk assessment and risk-taking skills, relationship building and communication skills, and implementation skills. The Conference Board of Canada (2014) further emphasizes commercialization skills, which include skills in the areas of management, capital-raising, networking, and sales and marketing.

Firms need all these skills at different stages of the innovation process. Thus, in developing a policy agenda to (in the words of Government of Canada, 2016a) "equip our young people with the right skill sets for the economy of the future," it is important not to take too narrow a view of what these skill sets should include.

For example, the most compelling evidence on the importance of skills for innovation and productivity growth pertains not to technical skills but to management skills. Bloom *et al*. (2012) show that the superior management practices of U.S. multinational firms in Europe explain why those firms experienced higher productivity from information technology after 1995 while other firms operating in Europe did not. Other studies showing a strong link between managerial quality and firms' productivity include Bender *et al*. (2016), Bloom *et al*. (2015) and Bloom *et al*. (2013). Better management is associated with improved productivity, profitability, growth and survival for firms. Andrews and Westmore (2014) and Saia *et al*. (2015) show that, among OECD countries, managerial quality is an important facilitator of technology adoption and productivity convergence. Canadian researchers in the life sciences cite a lack of managerial skills as a barrier to the commercialization of university research (Galushko and Sagynbekov, 2014).

Canada performs well according to measures of average managerial quality.[31] However, two caveats warrant attention. First, there is substantial variation in managerial quality across firms. This implies that there is plenty of room to improve management quality in Canada either through increased market competition (which facilitates the reallocation of market share toward firms with better management), improved manager training, or the sharing of management best practices to raise the quality of low-performing managers. Second, while average managerial quality tends to be higher in foreign-owned firms than in domestically-owned firms within most advanced economies, that differential in quality is larger in Canada than in most of its peer countries (Van Reenen, 2015). Finding ways to train better managers and adopt the best management practices from leading firms would help close that gap and yield benefits in terms of productivity and technology adoption.

In any case, the point is that a wide variety of skills and talents play a role in an innovation system. From an inclusiveness perspective, this is a good thing. Not everyone has to have a STEM PhD in order to participate in an inclusive innovation system.

At all levels of education and training, education should help students to develop skills and attitudes transferrable to the world of innovation. These include the advanced STEM skills associated with high-tech innovation, but also applied technical skills acquired through colleges and management skills acquired through business programs.

Many businesspeople and analysts have suggested that there may be some value in finding ways to incorporate entrepreneurship and innovation in the education system. The Canadian Chamber of Commerce (2014) recommends studying existing entrepreneurship programs at post-secondary institutions and expanding those that prove effective at fostering students' subsequent entrepreneurial and innovative activities. They also recommend expanding co-op and entrepreneurial apprenticeship programs for business students to allow them hands-on experience in innovation. In a similar vein, Ernst and Young (2016) advocates finding ways to integrate entrepreneurship training into education from elementary to post-secondary, with an emphasis on STEM. Institute for Competitiveness and Prosperity (2016) recommends educational programming to promote entrepreneurial culture.

These ideas are worth considering. From an inclusiveness perspective, the provision of such programming in public schools could facilitate the development of entrepreneurial skills among marginalized segments of the population who might otherwise have had no access to the world of entrepreneurship. That being said, so far there is no strong evidence base to support the efficacy of such programs. Thus, programs should undergo rigorous evaluation before being scaled up.

A final point: high-quality and accessible labour market information (LMI) is a key component of an inclusive skill development agenda, since it is LMI that allows students and workers to make informed choices about their investments in skills. Drummond and Halliwell

[31] Canada ranks fifth out of 35 countries in overall management score in the World Management Survey, behind the United States, Japan, Germany and Sweden (Bloom *et al.*, 2014). Canada ranks eighth out of 156 countries in the World Economic Forum (2014) 'reliance on professional management' indicator, a measure of managerial quality used by Andrews and Westmore (2014).

(2016) point out that while much high-quality LMI exists in Canada, it is often fragmented and difficult to access. They offer a number of recommendations to improve Canada's LMI system.

B. Place-based Policies to Create Clusters

Support for Clusters

One of the areas for action specified by the Government of Canada (2016a) is to create "world-leading clusters and partnerships." The Government explains, "The goal is to make significant targeted investments in these clusters so that Canada can attract the best ideas, brightest talent and smart capital necessary for success."

Enrico Moretti, a leading expert on urban economics and industrial agglomeration, devoted a chapter of his recent book to the issue of whether policy can reliably create innovative clusters (Moretti, 2012). He concluded that it cannot. The innovation hotbeds of today – Silicon Valley, Seattle, and so on – emerged where they did not because of policy, nor because of the presence of elite universities or a young 'creative class.' Rather, they emerged because of good luck: a few innovators of particular importance happened to live in those cities and an innovation ecosystem built up around them. Once it exists, a cluster tends to persist because of the self-reinforcing forces of agglomeration. But there is a fundamental chicken-and-egg problem. Moreover, an emerging cluster can collapse if its central firm fails before the cluster has become robust enough to persist without it.

The rationale for using policy to *create* clusters is that government, through a large initial investment, can help overcome this chicken-and-egg problem among private actors. Once the cluster exists, the forces of agglomeration should make it self-sustaining. Sulzenko (2016) has suggested that government should support clusters after they have emerged, but no details are provided about how this could be done or why it would be desirable.

It is unclear whether place-based policies can enhance aggregate welfare through an agglomeration channel. Kline and Moretti (2014a) find that the investments associated with the Tennessee Valley Authority (TVA) in the United States led to agglomeration benefits in manufacturing in the localities that received investments, but that these were offset by losses in the rest of the country so that the agglomeration channel contributed nothing to aggregate welfare.[32] More evidence is needed to determine whether the high tech sector differs from the manufacturing sector in this regard. Kline and Moretti (2014b) sum up the current state of our knowledge as follows: "[The] presence of agglomeration economies does not imply that every state or country should attempt to generate a Silicon Valley equivalent from scratch via spatially targeted subsidies. … [At] this time, economists do not have enough information to reliably suggest strategies that can raise aggregate welfare via agglomeration forces."

[32] Note that this is different from the question of whether large government investments in infrastructure and industrial capacity can improve welfare through direct productivity enhancement. Moretti and Kline find that the TVA did accomplish this. But this is unrelated to clustering.

What Can Be Said for Policy to Create Clusters?

It is not obvious that the government should make the development of innovative clusters in specific locations a major policy priority as part of an innovation agenda, given the lack of evidence to support the effectiveness of such policy. If the government is intent on doing so, however, then what findings from the research literature may be relevant?

In a classic study, Bresnahan *et al*. (2001) studied the history of high tech clusters around the world. They found that the preconditions for the development of a cluster in the high tech sector include firm-building capabilities, managerial skills, the presence of a large supply of skilled workers, and connection to markets. It may be that the best government can do is to facilitate the development of these preconditions via education and regulatory policies of the kind discussed elsewhere in this report.

In a study of clusters in Ontario, the Institute for Competitiveness and Prosperity (2016) essentially agrees with this conclusion. Although their rhetorical framing is more favourable to a cluster-based policy approach than ours is, they acknowledge that their analysis "buttresses traditional policies designed to boost regional competitiveness by emphasizing foundational elements that underpin a competitive business ecosystem." Their policy recommendations -- focused mainly on investment in infrastructure and skill development and the relaxation of foreign direct investment restrictions -- are consistent with the "old fashioned" policies emphasized by Bresnahan *et al*. (2001). They also recommend the establishment of industry-led networking forums in which cluster stakeholders can form collaborative relationships. There is nothing to object to in this idea.

A more speculative policy idea is based on the fact that the arbitrary location choices of innovative entrepreneurs and star scientists help explain the development of clusters. Zucker *et al*. (1998) and a substantial follow-up literature show that the timing and location of new biotechnology firms in the United States is determined by the presence of ‘star scientists’; that is, scientists who have made (and are continuing to make) significant discoveries in the basic science underlying biotechnology (e.g. genetic sequencing). Queenton and Niosi (2003) find similar results using data on Canadian scientists and biotechnology firms. Zucker and Darby (2007) find evidence that star scientists may have similar effects in other high tech fields; when star scientists make fundamental discoveries, firms using technology related to their discoveries tend to form in their geographic proximity.

It is possible for policy to influence the location decisions of star scientists. Moretti and Wilson (2014) show that biotechnology subsidies and R&D tax credits provided by U.S. states increase the number of star scientists who locate in those states, and that this leads to significant spillover benefits to the local economy in terms of job growth in the non-traded sector. (They find mixed evidence on whether these gains are offset by losses in nearby states.)

Policies to attract star scientists to a specific location might be a way to raise the likelihood of a high tech cluster emerging in that location. Tax incentives like those studied by Moretti and Wilson (2014) are one possibility. Subsidies to help universities offer very high

salaries to star scientists from other localities might be another.[33] This could improve the quality of Canadian science (since star scientists make other scientists more productive) and, if we get lucky and one of the scientists generates very valuable ideas, could lead to the emergence of a cluster. Before taking this idea seriously, it would be prudent to study whether Canada's existing incentives for R&D, already quite generous, have attracted any star scientists. It would also be useful to rigorously evaluate the Canada Research Chairs program in terms of its impact on innovation.

Clusters and Inclusiveness

Beyond questions about their effectiveness, policies aimed at promoting clusters pose a potential trade-off between the goals of innovation and inclusion. On one hand, a cluster in an innovative sector like software development can deliver a high rate of innovation as the firms in the cluster benefit from the spillover benefits of knowledge sharing. On the other hand, the geographic concentration of the successful cluster implies an increase in economic inequality across space and tends to be associated with an increase in economic inequality within the city itself. The city with the cluster grows wealthy, while other cities do not. Within the cluster city, workers with the skills to work in the cluster can earn high wages, while those without the required skills may be priced out.

Martin *et al*. (2015) provide quantitative evidence on these effects using city-level data from the United States. They show that cities with a greater share of employment in industry-occupation categories associated with the high-tech sector tend to have high scores on measures of innovative activity and high average wages relative to other cities. Indeed, workers in all of their employment categories (not just the high-tech workers) have higher wages in those cities. However, those cities also have greater income inequality and, crucially, significantly higher housing costs. When wages are adjusted for housing costs, workers in the low-wage employment categories (i.e. those who perform relatively routine tasks in their jobs) are actually worse off in those tech-hub cities. Summarizing similar research findings, Florida (2013) concludes that

> [on] close inspection, talent clustering provides little in the way of trickle-down benefits. Its benefits flow disproportionately to more highly-skilled knowledge, professional and creative workers whose higher wages and salaries are more than sufficient to cover more expensive housing in these locations. While less-skilled service and blue-collar workers also earn more money in knowledge-based metros, those gains disappear once their higher housing costs are taken into account.

If the government did succeed in facilitating the creation of an innovative cluster, there would likely be implications for economic inequality. In addition to income redistribution through taxes and transfers to mitigate these effects, important measures to promote economic inclusiveness in the presence of innovative clusters should include urban zoning regulations that facilitate the expansion of the local housing supply. Green *et al*. (2016) show that Canadian cities with more restrictive land-use regulation experienced slower housing supply growth between

[33] It might be necessary to hire multiple star scientists at once, since they tend to be more productive in groups. Zucker and Darby (2007) find that star scientists tend to migrate in order to cluster together.

2006 and 2011, and a substantial literature starting with Glaeser and Gyourko (2002) establishes that restrictive urban land-use regulation leads to high housing costs.

Another important policy to promote inclusiveness within cities is investment in public transit, so that workers living in all areas of the city can access available jobs opportunities. The federal government could offer financing for such investments subject to the requirement that lower orders of government relax unduly restrictive land-use regulations and explore other options for affordable housing. Such policies would facilitate the inclusion of low-income people in the benefits that a successful innovative cluster could bring to an urban area, effectively acting as a redistribution of resources from homeowners to renters and from car owners to public transit riders (Moretti, 2012). The so-called NIMBYism of the wealthy members of an urban community can pose a political barrier to such policies.[34]

C. Support for Entrepreneurship and Firm Growth

The Financial Environment

Perceptions differ on the question of whether Canada's financial environment for start-ups and growth-oriented firms is sufficient to support robust and inclusive innovation. Venture capital (VC) financing in Canada reached a ten-year high in 2015, but it remains only between one half and one third of the level of U.S. venture capital financing on a per capita basis (Florida and King, 2015). Some commentators regard this as a sign of poor performance on the part of the Canadian VC industry, and of the financial system broadly (Sulzenko, 2016).

On the other hand, Ernst and Young (2016) rates Canada first among the G20 countries in terms of access to finance for digital entrepreneurs, essentially tied with the United States. The Ernst and Young report underscores the point that VC financing is not the only aspect of the financial system that matters for entrepreneurs in the innovative technology sector. The United States does significantly outperform Canada (and all other countries) on the Ernst and Young risk capital indicator, but the overall indicator of financial conditions also includes measures of lending conditions and the quality of financial regulation. Canada is among the highest performers in all three areas.

Even when it comes to risk capital, one's judgment about the adequacy of Canada's VC performance will depend on the degree to which one focuses on the United States as the relevant comparator. The share of GDP devoted to VC funding in 2014 was 0.28 per cent in the United States, 3.5 times larger than Canada's VC share of 0.08 per cent. However, the United States is a special country. Table 9 shows the VC shares of GDP for selected OECD countries in 2014.

Israel and the United States are extreme outliers, with shares of 0.38 and 0.28 per cent, respectively. Among the remaining countries, Canada in fact has the *largest* total VC share. In both early-stage and later stage funding, Canada more than doubles the average performance of its peer countries once Israel and the United States are excluded.

[34] See the comments of J. Bradford DeLong in Brookings Institution (2016).

Sulzenko (2016) uses the comparison with the United States to label venture capital in Canada an "infant industry." This only makes sense if one thinks that Israel and the United States are the only countries in the world with "mature" VC industries. Canada's national commitment to VC funding is not small compared to other comparable countries.

What about the allocation of VC funding across projects? Members of Canada's business community often assert that there is a shortage of later-stage funding to help businesses expand and commercialize their ideas. In a recent survey, Canadian entrepreneurs noted that there are several programs designed to support start-ups and initial innovation but few to support commercialization (Canadian Chamber of Commerce, 2014). Entrepreneurs surveyed by the Canadian Chamber of Commerce (2014) made a similar point, and academics cite a lack of

Table 9: Venture Capital as a Share of GDP, Selected OECD Countries, 2014, Per Cent

	Venture Capital as Share of GDP (Per Cent)		
	Seed/start-up/early stage	Later stage venture	Total
Israel	0.270	0.113	0.383
United States	0.095	0.189	0.284
Canada	0.046	0.036	0.082
Sweden	0.031	0.035	0.066
Finland	0.042	0.019	0.060
Japan	0.032	0.006	0.038
United Kingdom	0.018	0.020	0.038
Norway	0.015	0.017	0.031
France	0.014	0.015	0.029
Belgium	0.015	0.013	0.028
Netherlands	0.019	0.007	0.026
Denmark	0.022	0.004	0.026
Germany	0.014	0.008	0.023
Australia	0.007	0.011	0.018
Spain	0.005	0.005	0.009
Italy	0.002	0.001	0.002
Average	0.040	0.031	0.072
Average Excluding Israel and United States	0.020	0.014	0.034

Note: Figures are for 2013 for Japan and for 2014 for all other countries.
Source: OECD (2015e), Figure 7.1. Venture capital investments as a percentage of GDP.

available funding as a barrier to the commercialization of academic discoveries in the life sciences (Galushko and Sagynbekov, 2014).

These claims are difficult to square with the data on the allocation of VC funding in Canada. In Ontario (which accounts for the bulk of Canadian VC funding), expansion and later-stage funding accounted for 67 per cent of total VC funding in 2015, compared to 32 per cent in comparable U.S. states (Institute for Competitiveness and Prosperity, 2016). Combined with Canada's high overall level of VC funding, these figures do not suggest a serious shortage of later-stage funding.

For an inclusive innovation system, we care not only about the level of entrepreneurship financing but also its accessibility. In geographical terms, Canadian VC funding is highly concentrated in a small number of cities in Ontario, Quebec and British Columbia, while the rest of the country receives relatively little (Canadian Venture Capital and Private Equity Association, 2016). This reflects the fact that VC investors are part of an economic ecosystem that tends toward geographic clustering due to agglomeration forces. (VC funding is highly spatially concentrated in the United States as well.) Thus, the geographic concentration of VC funding poses challenges for inclusiveness that are similar to the challenges associated with clusters, which we discussed earlier. Policymakers should not necessarily seek to change the spatial allocation of VC, but they should be aware of the implications for regional inequality.

Hard data on the demographic composition of Canada's tech sector are not readily available, but anecdotal evidence suggests that the sector is largely male and less ethnically diverse than the population as a whole.[35] Small business owners in Canada tend to be middle-aged males with above-average levels of education (Fisher and Reuber, 2010). Young people and those with lower incomes and education levels have more difficulty accessing credit and financial services generally (Reynolds and Novak, 2011).

To the extent that this reflects differences in skills, it underscores the need to promote the development of skills for participation in innovation. If it reflects financial frictions that limit some entrepreneurs' access to financing, the relaxation of those constraints could enhance the inclusiveness of Canadian entrepreneurship and innovation. Evidence from other countries suggests that financial constraints do matter for entrepreneurial activity. For example, recent evidence suggests that fluctuations in house prices lead to changes in business start-up activity via a collateral channel.[36] This evidence suggests that, on the margin, entrepreneurs are constrained in their ability to finance investments that they regard as worthwhile.

Policies to encourage a general loosening of financial conditions relative to the status quo would probably do more harm than good. This is true from the perspective of both growth and inclusiveness. For OECD and G20 countries, Cournede and Denk (2015) find that "too much

[35] See, for example, Hughes (2015) and Burgmann (2016).

[36] See Decker (2015) and Corradin and Popov (2015) for the United States, Schmalz *et al.* (2015) for France, and Connolly *et al.* (2015) for Australia. A contrary view is provided by Kerr *et al.* (2015). Using U.S. data, they argue that the connection between house prices and entrepreneurship works mainly through demand effects rather than a collateral channel.

finance" slows economic growth.[37] Moreover, the expansion of finance tends to increase economic inequality because high-income people are better able to exploit the associated investment opportunities and the financial sector itself pays high wages compared to those earned by similar workers in other sectors (OECD, 2015d).

Supporting Entrepreneurs and Small Enterprises for Inclusive Growth

There is an emerging view that policy should target financial support toward innovative and high-growth firms rather than provide support to small enterprises in general, most of which are unlikely ever to grow large or to innovate. This approach has been advocated by various authors in recent years (e.g. ICAP, 2012; Herman, 2013; Carey *et al*., 2016), and it is consistent with the Government of Canada (2016a) area for action on growing companies and accelerating growth.

The key challenge is in identifying the firms that are likely to grow large and achieve success in innovation. Existing research sheds light on this problem. Among Canadian firms, profitability outperforms current growth as a predictor of subsequent growth (Industry Canada, 2012). This is true whether growth is defined in terms of employment, revenues or assets. Firms that go on to experience high growth are also more likely to be R&D intensive and export-oriented (Herman, 2013). Evidence from the OECD confirms the notion that high-growth firms are likely to be export-oriented, to conduct R&D and to hold intellectual property (Audretsch, 2012). High-growth firms also tend to be established firms with several years of operating history (Herman *et al*., 2013).

These facts provide a starting point for identifying which firms should be targeted for support. In Canada, such growth-oriented firms account for a small share of small- and medium-sized enterprises (SMEs).[38] Further research on the characteristics of high-growth firms in Canada would be useful.

The fact that high employment growth and high propensity to innovate seem to go together among SMEs is an advantage from the perspective of economic inclusiveness. While the main purpose of an innovation policy agenda is to promote innovation and productivity growth, job creation can be a way of spreading the gains from innovative firms throughout the population. Fortunately, the financing of growth-oriented firms is an area in which the goals of innovation and employment growth can be aligned. The literature on small business dynamism shows that growth-oriented small businesses (and not small businesses generally) are key drivers of both employment growth and innovation.[39]

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[37] In particular, expansions of credit beyond a certain point lead to slower economic growth through a number of channels including deteriorating loan quality, the emergence of 'too big to fail' subsidies to large credit suppliers, and a disproportionate increase in credit to households rather than to businesses. That last point may be of particular relevance to Canada.

[38] Firms that experience high growth in terms of revenues and employment accounted for 4.7 per cent of Canadian SMEs between 2003 and 2006 (Industry Canada, 2012). 'Innovative SMEs' that allocate at least 20 per cent of their investment expenditures to R&D accounted for 4.2 per cent of Canadian SMEs in 2004 (Wang, 2009).

[39] See Bravo-Biosca *et al*. (2013) and Criscuolo *et al*. (2014) for evidence from OECD countries, and Davis and Haltiwanger (2014) and Decker *et al*. (2016) for evidence on the United States. An important finding from this literature is that the prevalence of high-growth young firms has been declining since around the year 2000.

Using data from OECD countries, Bravo-Biosca *et al*. (2013) study the effects of a number of policy instruments on the firm growth distribution. They find that well-developed financial systems, higher competition in the banking sector and better contract enforcement are associated with greater business dynamism; that is, with more high-growth firms and faster resource reallocation. They find that strong employment protections and generous fiscal incentives for R&D are negatively associated with business dynamism.

That last result suggests that a general policy of financial support for R&D may tend to favour large incumbent firms more than high-growth SMEs. Bravo-Biosca *et al*. show that, across the OECD, supports for R&D are associated with faster employment growth among larger incumbents but with lower dynamism, lower MFP growth and lower aggregate employment growth.

Whether this is true in any given country may depend on the details of the country's R&D support system. Policy must be carefully designed so that it does not impose barriers to the growth of small growth-oriented firms. In terms of providing support to such firms, useful policy reforms might include a shift from R&D tax credits to direct subsidies or matching funds. Jenkins *et al*. (2011) pointed out that Canada's R&D support system is heavily weighted toward tax credits and that this should be changed. Canada's support system for R&D builds in significant preferences for small firms. At the margin, the federal subsidy for R&D for small and large firms averages 30 per cent and 13 per cent, respectively. Both the level of the subsidy for small firms and the gap between the subsidies for small and large firms are among the highest in the OECD (Carey *et al*., 2016). And this does not account for the additional effects of provincial subsidies.

Analyses of the relevant market failures suggest that there is no strong case for subsidizing small firms on the basis of their smallness *per se* (Institute for Competitiveness and Prosperity, 2012; Carey *et al*., 2016). Instead, policy should provide incentives for SMEs to pursue growth and to adopt an international orientation. Herman *et al*. (2013) identify a lack of such incentives as a major barrier to business growth in Canada. Aspects of federal and provincial tax systems that advantage small firms should be reformed so that they do not penalize growth. This was mentioned as a major barrier by the entrepreneurs surveyed by the Canadian Chamber of Commerce (2014). Carey *et al*. (2016) report that the combined federal and provincial tax rate on business income is 14.7 per cent on income below $500,000 and 26.8 per cent on income above $500,000.

The 2016 federal budget included plans to help innovative, high-growth firms to scale up and to pursue an international orientation. The plan is to provide firms with advice, financing and technical support toward those ends. This is a good first step. Any programs put in place under this plan should be subject to rigorous evaluation to determine their effectiveness. If they are shown to be effective, then a good next step would be to scale back policy supports for SMEs in general and channel the resources into the programs targeted at promoting innovation, international orientation and growth.

D. Regulation, Institutions, and Competition

One of the most important things policy can do to foster inclusive growth is to set up 'rules of the game' that ensure that markets are competitive and that firms' incentives are aligned in the direction of socially valuable innovation. Discussing societies that have built relatively inclusive innovation systems, Heeks *et al*. (2013) assert that "[effective] policies are typically foundational around trade, competition, business: 'it is only a slight exaggeration to conclude that the policies which have fostered inclusive innovation in these cases are not centrally about either inclusivity or innovation.'"

In this subsection, we first address 'traditional' market-oriented regulatory and institutional reforms. Canada has already undertaken many such reforms in recent decades, but we identify a few areas in which additional reform might yield benefits in terms of innovation and economic inclusiveness. These include reducing the regulatory protection of incumbents, reducing barriers to trade and investment in certain sectors, and improving the speediness and accessibility of Canada's legal system. At the end of the subsection, we discuss new regulatory challenges that might arise with the advent of the 'digital economy.'

Further Deregulation to Increase Competition

In recent decades, Canadian policymakers seeking to improve the country's productivity growth performance have implemented market-oriented policy reforms intended to increase competition and create incentives for innovation. As a result, Canada's regulatory environment is not restrictive along most dimensions by OECD standards.[40] Nevertheless, Canada's productivity performance has been poor. The coincidence of pro-market reforms and poor productivity growth has been described as a paradox (Sharpe, 2010).

This past experience makes us skeptical that additional market-oriented regulatory reform will have a large impact on innovation, but that does not mean regulatory improvement should not be undertaken where opportunities exist. Our review of the evidence suggests two key areas for improvement, which we address in turn.

The first opportunity for improvement is that regulatory protection of incumbents is above the OECD average in Canada. This is attributable to Canada's use of antitrust exemptions and barriers in network sectors. Regulation that protects incumbent firms is harmful in terms of innovation because protected firms have less incentive to innovate. It is harmful in terms of economic inclusiveness in two ways. First, it inhibits wider participation in innovation by placing barriers in the way of entrepreneurs who wish to enter protected sectors. Second, firms that are protected from competition are able to use their market power to charge high prices. The effects of this are felt most by low income households.

[40]According to OECD product market regulation indicators, Canada is at about the OECD average in terms of overall product market regulation, and better than average in public ownership and barriers to entrepreneurship. In terms of labour market regulation and the timeliness of bankruptcy resolution, Canada is among the top performers in the OECD (Carey *et al*., 2016). According to the Fraser Institute's Economic Freedom Index, Canada ranked fifth out of 159 countries and territories in 2014 in terms of economic freedom, behind Hong Kong, Singapore, New Zealand and Switzerland (Gwartney *et al*., 2016).

The second opportunity for improvement is that Canada imposes barriers to trade and investment in certain sectors that are more restrictive than the OECD average. This is due in part to barriers to foreign investment. Canada' barriers to foreign direct investment are third-highest in the OECD and, by a wide margin, the widest among the G7 (Institute for Competitiveness and Prosperity, 2016). Canada's poor performance is driven by severe equity restrictions and by an arduous screening and approval process. High barriers to foreign investment reduce competitive pressure on Canadian firms and inhibit the transfer of foreign technology into Canada.

Barriers to competition in network sectors are especially destructive, so we will pursue that in detail as an illustrative example of a case in which further deregulation could prove fruitful for inclusive innovation. Network sectors include energy, telecommunications and broadcasting, and transportation. OECD (2014a) stresses the importance of these sectors for inclusive growth because they form the network infrastructure that marginalized people need in order to seize economic opportunities.

The telecommunications sector is of particular relevance for the Government's aim of preparing Canada to compete in the digital economy. Evidence surveyed in CSLS (2013) reveals that access to broadband has a significant positive effect on economic development. Canada's performance in broadband internet quality and accessibility is not terrible, but there is room for improvement. In terms of broadband penetration, fixed broadband subscriptions per capita in Canada were slightly above the OECD average in 2014, although few subscriptions were in the highest speed tiers compared to comparable countries (Luu, 2016). Although it deemed Canada's digital business environment to be good overall, Ernst and Young (2016) found that Canada's digital infrastructure was below the G20 average.

Broadband internet in Canada is of slightly above average quality relative to other OECD countries, as measured by average connecting speed. Canada's average connection speed in 2014 was 9.7 Mbits/s, compared to an OECD average of 8.8 Mbits/s and an average of 9.2 Mbits/s for the fourteen 'peer countries' listed in Table 1 earlier.[41] (The fastest average speed was 23.6 Mbits/s in Korea.) Canada's broadband prices, however, are among the highest in the OECD. Fixed broadband subscriptions ranged from $37.0 to 173.7 per month in Canada in 2014 (in PPP-adjusted US dollars). These were the fifth highest entry-level prices in the OECD and the sixth highest high-end prices.[42] The OECD average entry-level price was $28.8.

It may be that Canada's high prices and average quality in part reflect the difficulty of providing network infrastructure for a large and sparsely populated country. It is also true that increased competition in the sector could deliver improvements in quality and accessibility. Canada imposes restrictions on foreign entry in telecommunications that are severe relative to the rest of the OECD. The removal of these restrictions has been recommended by Luu (2016). The effect of decreased foreign ownership restrictions on the quality and price of broadband

[41]The figures in this paragraph are from the OECD Broadband Portal. Connection speeds are 'Actual download speeds, fixed or unspecified broadband, Akamai.' Prices are 'Fixed broadband subscription price ranges, September 2014, all platforms, logarithmic scale, USD PPP.'

[42] In Korea, which has the fastest average speed among OECD countries, the high-end price of $34.0 is below Canada's entry price.

services would depend on whether the change results in greater competition or merely the takeover of Canadian firms by foreign ones with no increase in competition. Estimates by Rouzet and Spinelli (2015) suggest that the elimination of the restrictions would reduce price mark-ups in the sector by eight per cent.

To ensure economic inclusiveness, an important area of focus is First Nations reserves. In 2011, broadband was available on 70 per cent of First Nations reserves in Canada, while 94 per cent of Canadian households had access to connectivity of at least 1.5 Mbits/s (CSLS, 2013). Given the challenges of infrastructural deficits and geographic remoteness faced by many reserves, fast and reliable internet connectivity is of special importance in ensuring the inclusion of residents of reserves in the innovation system.[43] Data limitations make it difficult to assess the importance of internet connectivity for economic growth on remote reserves, but in general connectivity is important as a means of job search and as a facilitator of business activity (Kuhn and Mansour, 2014; Manyika and Roxburgh, 2011).

Efficient and Accessible Legal Institutions

Moretti (2012) notes that local law firms specializing in intellectual property, licensing and incorporation law comprise an important component of an innovation cluster. Survey evidence from Ibrahim (2012) and anecdotal evidence from news media (e.g. Joeveer, 2014; Divon, 2015) suggest that legal services are important to entrepreneurs as they seek to enter regulated markets, introduce new products, and so on. These facts imply that the high cost of legal services may pose a barrier to innovation, and especially to socioeconomically inclusive innovation.

Some indicators suggest that this may be a problem in Canada. As noted earlier, contract enforcement is slow in Canada relative to the OECD average (Carey *et al*., 2016). Among a set of North American and European countries, Canada had the second-highest liability costs as a share of GDP at 1.19 per cent, lower only than the United States at 1.66 per cent (Institute for Legal Reform, 2013). According to the 2015 World Justice Project Rule of Law Index, Canada ranked ninth among fourteen OECD countries in terms of the overall performance of its justice system (Table 10). Canada's particularly poor relative performance in civil law was driven by poor scores on the indicators of accessibility and affordability, freedom from discrimination, and lack of unreasonable delays. Summarizing the evidence on the accessibility of Canada's legal system, Farrow (2014) says that "Access to justice is the most pressing justice issue today." DAS (2014) found that among Canadians who had accessed the legal system within the past five

[43] See Sharpe and Lapointe (2011) for a comprehensive assessment of the role of geographic remoteness in educational and labour market outcomes on reserves.

Table 10: Performance of Legal System, Canada and Selected OECD Countries, 2015

	Canada	Average of Peer Countries	Canada's Rank
WJP Rule of Law Index: Overall Score	0.78	0.79	9
Factor 1: Constraints on Government Powers	0.70	0.75	10
Factor 2: Absence of Corruption	0.81	0.82	9
Factor 3: Open Government	0.75	0.73	6
Factor 4: Fundamental Rights	0.79	0.83	10
Factor 5: Order and Security	0.90	0.86	4
Factor 6: Effective Regulatory enforcement	0.77	0.76	9
Factor 7: Civil Justice	0.70	0.75	10
7.1 People have access to affordable civil justice	0.55	0.63	12
7.2 Civil justice is free of discrimination	0.59	0.73	12
7.3 Civil justice is free of corruption	0.90	0.87	7
7.4 Civil justice is free of improper state influence	0.85	0.83	8
7.5 Civil justice is not subject to unreasonable delays	0.47	0.60	11
7.6. Civil justice is effectively enforced	0.73	0.75	9
7.7 ADRs are accessible, impartial, and effective	0.83	0.81	5
Factor 8: Criminal Justice	0.72	0.73	9

Note: Scores are index numbers on a 0-1 scale, where 0 is the worst score and 1 the best.
Peer countries are the countries listed in Table 1: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, the United Kingdom and the United States.
Source: World Justice Project Rule of Law Index, 2015. See Botero and Ponce (2011) for documentation.

years, only 45 per cent had hired a lawyer to represent them. The most common reasons cited for this had to do with the financial cost.

While further evidence would be desirable, it is plausible that the slowness and inaccessibility of Canada's legal system (relative to those of peer countries) is a barrier to entrepreneurship and innovation.[44]Other aspects of the legal system, such as bankruptcy laws that provide timely resolution and do not excessively punish failure, have been shown to support innovation (OECD, 2013c). More generally, the OECD (2014a) stresses the importance of the rule of law and access to justice as crucial underpinnings of inclusive growth.

Innovations within the legal services sector to enhance the inclusiveness of the legal system would themselves be forms of inclusive innovation. Palumbo *et al*.(2013) find that some measures of innovation within the legal system, such as extent of computerization, were related to better performance. If innovations such as computerization and data tracking in law (and in

[44] The OECD has begun collecting comparable data on characteristics of legal systems, including accessibility (Palumbo *et al*., 2013). Unfortunately, Canada is not in the dataset. In principle, these data can be used to investigate how the functioning and accessibility of the legal system interact with innovation.

other fields such as medicine, etc.) can improve quality and accessibility of services, the inclusiveness of Canada's innovation would be enhanced. Canadian Bar Association (2013) stresses the need for such innovations to enhance the inclusiveness of the justice system.[45]Vickery (2014) discusses the costs and benefits of computerization in the legal system through a case study of a project undertaken by courts in Australia. Digital technology facilitates communication but also drastically increases the volume of information generated and stored during litigation. Whether costs are increased or decreased depends on the way in which new technology is managed. Muller *et al*. (2013) collect examples of legal innovation from around the world and suggest a set of best practices.

Additional Areas for Improvement

Before moving on to discuss the regulatory implications of the digital economy, we touch upon a few additional areas for improvement in 'traditional' regulatory policy.

The Government of Canada (2016a) makes increased Canadian participation in global value chains (GVCs) one of the goals of the inclusive innovation agenda. Regulatory reform can contribute to this goal.

Nott (2016) notes that Canada is a poor performer in terms of the costliness of customs procedures. She also argues that the complexity of import-export regulation and uncertainty about the shifting interpretation of some regulations further impede Canada's integration with GVCs. Simplification and clarification along these lines could be beneficial. Van Assche (2016) also emphasizes regulatory simplification to facilitate Canada's entry into GVCs.

GVC integration is important for technology transfer and the conventional wisdom is that Canada does poorly.[46] Baldwin and Yan (2014) show that manufacturers that participate in GVCs become more productive via technology transfer, consistent with OECD macro evidence. That said, Canada has the offsetting advantage of being located directly beside the country at the technical frontier and being its largest trading partner. OECD research suggests this is a more important determinant of technology transfer than GVC integration (Saia *et al*., 2015).

While evidence suggests that international trade facilitates technology diffusion, we know of no evidence on the impact of internal trade within Canada on innovation or technology diffusion. We are sceptical that the impact would be large, but further research is required. Nevertheless, some estimates suggest that the elimination of interprovincial trade barriers unrelated to geographic distance would increase GDP by $50 to $130 billion, with poorer provinces enjoying larger benefits (Albrecht and Tombe, 2016). This might help to spread the gains from innovation and growth.

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[45] A cynical but economically astute reader might wonder whether bar associations (and other professional associations with regulatory powers over their own markets) have any incentives to pursue innovation in legal services. To the extent that productivity growth would lead to fewer jobs or fewer billable hours in legal services, such associations might prefer to block it rather than embrace it. See Hadfield (2008) for an argument along these lines.

[46] There exist contrary views. Koldyk *et al*. (2016) argue that Canada's alleged lack of participation in GVCs is overstated once one accurately accounts for the true country origins of value added in imports and exports.

Another area in which regulatory policy can play a role is clean technology. The development of clean technology is important both for the sustainability of economic growth and for its inclusiveness. OECD (2014a) notes that marginalized people are more likely to be exposed to pollution and other environmental hazards.

Market-based approaches such as carbon taxation provide firms with incentives to develop carbon-saving technologies and are already being pursued by some provincial governments.[47]Empirical evidence suggests that increases in the relative price of energy inputs lead to the development and adoption of energy-saving technologies (Newell *et al*., 1999; Popp, 2002). The European Union Emissions Trading System increased carbon-saving patents among firms subject to the system without crowding out other patents or innovation by unregulated firms (Calel and Dechezlepretre, 2016). On theoretical grounds, Acemoglu *et al*. (2012) argue that both taxes and targeted R&D subsidies play a role in the optimal policy mix to bring about environmentally sustainable growth.

It is also possible to use non-market regulatory policies, such as efficiency standards, to direct innovative efforts toward the development of clean technology. A sizable body of literature surveyed by Ambec *et al*. (2011) finds that environmental regulation is associated with greater innovation in clean technology. In Germany, for example, building efficiency standards are associated with significant increases in the energy requirements of residential buildings (El-Shagi et al., 2014).

However, market-based approaches should be preferred to command-and-control regulation. In a survey of the evidence, Sustainable Prosperity (2015) find that "flexible" regulations (by which they mean market-based approaches like carbon taxation and cap-and-trade) have a better track record in terms of encouraging clean innovation.

It is often observed that poor people are more vulnerable than affluent people to global climate change. This makes the development of clean technology a crucial aspect of inclusive innovation. It also matters for the estimation of the social cost of carbon, a key input into the setting of carbon prices by regulatory bodies. Denning *et al*. (2015) find that when the heterogeneity of climate change impacts across the income distribution is accounted for in an otherwise standard integrated assessment model of climate and the economy, the estimated social cost of carbon increases dramatically and, hence, the implied optimal emissions abatement strategy becomes much more aggressive.

A government concerned about inclusiveness should keep this in mind when deciding whether it may be advisable to adopt more aggressive emissions reduction targets.

[47] As of the time of writing, the federal government is developing plans for a minimum national carbon price. Provinces will have freedom in terms of how to implement it (e.g. by means of a carbon tax or a cap-and-trade system).

Regulation and the Digital Economy

In the digital economy, *content providers* provide services to *end-users* (i.e. consumers) via intermediating *digital platforms*. Broadly speaking, platforms include both physical infrastructure (e.g. broadband internet cable, cloud computing servers, etc.) and software applications that provide intermediation services (e.g. Airbnb, which matches travelers with vacant lodgings, or Facebook, which provides networking services, disseminates information, etc.). Kenney and Zysman (2015) refer to this structure as a 'platform economy.'

Competition in the digital economy is influenced by two countervailing forces. On one hand, the digital platforms are characterized by network effects and scale economies that tend to promote market concentration. On the other hand, barriers to entry in content provision and in software-based platforms are relatively low. This tends to promote market contestability; new entrants can emerge to compete with incumbents more quickly and easily than was possible in the past (Van Gorp and Batura, 2015). The rise of Uber to compete with traditional taxi services in many cities is a recent example of this new market contestability. The combination of these two characteristics -- strong network effects and high market contestability -- is what distinguishes the emerging digital economy from the old traditional economy.

The regulatory challenges posed by market concentration are not fundamentally new and should be handled by the careful application of traditional competition policy, suitably adapted where necessary. Network effects imply that the domination of some digital markets by a small number of firms is not necessarily undesirable, but regulators must take care to prevent those firms from engaging in anticompetitive behaviour to entrench their dominant status. Strategies that dominant firms could abuse to anticompetitive ends include waging 'price wars' against other firms, using proprietary data formats and interoperability restrictions to 'lock in' consumers, and pre-emptive mergers. Regulators should study the extent to which dominant digital firms use these strategies to anticompetitive ends, though care must be taken because anticompetitive behaviour can be difficult to distinguish from legitimate business strategy.

The contestability of old markets by new digital competitors raises many difficult challenges in terms of the definition of markets and the classification of economic agents. New firms are using digital technology to disrupt old markets in a way that often leads to confusion about whether old regulations are applicable. Hotels are subject to stringent regulation in most cities. Should people's apartments be subject to the same regulation when they rent the apartments on Airbnb? Or should they be subject to tenancy regulation as if they were landlords renting apartments? Or should some new regulatory category be created? Similar questions can be raised about other digital technologies of this sort. (Should Uber be subject to the same regulations as local taxi companies? Are Uber drivers employees or independent contractors?)

Questions such as these are contentious because the choices regulators make can determine the distribution of incomes and rents in the industries as well as the sustainability of the innovators' new business models. A balance must be struck between facilitating innovation and protecting important aspects of the public interest (public safety, workers' rights, etc.). To some extent these are value judgments that must be resolved by public debate. From an inclusiveness perspective, low entry barriers and highly contestable markets should be a positive

development. The implications for inclusiveness of any given business model in the digital economy are, of course, unclear *a priori*.[48]

New digital technologies introduce at least two challenges for intergovernmental policy coordination. The first is that the advent of 'smart' devices and infrastructure will require the development of new regulation (or the decision to let old regulation cover the new technologies). A leading example is the advent of driverless automobiles. Transportation regulation is the responsibility of provincial governments, but it will be important to avoid a piecemeal approach to regulation that might generate transportation frictions across provincial borders. The federal government could play a coordinating role here, and could also help to ensure coherence between Canada's policy and that of the United States.

The second challenge for intergovernmental policy coordination arises from the global scope of new digital platforms. The value of digital platforms such as Facebook, YouTube, and Netflix to consumers, content providers, and advertisers grows larger as the number of users increases.[49] How should national regulatory policies be adjusted so that their benefits to consumers are maximized and their growth is not unduly stifled? For example, country-specific licensing of intellectual property restricts the availability of content on these networks. International coordination to eliminate these restrictions could increase innovation incentives (especially in the arts and entertainment sector) by better exploiting the global reach of the networks.[50]

At the national level, regulation should respond to the changing realities of the digital economy. Canadian content regulation provides an illustrative example of a case in which regulation has not kept pace with technological change. As digital media platforms have proliferated in recent years, Canada's government has continued to promote Canadian artistic and cultural production by means of the imposition of content quotas on traditional television and radio outlets. There may be reasonable arguments for subsidizing Canadian artistic and cultural production, but the current approach is outdated in today's world of global digital media platforms (Dachis and Schwanen, 2016; Katz and Speer, 2016). The current regulatory framework should be replaced by a system of direct subsidies, and Canadian content providers should compete for exposure on today's global digital platforms.

From an inclusiveness perspective, the advent of ever-cheaper recording technology together with media platforms such as YouTube mean that opportunities to participate in cultural

[48] For several years, anecdotal evidence has suggested that African Americans prefer ride-sharing apps such as Uber and Lyft because it allows them to avoid racial discrimination from traditional taxi drivers. See Mudede (2016), for one example of this claim. Recent statistical evidence, however, suggests that drivers for ride-sharing apps also engage in a statistically significant degree of discrimination against customers on the basis of both race and gender (Ge *et al*., 2016). Evidence for discrimination has also been found in Airbnb rentals (Edelman *et al*., forthcoming). Thus, the digital economy is no panacea for problems of economic and social inclusiveness. (Whether these digital platforms involve more or less discrimination than traditional markets is a separate question.)

[49] Their size raises the issue of market concentration, as discussed earlier. A related intergovernmental coordination issue is: what government is responsible for regulating a global network? This is not so different from traditional issues around the regulation of large multinational firms.

[50] This issue has received discussion as part of the European Union's Digital Single Market plans (Van Gorp and Batura, 2015).

production and innovation are more broadly available than ever. This is less true of production for traditional media platforms such as television and radio, which remain the targets of Canadian content regulation.

This discussion has outlined a few examples of regulatory challenges posed by digital technology. The general point is that the basic economics of digital technology are not outside the realm of past experience, but that the disruption of existing markets by digital innovators will require regulators to re-examine the applicability of current regulatory frameworks. Low entry barriers and contestable markets should be conducive to the expansion of economic opportunity, so regulators should be careful not to erect new entry barriers at the behest of incumbent firms. At the same time, digital technology certainly does not eliminate all barriers to economic inclusion.

E. Public Investment

We discussed supply-side support for business innovation earlier. Such tax and regulatory policies focus on creating conditions within which private investors can pursue innovation. An alternative strategy is direct public investment in innovative activity. There are sound reasons to believe that government investment can play a productive role in the innovation system. These include:

1. **Public vs. private time preference:** A large literature suggests that the state should discount the future at a lower rate than private investors do. The patient government should be willing to invest in projects with a long payoff horizon relative to those projects that private investors choose.

2. **Public risk capacity:** If financial market imperfections impede the pooling of risk, private investors may avoid socially valuable projects that they deem to be too risky. Cutting-edge technologies in their early stages of development may fall into this category. Government, with its ability to spread risk across the entire tax-paying population, can enhance innovation by taking on this risk. One effect of this is that government can raise funds at lower rates than private investors can.

3. **Overcoming coordination problems:** Some technologies, especially in network sectors, are characterized by a chicken-and-egg problem: it makes sense for one person to adopt the technology only if many others do so at the same time. In such cases, a large government investment can jumpstart private-sector investment in the technology. Once sufficiently many private actors have invested, private investment becomes self-sustaining.

4. **Reducing uncertainty:** Clear signals from government about the desired path of future technological development, together with credible commitments to support development along that path, reduce private investors' uncertainty about what type of innovation to invest in.

In terms of inclusiveness, public investment in innovation can play two roles. First, economic inclusiveness will be promoted to the extent that the technologies supported by the government themselves facilitate economic inclusion. An example along these lines might be green energy technology, given the unequal burden of the costs of pollution and climate change across the income distribution (Denning *et al*., 2015). Second, government investment can facilitate marginalized persons' access to new technologies directly. Examples might include public spending on broadband infrastructure, on new software and equipment in public schools, or on technologies to enhance productivity in public health care.

Clean Energy Technology

There is a strong case for the development of clean energy technology to have a prominent place in an inclusive innovation agenda. We have already noted the unequal distribution of the projected costs of climate change between rich and poor (Denning *et al*., 2015). More importantly, the development of clean energy technologies will be necessary in order to ensure the sustainability of economic growth in the long term (Popp, 2010).

The Government of Canada (2016a) asked for "market-based approaches to encourage wider adoption of clean technologies by the private sector." A carbon tax is such a policy, and it is good that the Government is proceeding in that direction (and that some provinces have already done so).

When it comes to energy technology, however, the focus in the near term should be on innovation more than on adoption. A 2014study by the Brookings Institution compared the net social benefit per megawatt per year from replacing a coal-fired energy facility with five cleaner technologies: wind, solar, hydroelectric, nuclear, and gas combined cycle. The results indicated that wind and solar (the two technologies usually associated most closely with 'clean energy technology') remain inferior to the others; indeed, wind and solar delivered *negative* net benefits (i.e. were worse than coal) under most parameterizations because their costs, while they have fallen in recent years, remain very high (Frank, 2014).[51]

As argued by Atkinson (2015a), the widespread adoption of clean energy technology is unlikely to occur until the technology is cost-competitive with fossil fuels. As long as clean energy is relatively expensive, countries and firms have a strong incentive to continue using greenhouse gas-emitting energy technologies and free-riding on the emissions abatement efforts of others.

Carbon taxes and regulatory standards can help drive innovation in clean energy technology, as already discussed. The other crucial role for government is in direct investment in basic research on clean energy technology. All four of the justifications for public investment in innovation listed on the previous page apply to the case of clean energy technology. Wind and

[51] The authors state: "Wind and solar power are very costly from a social perspective because of their very high capacity cost, their very low capacity factors, and their lack of reliability." The baseline results assumed a social cost of carbon of $50 per metric ton of CO_2. The break-even carbon prices for wind and solar were, respectively, $61.87 and $185.84. The EPA (2015) estimates the social cost of carbon to be $56.00 in 2015 (under a 2.5 per cent discount rate; a higher discount rate makes the social cost of carbon lower).

solar energy remain "characterized by market and technological uncertainty" and do not promise sort-term profitability, so risk-averse and impatient private investors are unlikely to provide sufficient investment (Mazzucato, 2015). Government can help reduce that uncertainty by setting clear and ambitious goals for future clean energy production and by making large investments in innovation to reinforce the credibility of those goals. In the medium term, when the technology is ready for wider adoption, public investment can help the technology to overcome the sunk cost and coordination advantages enjoyed by incumbent technologies.

The 2016 federal government budget outlines a plan for $350 million in spending related to clean energy technology in 2017-2018, of which $251 million is allocated to direct public investment in clean technology development (Government of Canada, 2016c).[52]Is this 'enough'? As a benchmark, Atkinson (2015a) recommends that the United States undertake about $5.2 billion USD in annual direct public investment in clean energy innovations, mainly via increased funding for federal scientific organizations such as the National Science Foundation.[53]A comparable plan for Canada would allocate about $500 million in funding to organizations including NSERC and Sustainable Development Technology Canada (SDTC), earmarked for clean energy research. In the initial stages, part of the funding should be used to conduct a study to identify the specific areas of clean energy research in which government investment is likely to have the biggest 'bang for the buck.' Such spending would be a productive way of using revenues raised by a federal carbon tax.

Clean energy innovation is inclusive in the sense that the benefits of avoiding drastic climate change would accrue disproportionately to those at the bottom of the (global) socioeconomic distribution. In terms of participation, inclusiveness in the research stage can be facilitated in the long term by means of education and skill development, as discussed earlier.

Funding University Research

Clean energy innovation is a demonstration of the general importance of government funding for basic research. Basic science is the form of research with the longest time horizon, the most uncertainty in terms of its ultimate economic value, and the most severe non-excludability.[54]

Much basic research occurs in universities. Spending on universities not only helps fund skill development (as discussed earlier), but also basic scientific knowledge. This is a strength of Canada (Council of Canadian Academies, 2013). To maintain this strength, government should not sacrifice funding for basic research (especially in physical sciences) in favour of commercialization and applied research. Galushko and Sagynbekov (2014) found that Canadian scientists felt the pendulum had swung too far in this direction by 2014 and that it was harming

[52] This includes $195 million for 'clean technology innovation' and $56 million for 'accelerating clean technology development.'

[53] This figure does not include additional tax expenditures and spending on clean technology deployment, which Atkinson recommends on top of the direct investment in innovation.

[54] Non-excludability means that the creator of the knowledge cannot exclude others from exploiting it for economic gain. Specific technological innovations can be rendered excludable through patent protection, but this is not possible for basic scientific knowledge. Non-excludable products tend to be underprovided through conventional market mechanisms, justifying public investment.

basic research capabilities. New federal government support for research in 2012 and 2013 was allocated entirely to academic-industry partnerships oriented toward technology commercialization, and by 2012-2013 NSERC was providing more funding for such industry-oriented research than for basic research (Canadian Association of University Teachers, 2013).

Since commercially-oriented research is less subject to the market failures outlined at the beginning of this subsection, the case for supporting it with government funding is weak relative to the case for supporting basic research. The fact that the 2016 federal budget began to shift the funding balance back in favour of basic research is therefore a positive development (Semeniuk, 2016).

Beyond basic research, universities can enhance the inclusiveness of innovation by providing incentives for innovation aimed at areas of special public interest. An example from the United States is the MIT Inclusive Innovation Competition, which offers innovators the chance to compete for recognition and prizes by producing new technologies in the areas of labour market matching, skills development and human-machine interaction.[55] Prizes of up to $125,000 are available to the best ideas, as judged by a panel of experts. Government and civil society organizations can work together with Canadian universities to host similar inclusive innovation competitions aimed at facilitating inclusive innovation. This approach is particularly promising in areas like health and education, sectors that are important to all Canadians and that, for a variety of reasons, have low rates of productivity growth.

Other Areas for Investment

Information technologies such as broadband internet are known to enhance productivity growth (Oulton, 2010). We have already discussed the potential for deregulation in telecommunications to increase the quality and accessibility of Canadian broadband. In terms of accessibility, though, public provision is an alternative avenue. This is probably not necessary for the areas where most Canadians live, but might be valuable in remote areas underserved by current broadband infrastructure. The emergence of small municipal optical fibre networks provides a potential model for such investment.[56] For every municipality to have its own broadband network would not be advisable, since there are economies of scale in network infrastructure, but it may make sense as a strategy for the inclusion of remote and underserved areas. The idea warrants a systematic study.

Beyond internet network infrastructure, digital infrastructure includes all the forms of physical infrastructure – roads, waterways, the electrical grid, and so on – that make use of digital technology to enhance productivity. Atkinson *et al*. (2016) provide a comprehensive overview of opportunities to improve transportation infrastructure using information technology.

[55] See https://www.mitinclusiveinnovation.com.
[56] See, for example, http://swiftnetwork.ca and Alcopra (2015).

F. Macroeconomic Policy Underpinnings of Inclusive Growth

A stable, predictable macroeconomic environment is one of the key underpinnings of innovation and growth, and stabilization policy facilitates inclusiveness by dampening the impact of macroeconomic shocks that often have their largest effects on the households least able to deal with them. In this section, we briefly discuss monetary policy through the lens of inclusiveness. We then touch on the role of social spending and transfers in facilitating inclusive growth.

Monetary Policy

Monetary policy is the primary tool for maintaining the stability of the economic system. Stable, predictable inflation (and, by extension, a stable and predictable macroeconomic environment overall) are conducive to long-term investment and risk-taking, both crucial contributors to innovation.[57]

In our view, macroeconomic stabilization should be the main role of monetary policy in an inclusive innovation system. It creates a stable environment for investment and protects low-income households whose employment situations are likely to be more sensitive to macroeconomic fluctuations. We therefore do not advocate changes in Canada's monetary policy.

That being said, we think it worth touching upon a few aspects of monetary policy that are relevant for inclusiveness and that have been the subject of recent research. First, monetary policy has direct implications for the distributions of income and wealth through its effects on asset prices and economic activity. These effects are only beginning to be understood in quantitative terms. Second, there is debate about whether the current practice of monetary policy in Canada gives enough weight to unemployment, a crucial factor in economic inclusiveness. Third, the decline of long-term interest rates around the world in recent decades and the challenges faced by monetary policy-makers following the Great Recession have raised the question of whether central banks should increase their inflation targets. This would have both direct and indirect distributional effects.

Nakajima (2015) summarizes channels through which monetary policy influences the distribution of income and wealth. Households are heterogeneous in terms of their income sources, asset portfolio compositions, and net asset positions, as well as in the sensitivity of their employment situations to macroeconomic fluctuations. These forms of heterogeneity mean that monetary policy will affect the incomes of different households in different ways, and hence may affect measures of economic inequality. The direction of the effect is ambiguous *a priori*, and empirical evidence is mixed. Coibion *et al*. (2016) find that, on balance, contractionary monetary policy shocks increase inequality in labour earnings, total income, and consumption in the

[57]The Bank of Canada (2012) describes its policy objectives as follows: "Low and stable inflation ... creates an environment favourable to steady, healthy growth in output, employment and incomes over time. It gives Canadians greater confidence about the future, allowing them to make sound economic decisions. Specifically, it helps to encourage long-term investments that contribute to lasting economic growth, job creation and productivity gains that are critical to improvements in our standard of living."

United States.[58] Davtyan (2015) finds that these results may be sensitive to the use of data that does not adequately capture the income of the top one per cent of income earners. O'Farrell *et al*. (2016) examine data on the wealth distribution and portfolio composition in several OECD countries and argue that the effect of monetary policy on inequality via asset price changes is likely to be small.

Given the conflicting evidence, and given that secular changes in economic inequality are probably driven by structural factors rather than by monetary policy, we do not think inequality should be of first order concern to monetary policy authorities. Still, further research in this area is warranted, especially relating to Canada.

It might be argued that the Bank of Canada's singular focus on maintaining low and stable inflation results in too little weight being given to unemployment, a major obstacle to economic inclusiveness (Osberg, 2011). We do not view this as a major concern. If unemployment is persistently higher than it need be due to structural frictions in the labour market, then the appropriate tool with which to address the problem is not monetary policy but active labour market policy. A monetary policy rule that responds strongly to changes in the unemployment rate can be appropriate in contexts in which persistent unemployment arises from so-called hysteresis effects. Gali (2016) studies optimal monetary policy under hysteresis and argues that it is relevant for the Euro Zone. However, the balance of the evidence (though somewhat out of date at this point) does not find evidence of significant hysteresis in Canada's labour market (Jones, 1995).[59] Moreover, the Bank of Canada does base its policy on estimates of the (unobservable) output gap, which to some extent should capture deviations of unemployment from its 'natural' rate (Drummond and Murray, forthcoming).

In light of recent events, some economists have called on central banks to raise their inflation targets.[60] The purpose of this would be to increase the long-run level of the nominal interest rate so that, in the event of a recession, central banks would have more room to lower it without running into the effective nominal interest rate lower bound. The proposal is controversial and research into its likely effects is ongoing. From the perspective of economic inclusiveness, the main benefits would be superior macroeconomic stabilization (since costly zero-lower-bound events would become less likely to occur) and, perhaps, a one-time redistribution of wealth from net savers (who tend to be wealthy) to net debtors (who tend to be poor). Harm to inclusiveness would include a faster reduction in the purchasing power of workers' wages if nominal wages are slow to adjust to price inflation, as well as faster declines in the real value of cash savings, which make up a larger share of the asset portfolios of low-income households relative to rich households. Further research in this area is needed.

[58] They also show that government transfers to low-income households offset the deleterious effects of a monetary contraction on low-end household incomes, so that the effect on inequality mainly reflects increases in the incomes of high-income households. This illustrates the important role of fiscal policy in counteracting undesirable distributional effects of monetary policy. Bernanke (2015) argues that this reflects an appropriate division of responsibilities between monetary and fiscal policy.

[59] The issue of hysteresis in unemployment received significant attention from Canadian researchers in the late 1980s and early 1990s but almost none since then. It would be worthwhile to develop new evidence on the question.

[60] See Blanchard *et al*. (2010), Ball (2014), and Williams (2016), among others.

OECD (2014a) discusses the relationship between monetary policy and inclusive growth. It emphasizes the importance of macroeconomic stabilization in cushioning the impact of macroeconomic shocks on vulnerable households, but also notes that macroeconomic stability does not ensure an equitable distribution of the gains from growth. While the distributional implications of monetary policy must be kept in mind, our view is that monetary policy should continue to focus on the maintenance of a stable and predictable macroeconomic environment. To ensure an equitable distribution of income and wealth is the role of other policy levers.

Transfers and Social Programs

The most direct way for the government to reduce economic inequality is by means of redistribution by taxation and transfer.[61]We will not devote much attention to this because it is related to innovation only indirectly, but OECD (2014a) emphasizes the important role of income redistribution in ensuring the inclusiveness of growth by spreading the gains from growth throughout the income distribution. In turn, this should feed into innovation because it allows a larger segment of the population to invest in skills and seize innovation opportunities. The empirical evidence surveyed in Section II implied that such redistribution would not harm economic growth; on the contrary, given the prevailing high levels of economic inequality, redistribution would probably raise growth.

Some of that evidence did find that the form of government social spending matters for its growth impact. Arjona *et al*. (2003), for example, show that "active" spending on programs such as job search assistance was more likely to promote economic growth than "passive" transfer spending. There is a role for such active policies in an inclusive innovation system because they actively facilitate economic inclusion. Corak (2013b) advocates that the government consider "raising the benefit level [of the Working Income Tax Benefit]" and "reducing the rate at which benefits are phased out." A substantial increase in the WITB would transfer income to those with low incomes while maintaining incentives for them to participate in the economy.

Job search assistance and career counselling services generally pass the cost-benefit test, so they should be well-funded and perhaps expanded (Murray, 2010a; 2010b). To further promote economic inclusiveness, new services should be specially tailored for groups that have low labour force attachment and face specific challenges (e.g. new immigrants, persons with disabilities, older workers, and Aboriginal people). There is room for innovation in terms of the design of such tailored programs.

To give one concrete example: employers find that their usual ways of finding new workers (referrals or ads in traditional media or on English or French web sites) do not connect them with immigrants (Rai, 2013). There exist electronic labour exchange web sites that provide tailored services for immigrants and other groups facing special barriers, but low activity levels on these web sites suggest that most employers are not willing to pay to 'narrowcast' their job openings to these groups (Sharpe and Murray, 2011b). Can tools be designed to improve the flow of information between employers and immigrant workers who might be suitable for the

[61] See Sharpe and Capeluck (2012) for a comprehensive analysis of the redistributive impact of Canada's tax and transfer system in recent decades.

jobs? Innovation in this area would contribute to the inclusiveness and the efficiency of the economy.

VI. Summary and Conclusions

Let us return to the six areas for action laid out by the Government of Canada (2016a) for the inclusive innovation agenda:

1. developing an entrepreneurial and creative society,
2. promoting global science excellence,
3. developing world-leading clusters and partnerships,
4. growing companies and accelerating clean growth,
5. competing in a digital world, and
6. increasing the ease of doing business.

In this report, we have claimed that inclusive growth is the appropriate end goal of innovation, and hence of innovation policy. In light of this normative claim, we defined an inclusive innovation system is an innovation system in which opportunities to participate in innovation are broadly available to all and the dividends of innovation are broadly shared by all. Then, in our policy discussion, we considered a variety of policy areas through the lens of inclusive innovation. The policy areas we chose to discuss were meant to touch upon the Government's six areas for action.

After all this, what can we say about these six areas for action and their relationship to inclusive innovation? We first make some specific comments about each, then conclude with general comments.

Creative and Entrepreneurial Society

By our interpretation, creating an 'entrepreneurial and creative society' means ensuring that as many people as possible have the skills and the substantive freedom to participate in the innovation system. This action area is therefore fundamental to an inclusive innovation agenda, since equal opportunity for participation is one half of our notion of inclusive innovation. In our policy discussion, we emphasized that advanced skills in STEM fields (valuable though they may be) are not the only skills required in a successful innovation system. People with little interest in or aptitude for STEM disciplines can bring their entrepreneurial or managerial skills to the table and play a key role in translating raw ideas into economically valuable products or processes. This is reassuring from the perspective of inclusiveness.

That being said, substantive freedom to participate means that barriers to participation must be broken down. We emphasized this throughout our policy discussion. Governments and the private sector must continue making serious efforts to facilitate inclusion through programs such as mentorship programs for visible minorities in graduate schools or reforms around parental leave in research workplaces. Basic economic reasoning implies that as long as barriers exist, society cannot make efficient use of its innovative resources.

Global Science Excellence

The second action area is promoting global science excellence. Global science excellence is an obvious contributor to a country's innovation performance, but its implications for inclusiveness are more complicated because 'excellence' necessarily implies a certain elitism. In our discussion of education policy, for example, we suggested that schools make special efforts to support the development of high-ability students because evidence suggests that such support can increase the likelihood of their eventual participation in high-level scientific activities. A dollar spent promoting the 'excellence' of these students is a dollar not spent helping their underperforming peers. The same might be said for a marginal dollar of spending on public investment in basic science instead of on, say, job search assistance for the unemployed.

The answer to this trade-off must be two-fold. First, social policy can ensure that the benefits of excellence are shared by everyone in the society. This is why our policy discussion included a section on tax and transfer policy and other social programs not obviously related to innovation *per se*. Second, schools and other institutions must take concrete steps to ensure that 'opportunities for the cultivation of excellence' are available to everybody, not just to the privileged. This is why we emphasized, for example, that the selection of students for gifted programs in schools should be done through universal screening rather than through informal processes likely to be biased against certain kinds of people and in favour of others. Ultimately, the cultivation of excellence is an area that is fundamental to innovation performance but in which there are trade-offs in terms of inclusiveness. An inclusive innovation system must include measures to address the trade-offs.

World-Leading Clusters and Partnerships

The third area of action is the least compelling of the six. Stories of Silicon Valley may be dazzling, but there is no evidence that government policy can create innovative clusters or that it would necessarily be desirable to do so if it were possible. A better approach is to create a general policy environment that is conducive to innovation and productivity growth. This is not a prescription for *laissez faire*; the policy mix may include active policies such as public investment in science. But there is to date limited evidence to support making the exploitation of agglomeration effects a central part of the innovation policy framework.

If an innovative cluster should happen to arise in Canada, it will pose a challenge in terms of economic inclusiveness. A cluster involves the concentration of economic activity in one location while other cities and regions are left behind in relative terms, so regional inequality would tend to rise. At the local level, any rapid increase in average incomes and wealth levels (whether associated with a cluster or not) can generate problems of social and economic exclusion for those who do not share in the gains. Policymakers at all levels of government should take steps to mitigate these inequalities.

Growing Companies and Accelerating Clean Growth

An emerging consensus among innovation policy analysts holds that government should stop giving preferential tax and subsidy treatment to small firms *per se* and should instead seek to identify and support the small firms that are growth-oriented. This may be a policy area in which the goals of innovation and inclusiveness are aligned because it is the growth-oriented firms that create jobs as they grow large. Employment is one of the most important ways in which the gains from growth are spread throughout the population, so any opportunity to pursue a policy that can raise both innovation and job growth should be seized.

The environmental sustainability of economic growth matters for everybody. The widespread adoption of clean energy technology is unlikely to occur until clean energy is cost-competitive with fossil fuel energy, so a top priority for now should be innovation in clean energy technology. In the report, we suggested a policy mix that combines carbon taxation and robust government funding for clean energy research.

Competing in a Digital World

The defining characteristic of the 'digital economy' is the near-zero marginal cost of replicating digital information and transmitting it across digital networks. This has a number of implications for inclusive innovation. First, being connected to digital networks and having the skills to manipulate digital information are of immense importance as prerequisites for participation in digital innovation. Second, conditional on these prerequisites, entry barriers to innovation are low but markets will tend to be dominated by a small number of players due to network externalities and increasing returns to scale.

In this report, we focused on ensuring equal access to digital networks and digital skills for all Canadians. Everyone should have access to high-quality broadband internet. The market may deliver this for most people, though there may be a role for government in ensuring connectivity for certain hard-to-reach populations. Moreover, schools should provide students with the opportunity to receive high-quality training in digital technology skills through computer science curricula.

Ease of Doing Business

Canada has already gone a long way toward relaxing regulatory barriers to business activity, so the prospects for further improvement along this dimension are limited. We outlined a number of possible improvements: a speedier and more accessible legal system; greater competition in network sectors; simpler import-export regulation; and market-based environmental policies such as carbon taxes. All of these might yield some benefits in terms of innovation and productivity growth, and we argued that some of them (especially the legal and environmental reforms) would enhance economic inclusiveness. However, the experience of recent decades leads us to think that the impact of further regulatory reform (with the possible exception of carbon pricing) is likely to be small. The emergence of the digital economy poses some regulatory challenges in terms of intergovernmental coordination, market definition, and

the updating of old rules to reflect new technological realities. These are mainly matters of adapting regulation to new innovations, as opposed to crafting regulation to promote innovation.

General Concluding Remarks

In this report, we have *not* argued that any policy that promotes innovation at the expense of inclusiveness should not be pursued. The first-order goal of innovation policy should be to increase innovation.

That being said, we claim that the ultimate purpose of innovation from a societal perspective is inclusive growth. It is this goal that leads us to consider innovation policy ideas through the lens of inclusive innovation. If a policy reform would enhance both innovation and inclusiveness, the inclusive innovation framework says that there is a strong case for implementing that reform. If another policy reform implies a trade-off between innovation and inclusiveness, the inclusive innovation framework tells us that we must look for complementary policies to mitigate the negative effects of the reform for inclusiveness.

We conclude by identifying a number of directions for future research that would improve our understanding of innovation and its relationship to economic inclusiveness. First, more detailed evidence on the relationship between innovation and specific skills or competencies would be beneficial. Second, what are the implications of interprovincial trade barriers for technology transfer across provinces, or more broadly for the distribution of innovation opportunities and benefits across regions? Third, a richer evidence base should be developed on the role of policy in the development of clusters and on assessing the local and national welfare impacts of such policies if they were to succeed.

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Appendix A: Details on the OECD Inclusive Growth Measure

In this appendix, we provide a short description of the methodology underlying the OECD Inclusive Growth Measure discussed in Section III.

The OECD's method of measuring inclusive growth is developed in Boarini *et al*. (2014) and Boarini *et al*. (2015). The inclusive growth measure is based on three principles:

- **Multidimensionality:** OECD research on well-being emphasizes that per capita GDP is not a sufficient index of economic welfare (OECD, 2011b; 2013b). Additional dimensions of economic welfare, such as employment, skills and education, health status, environmental quality, and social connections, should be included in a measure of economic welfare.

- **Emphasis on Distribution:** In keeping with the OECD (2014a) definition of inclusive growth, the inclusive growth measure should capture not only average outcomes but also inequalities in outcomes and opportunities across members of society.

- **Policy Relevance:** The inclusive growth measure is intended not only for comparing economic welfare across regions or over time, but also for comprehensive assessment of policy outcomes.

This notion of inclusive growth is operationalized in three steps. First, a set of dimensions of economic welfare are selected for inclusion in the index. Second, the selected variables are aggregated into a unidimensional index. Third, the index is adjusted by a penalty that reflects inequality in the distribution of outcomes.

In principle, many dimensions of economic welfare could be included in the inclusive growth measure. In its empirical work so far, the OECD has focused on a measure that includes three dimensions: real household net adjusted disposable income, the unemployment rate, and life expectancy.

To aggregate the three variables into a single index, Boarini *et al*. use an equivalent income method. First, they select some baseline values of the unemployment rate and life expectancy to serve as a benchmark. Then, given a society's actual household income, unemployment rate, and life expectancy, the equivalent income method seeks an answer to the following question: *What level of household income would leave this society's welfare unchanged if its unemployment rate and life expectancy were changed to the benchmark values?* As benchmark values, Boarini *et al.* choose an unemployment rate of zero and a life expectancy equal to the maximum life expectancy among OECD countries (which turns out to be that of Japan). Thus, a country's equivalent income is the level of household income that would just compensate for its switch to the unemployment and life expectancy benchmarks.

This notion of equivalent income is well-anchored in economic theory, but it poses a difficult empirical challenge because it requires the assignment of money values to the non-monetary dimensions of well-being. It is difficult to know the social 'shadow price' of an additional percentage point of unemployment above zero or a one-year shortfall of life expectancy below the Japanese benchmark.

To estimate these prices, Boarini *et al*. collect data on household income, the unemployment rate, life expectancy, and self-reported subjective well-being for a sample of countries and regress subjective well-being on the three economic variables. The estimated regression coefficients yield the relevant shadow prices. Equivalent income can be estimated as the amount of income that keeps the predicted value of subjective well-being unchanged if unemployment and life expectancy are set to the benchmarks.[62]

The final step is to adjust the equivalent income measure for inequality. Boarini *et al*. do this using a Kolm-Atkinson index.[63] The Kolm-Atkinson index ranges between zero and one, where a higher value indicates greater inequality. Equivalent income is scaled by one minus the Kolm-Atkinson index, so that greater inequality leads to lower inequality-adjusted equivalent income.

These three steps yield the OECD inclusive growth index. In their baseline estimates, OECD (2014a) compute it for the median household in each country by using median household income as the measure of the income dimension. In addition to money income, the income measure reflects in-kind transfers received from the government (health, education, housing, etc.) and is net of depreciation of capital assets held by households.

Appendix B: Developing Skills for Inclusive Innovation and Growth

The development of the skills a person needs in order to exploit innovative opportunities and to share in the benefits of innovation must begin early in life and continue throughout life. A policy agenda to promote skill development must ensure equality of access for all segments of society.

Early Childhood Education

Research by James Heckman and various coauthors suggests that early childhood education programs targeted at children from disadvantaged communities can have high social rates of return.[64] Implementing such programs on a large scale can face political opposition

[62]The authors also use a second, more structural approach whereby they calibrate a utility function over lifetime consumption and use it to compute the implied equivalent income measures. They find that the two methods yield comparable results.

[63] This index is based on the notion of 'equally distributed equivalent income,' which is "the level of income per head which if equally distributed would give the same level of social welfare as the present distribution" (Atkinson, 1970). The Kolm-Atkinson index is then defined as one minus the ratio of equally distributed equivalent income to actual income.

[64] See Heckman *et al*. (2010), Heckman (2008), Elango et al. (2015), and Heckman (2016), among others.

because high-quality programs are costly up front while the benefits are less easy to measure and emerge over a long period of time. Nevertheless, the balance of the evidence suggests that early education interventions of high quality pass the cost-benefit test.

Early education is important from an inclusiveness perspective because the benefits are especially large for children from disadvantaged backgrounds. High-quality programs lead to a larger improvement in the educational environment for disadvantaged children than for advantaged ones. Both targeted and universal programs tend to yield significant benefits for disadvantaged children, while the effects can be zero or even negative for children from advantaged backgrounds who enter universal programs (Elango *et al*., 2015). Evidence reported in Elango *et al*. stresses the importance of quality. It is crucial that policymakers avoid sacrificing quality in order to save money. Low-quality childcare and early childhood education programs reduce skills rather than enhancing them.[65] High-quality programs are center-based (as opposed to home-based) and maintain high standards for educational content and instructor training.

Early childhood education programs in Canada are administered by the provinces and territories (except in the case of programming for Aboriginal children). Programs differ from jurisdiction to jurisdiction, with no national coordination or standards and little federal funding. Total spending by provincial and territorial governments on early childhood education and childcare amounted to 0.60 per cent of GDP in 2014, a substantial increase over 0.25 per cent in 2006 but well below the average of 1.0 per cent in OECD countries (Atkinson Centre, 2014). Most province have developed or are developing curriculum requirements for early childhood education. All jurisdiction requires that some (but not all) the childcare providers have early childhood education qualifications. There exists no hard empirical evidence on the effects of these programs on children's outcomes except in the case of the Quebec system, which is evaluated in Baker *et al*. (2008; 2015) with results that are mixed at best. Given the importance of quality as a determinant of outcomes, this is a high priority for future research.

Aboriginal Education

Another important area in which education can be made more inclusive in Canada is Aboriginal education. Aboriginal people are a fast-growing segment of the country's population, and their educational outcomes, particularly for those living on reserves, are poor relative to those of others in Canada. In addition to being a moral imperative, improving education for Aboriginal people would yield economic benefits by facilitating the participation of a currently-marginalized population in the innovation system.

A first step toward this goal would be to close the 30 per cent shortfall in per-pupil funding for education on reserves relative to funding for public schools off reserve (Drummond and Rosenbluth, 2013). The long-standing underfunding of Aboriginal education may help

[65] The universal childcare program in Quebec may fall into this category (Baker *et al*., 2008). Elango *et al*. (2015) summarize the evidence as such: "Programs that crowd out high-quality alternatives for advantaged children, as in Quebec, produce weak or even negative effects." Baker *et al*. (2015) find that the Quebec program does yield small benefits for disadvantaged children. It also substantially increases female labour supply, which is a non-educational benefit of childcare and early childhood education programs.

explain the fact that the share of the working-age population with no educational certificate was 28.9 per cent among Aboriginal people in 2011, compared to 12.1 per cent among non-Aboriginal people. A second step would be to encourage greater university enrolment among Aboriginal young adults. The share of working-age adults with a high school diploma is similar among Aboriginal and non-Aboriginal people, but the share with a university degree in 2011 was just 13.4 per cent among Aboriginal people, compared to 31.4 per cent among non-Aboriginal people. Calver (2015) estimates that closing the educational attainment gap between 2011 and 2031 could deliver economic benefits to Canada on the order of $261 billion.

Multiple programs are available to provide early childhood education for Aboriginal children.[66] We know of no studies that evaluate the effectiveness of these programs.

Primary and Secondary Education

Primary and secondary education systems should make it a priority to identify underperforming groups and develop evidence-based interventions to improve their outcomes. For example, boys tend to underperform girls in secondary school.[67]This may be attributable to gender differences in behavioural expectations. Fortin *et al*. (2015) find, for instance, that gender differences in post-secondary expectations explain most of the gender performance gap in U.S. schools. While boys are not regarded as a marginalized group, interventions to enhance their skill development by inculcating high expectations for performance and ultimate educational attainment would benefit society by preventing the needless underdevelopment of boys' skills.

A longitudinal study by the Government of Alberta (2009) provides evidence on predictors of high school completion. The study finds that students from disadvantaged socioeconomic backgrounds, students with special needs, and students who had switched schools a number of times were more likely to drop out. Such evidence could facilitate the development of programs to identify and help those students most likely to leave high school without a diploma. This would yield obvious benefits for economic inclusiveness.

Finding ways to help underperforming students to develop their skills is uncontroversial, in part because it facilitates both growth and inclusiveness. More contentious is the issue of providing special programs to nurture the development of the most high-performing students. Such programs may exacerbate inequalities, both because they provide help to people who are already likely to succeed and because they may be administered in a biased way that excludes gifted students from minority backgrounds (Card and Giuliano, 2015). There are also concerns that labelling a student as 'gifted' may itself harm that student's non-cognitive development.[68]

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[66] These include the First Nations and Inuit Child Care Initiative, Aboriginal Head Start On-Reserve, and Aboriginal Head Start in Urban and Northern Communities (ESDC, 2013).

[67] The 2013 Pan-Canadian Assessment Program found that eighth-grade boys and girls performed similarly in science and in mathematics but that boys' performance in reading significantly lagged that of girls in every province (O'Grady and Houme, 2014).

[68] According to Matthews (2014), the 'gifted' label can lead to damaging effects including "an aversion to challenging educational experiences; the masking of diverse learning needs, such as attentional or learning problems; self-doubts; a fear that the label is wrong, the sense of being an imposter; unrealistic expectations from self, teachers, parents, or others; complacency; arrogance; envy from others; and ability-masking in order to gain social approval."

On the other hand, longitudinal evidence summarized in Clynes (2016)suggests that high-ability children (e.g. young adolescents who score in the top percentile of university admissions tests) are many times more likely than even other "pretty good" students to obtain PhDs (including STEM PhDs), write STEM publications, obtain patents, and have incomes above the 95th percentile. Moreover, interventions to support these high-ability students significantly increase the likelihood of these outcomes. This evidence is relevant to the Government of Canada (2016a) goal of achieving global science excellence.

A key to nurturing high-ability students is to give them access to advanced material that is already available for older students. One longitudinal study found that students who skipped a grade in school were 60 per cent more likely to go on to obtain PhDs or patents and twice as likely to earn STEM PhDs relative to their peers of similar ability who did not skip grades (Park *et al*., 2013). Such evidence suggests that intellectually precocious students should be allowed to access advanced material that will keep them motivated if their potential is to be realized.

The potential of such supports to exacerbate educational inequality can be mitigated by applying universal screening procedures rather than relying on teacher referrals to identify top-performing students. Evidence suggests that teacher referrals are likely to be biased against students from disadvantaged backgrounds (Card and Giuliano, 2015).

An area of focus in the literature on education and inclusive growth has been teacher quality (Besley and Van Reenen, 2014; Pareliussen *et al*., 2015). Canada performs above the OECD average in terms of the educational requirements for teachers, the average length of teaching experience of teachers, and average teacher salaries (Guerriero *et al*., 2015). However, there is some evidence of a regional misallocation of teachers, with too many teachers in some regions and not enough in others, especially rural areas. The teacher undersupply in the latter regions is especially acute in scientific disciplines, which are crucial for Canada's innovation performance. Policies to enhance the regional mobility of teachers, especially teachers in STEM fields, would be beneficial in order to solve this mismatch problem.

Finally, it is important that school curricula reflect the kinds of skills likely to be useful to students when they enter innovation-oriented jobs. A particular area for improvement is computer science (CS). We could find no statistics on CS courses in Canadian elementary and high schools, but anecdotal evidence suggests that Canada is a laggard in this regard (CBC News, 2015). CS courses are available as electives in most high schools, but are not part of the core of STEM training. Nager and Atkinson (2016) argue that CS is the most important of the STEM disciplines in terms of preparing students to participate in innovation, and advocate that it be elevated to a status on par with subjects in the traditional core STEM curriculum, such as biology, chemistry and physics. Graduation requirements should allow students with an interest in CS to pursue it in depth. Public schools should ensure that students from all backgrounds are able to take advantage of such learning opportunities.

Post-Secondary Education

In the post-secondary education system, the two key priorities from the perspective of inclusive innovation must be to enhance accessibility and to promote student concentration in innovation-relevant areas. The latter will involve increasing the number of STEM majors and graduate program graduates, though as discussed earlier, these are not the only skills necessary for innovation.

Cheung *et al*. (2012) suggest strategies for enhancing the accessibility of post-secondary education in Canada. First, they suggest that Canadian provinces move to income-contingent student loan repayment systems in order to address the impact of rising tuition costs on access to tertiary education.[69]Second, they suggest that the targeting of financial aid to students with financial needs be increased. Relative to the rest of the OECD, Canada provides an above-average share of student aid in the form of loans and a below-average share in the form of grants. The share of private expenditure in total post-secondary spending is also above the OECD average (Guerriero *et al*., 2015). Evidence suggests that students who receive need-based grants perform significantly better (e.g. in terms of grade point average) than comparable students who pay for post-secondary education out of pocket or with loans (Cappelli and Won, 2016). Of course, any increase in targeted financial aid for needy students must be accompanied by efforts to ensure that information about the programs reaches the students who need it.

[69]Australia and the United Kingdom already have such systems. An evaluation of the Australian system found that it has made socioeconomic background a less important determinant of post-secondary education participation (Santiago *et al*., 2008).