

Facing the Facts: Reconsidering Business Innovation Policy in Canada

Peter Nicholson

IN BRIEF

The federal government's main strategy to sustain economic prosperity in coming years is through innovation. Yet for decades, successive governments have attempted to promote business innovation and failed. Indeed, Canadian businesses have managed to be successful despite their poor innovation performance. This time may be different. Globalization, technology, sustainability concerns and population aging will inevitably impose a shift to innovation as a core business strategy. Hence the need for an ambitious and comprehensive innovation policy to help promote economic growth. For this strategy to succeed, however, will require nothing less than a whole-of-government approach and a recognition that business is the primary vector of innovation in the economy.

EN BREF

En matière de prospérité économique, la principale stratégie fédérale des prochaines années se résume en un mot : innovation. Même si plusieurs gouvernements des dernières décennies ont aussi misé sur cette stratégie, elle n'a pas connu le succès escompté. Obtenant de bons résultats malgré leur déficit d'innovation, les entreprises n'étaient pas poussées à se réinventer. Mais la donne a changé. De la mondialisation aux transformations technologiques en passant par le développement durable et le vieillissement démographique, une série d'enjeux contraignent désormais les entreprises à innover pour demeurer compétitives. D'où la nécessité d'une politique d'innovation ambitieuse qui favorise la croissance de l'ensemble de l'économie. Pour en assurer l'efficacité, il faudra toutefois adopter une approche pangouvernementale et reconnaître que l'entreprise est le tout premier vecteur d'innovation au sein de l'économie.

ABOUT THIS INSIGHT

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INTRODUCTION

The longer you can look back, the farther you can look forward.

– Winston Churchill

Innovation is the economic buzzword of the twenty-first century: much discussed but less understood. This paper delves beneath the hype to marshal the evidence needed to address the following questions:

1. Why precisely is innovation so important economically?
2. How has Canada's economy managed to perform well despite weak business innovation?
3. What are the most important factors that will challenge Canada's low-innovation prosperity?
4. What lessons can be drawn from seven decades of public policy to promote business innovation?
5. What new elements of Canadian innovation policy are needed particularly to foster greater demand for innovation?
6. In view of the current federal government's innovation strategy, should we expect better results this time than in the past?

A substantial portion of what follows is devoted to questions 2, 3 and 4, since, to be effective, innovation policy needs to be based on a deep understanding of the national innovation system into which policies are being introduced.¹ Moreover, it is essential when considering the impact of innovation on economic growth to take a long-term view because the innovation ecosystem results from the coevolution of the country's industrial structure and its political system over time.² Consequently, the evidence presented here abstracts from the short-term quarterly and annual economic data that dominate media coverage but actually provide little insight into the fundamental processes that drive economic performance.

The concept of innovation I adopt in this paper is very broad, but still limited to its role as the principal source of long-term economic growth. The focus is therefore on innovation in the business sector. This is not to denigrate the essential role played by academic institutions and researchers in creating the knowledge and human skills on which innovation depends. But, as thoroughly documented in a series of expert panel reports

¹ J. Edler and J. Fagerberg, "Innovation Policy: What, Why & How," *Oxford Review of Economic Policy* 33 (no. 1, 2017): 17.

² J. Fagerberg, "Innovation Policy, National Innovation Systems and Economic Performance: In Search of a Useful Theoretical Framework" (working paper, University of Oslo, October 23, 2015), 9, https://www.sv.uio.no/tik/InnoWP/tik_working_paper_20150321.pdf.

from the Council of Canadian Academies, fundamental research is already a Canadian strength. Business innovation is not.³ Much of the current discussion of Canada's innovation conundrum – which usually focuses on the dismal trend of business research and development (R&D) and various other indicators that give Canada a failing grade within its developed-country peer group – lacks historical perspective, and therefore ends up as superficial and often misleading. This paper seeks to provide a corrective.

WHAT IS INNOVATION?

Although definitions of innovation abound,⁴ it can be thought of most simply as new or better ways of creating significant value. This broad definition encompasses artistic revolutions such as Impressionist painting and rock and roll; social innovations such as publicly insured health care; organizational innovations such as the assembly line and the limited liability company; marketing game changers such as the credit card and ad-supported television; process innovations such as refrigeration and 3-D printing; and countless product innovations, including penicillin, the microchip and, for better or worse, the atom bomb. Although science and engineering are antecedents of many such changes, the foregoing examples illustrate the much broader context of innovation.

From an economic perspective, innovation can be conceptualized in two dimensions. In the first, innovation occurs along a continuum from the radical to the incremental. Radical innovations are strikingly novel – for example, the telephone. They create entirely new capabilities and markets and get all the attention. But the vast majority of innovations are incremental – the continuous generation of improvements by which the first primitive telephones evolved over more than a century. The second conceptual dimension tracks the diffusion of an innovation from its first appearance in the world to its first appearance in a particular market or company. Although it might be great to be a world-first innovator, history demonstrates that the leading edge is also often the bleeding edge. The great majority of the economic value of innovation comes from uptake, adaptation to a particular use or market and steady incremental improvement. In other words, an “invention” is not an innovation unless and until it spreads.

³ See, for example, Council of Canadian Academies, Expert Panel on Business Innovation in Canada, *Innovation and Business Strategy: Why Canada Falls Short* (Ottawa: Council of Canadian Academies, June 2009); Council of Canadian Academies, “Paradox Lost: Explaining Canada’s Research Strength and Innovation Weakness” (Ottawa: Council of Canadian Academies, 2013); and Council of Canadian Academies, Expert Panel on the State of Science and Technology and Industrial Research and Development in Canada, *Competing in a Global Innovation Economy: The Current State of R&D in Canada* (Ottawa: Council of Canadian Academies, 2018).

⁴ For example, “[i]nnovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations”; see Organisation for Economic Co-operation and Development and Statistical Office of the European Communities, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd ed. (Paris: OECD, 2005), 46. Peter Drucker puts the emphasis on the link with entrepreneurship: “Innovation is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth”; see P.F. Drucker, “The Discipline of Innovation,” *Harvard Business Review*, August 2002, <https://hbr.org/2002/08/the-discipline-of-innovation>.

Canada cannot expect to account for more than roughly 1 to 3 percent of world-first innovations – about the same as its share of the population of the advanced countries. The great majority of innovations in Canada therefore consist of adoption and adaptation of innovations that have originated elsewhere. This should be obvious, but it is too rarely acknowledged in policy discussions. More important economically than world-first innovation is the speed and efficiency of the diffusion of innovation to and within Canada.⁵

THE ECONOMIC IMPORTANCE OF INNOVATION

For reasons I outline below, innovation is the ultimate source of material progress. Such progress can be approximated quantitatively by the per person growth of the output of marketed goods and services in an economy – that is, gross domestic product (GDP). Although GDP's shortcomings as a proxy for quality of life are well known, it nevertheless correlates closely with such indicators as average life expectancy, geopolitical influence and, up to a point, life satisfaction.⁶ A jurisdiction's GDP is also essentially its tax base, and is therefore the resource that ultimately supports society's capacity to deliver quality public services. Although the equitable distribution of GDP is of great importance for individual welfare and fairness, the aggregate amount of GDP determines the overall size of the pie, and thus constrains economic and political decisions about its distribution.

The connection of innovation with GDP per capita is through innovation's effect on labour productivity. By definition, GDP per capita can be expressed as the product of two factors:

$$\text{GDP/population} = \text{GDP/worker} \times \text{workers/population}.$$

In words, GDP per capita is equal to labour productivity (GDP per worker or per hour) multiplied by the employment ratio (the number of working people – or hours worked – as a fraction of total population).⁷ Growth of the employment ratio is inherently limited, since the labour force participation rate can increase only so far, unemployment cannot fall below zero and demographics caps the size of the labour force as a share of population. In fact, labour force demographics, long a tailwind for economic growth, is about to become an intensifying headwind as the population ages. In short, future per capita GDP growth will be determined by the growth of labour productivity, which, unlike the employment ratio, is not inherently limited.⁸

⁵ E. Gafni, "The Diffusion and Adoption of Advanced Technologies in Canada: An Overview of the Issues," CSLS Research Report 2005-05 (Ottawa: Centre for the Study of Living Standards, December 2005).

⁶ E. Ortiz-Ospina and M. Roser, "Happiness and Life Satisfaction," rev. ed., *Our World in Data* (May 2017), <https://ourworldindata.org/happiness-and-life-satisfaction>.

⁷ The employment ratio can be decomposed into a product of factors: average annual hours per employed person × employment as a fraction of the labour force × labour force as a fraction of the working-age population (the participation rate) × working-age population as a fraction of the total population.

⁸ Canada's employment ratio has been declining since 2007, and thus has already begun to be a drag on the growth of GDP per capita.

Innovation enters the picture through its dominant effect on productivity growth,⁹ and thus on the prospect of improving living standards through good-paying jobs and the growing availability and quality of public services. How so?

The statistical procedure of “growth accounting” can be used to decompose labour productivity growth into the sum of (usually) three growth components related to (1) the skills composition of the workforce, (2) capital per worker and (3) a catch-all measure dubbed “multifactor productivity” (MFP).¹⁰ The skills composition component (or “labour quality”) is usually measured as years of education and work experience weighted by wage rates as a proxy for value contributed. Improvements in labour quality, so measured, traditionally have accounted for about a fifth of productivity growth. Looking forward, slower growth in average years of education per person might reduce the contribution of labour quality to productivity growth. A well-educated and trained workforce will continue to be necessary, of course, and lifelong skills renewal will be needed to keep pace with future innovation in technology and processes.

Growth in the contribution of capital per worker (capital intensity) to productivity depends ultimately on innovation in the design and production of capital goods and services (embodied innovation). The third factor, MFP, primarily encompasses innovation in the ways that ideas, skills, capital and other resources are combined to generate market success – what one might refer to as “working smarter.”¹¹ MFP also captures the effect on productivity of scale economies, business cycles and a host of unmeasured factors.¹² But changes caused by these latter effects tend to average out over time, leaving innovation as the dominant source of long-run MFP growth.

Unfortunately, the growth of MFP has declined in virtually all highly industrialized countries since the 1970s, and has thus been principally responsible for a widespread decline in the growth of both labour productivity and per capita GDP.¹³ This would explain the preoccupation of policy-makers and business executives with finding better ways to foster innovation. Although innovation and productivity growth are nearly

⁹ The focus on productivity might appear to be simply a bloodless accounting exercise that fails to capture quality improvement and entirely new goods and services. But to the extent that product quality and novelty are properly reflected in prices, they are captured in GDP and therefore also in GDP per hour worked – that is, in productivity measurement. There are technical issues involved in “correcting” market prices to account for quality improvement – especially in the case of information technology – but these do not appear to have distorted aggregate productivity growth statistics significantly. See, for example, D. Byrne, J. Fernald, and M. Reinsdorf, “Does the United States Have a Productivity Slowdown or a Measurement Problem?” *Brookings Papers on Economic Activity* (March 2016): 109-82.

¹⁰ J.R. Baldwin, W. Gu, R. Macdonald, and B. Yan, “Productivity: What Is It? How Is It Measured? What Has Canada’s Performance Been over the Period 1961 to 2012?” *Canadian Productivity Review*, cat. no. 15-206-X, no. 38 (Ottawa: Statistics Canada, September 2014).

¹¹ For example, Amazon’s innovative business model has enabled an increase in the value of the company’s output per worker, which would be measured as an increase of MFP. At the same time, innovative information technology has cut the cost and increased the capability of Amazon’s capital investment in robotics and software. The company’s success is thus due to innovation in both capital goods and MFP.

¹² When productive capacity is underutilized – for example, during a business cycle downturn or any period of insufficient demand – MFP declines because output per hour drops while the capital stock stays roughly constant and hours worked might not be cut enough to offset the reduced output. Much of the productivity weakness in Canadian manufacturing after 2000 can be traced to underutilized capacity.

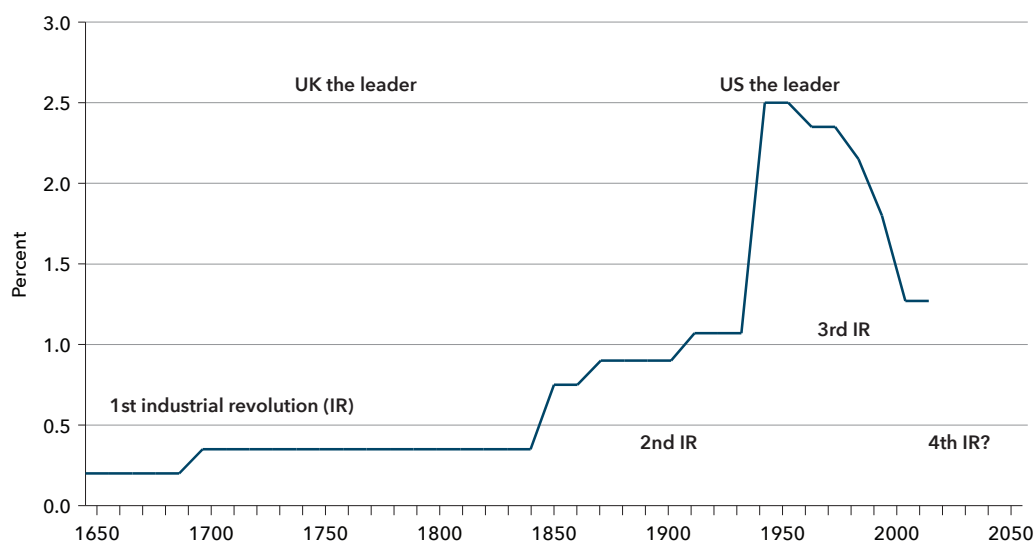
¹³ See Organisation for Economic Co-operation and Development, *The Future of Productivity* (Paris: OECD, 2015), <https://www.oecd.org/eco/OECD-2015-The-future-of-productivity-book.pdf>.

synonymous in the context of economic growth, productivity has been widely misunderstood as “working harder,” whereas innovation carries an inherently positive connotation and consequently has displaced productivity in political vocabulary. To paraphrase the economist and pundit Paul Krugman, innovation isn’t everything, but in the long run it is almost everything.¹⁴

THE GREAT GROWTH SLOWDOWN

In a series of influential papers analyzing the long-term pattern of economic growth in the industrialized countries, Robert Gordon presents aggregated data tracing estimates of the growth of per capita GDP of the most economically advanced country – first the United Kingdom since the mid-seventeenth century, then the United States after about 1900 (figure 1).¹⁵ The first industrial revolution, beginning in England in the early eighteenth century, barely boosted the per capita GDP growth rate until the mid-nineteenth century. Then, with the second industrial revolution – electric power, the internal combustion engine, industrial chemistry, scientific agriculture, among other innovations – things took off, driving unprecedented per capita GDP growth through to the early 1970s. Since then, and despite a brief boom triggered by the development and application of information and communications technologies (ICT), the rate of growth of per capita GDP has declined sharply across the industrialized world.

Figure 1. Growth rate of real GDP per capita of the leading economy, 1650-2010



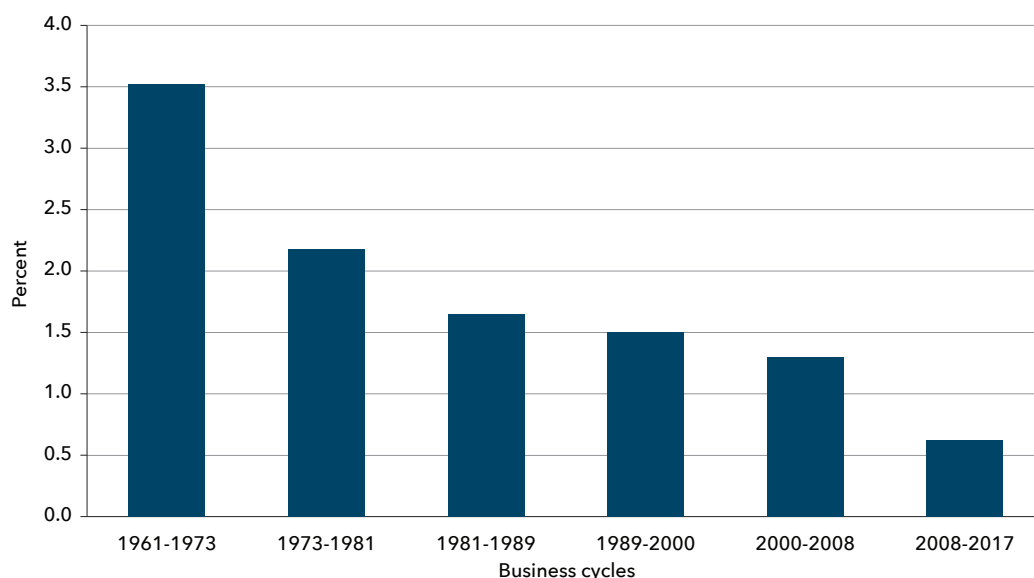
Source: Adapted from R. Gordon, “Is U.S. Economic Growth Over? Faltering Innovation Meets the Six Headwinds,” NBER Working Paper 18315 (Cambridge, MA: National Bureau of Economic Research, August 2012).

¹⁴ P. Krugman, *The Age of Diminished Expectations* (Cambridge, MA: MIT Press, 1994). The original text was: “Productivity isn’t everything but in the long run it is almost everything” (p 14).

¹⁵ R. Gordon, “Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds,” NBER Working Paper 18315 (Cambridge, MA: National Bureau of Economic Research, August, 2012).

In Canada, the average growth rate of per capita GDP has fallen with each successive business cycle since 1961 (figure 2). The main culprit has been a nearly continuous weakening in the rate of productivity growth, particularly the growth of MFP.¹⁶ Between 1961 and 1973, labour productivity in the business sector grew at an annual average rate of 3.5 percent, but over the period from 2000 to 2016, the rate fell to just under 0.9 percent, due primarily to a decline in annual MFP growth from 1.6 percent in the earlier period to a rate of –0.2 percent (figure 3).¹⁷

Figure 2. Average annual growth rate of real GDP per capita, Canada, 1961-2017



Source: Centre for the Study of Living Standards, "Income and Productivity Data," Ottawa, <http://www.csls.ca/data.asp>.

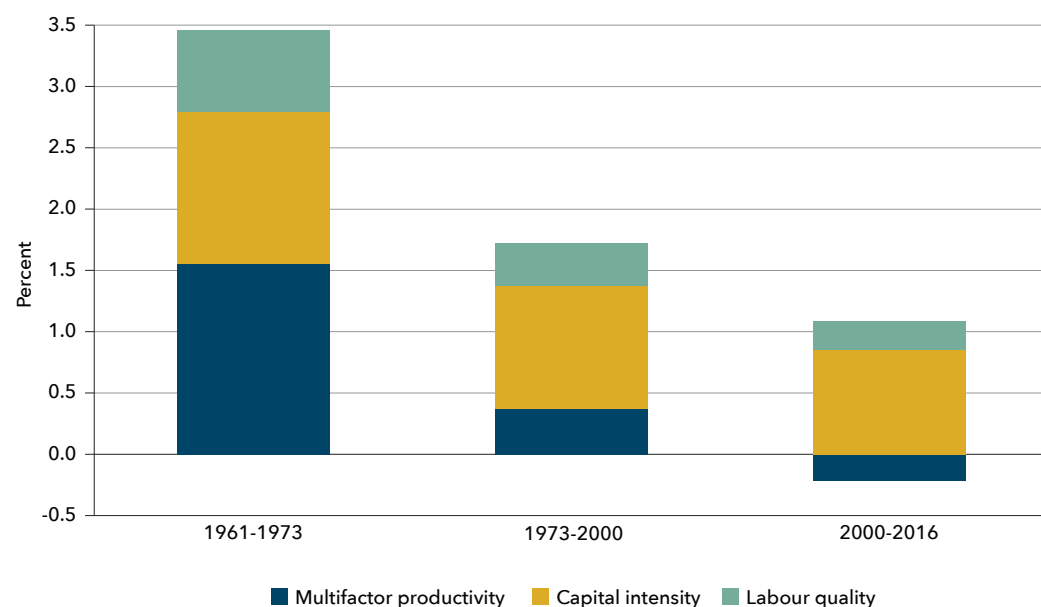
The pattern in the United States has been broadly similar. In the post-war period from 1947 through 1973, annual MFP growth averaged 2.2 percent, powering an unprecedented era of middle-class prosperity. But apart from the ICT-driven mini-boom (1995-2004), which saw annual MFP growth of about 1.8 percent, MFP increased by only 0.5 percent on average annually between 1973 and 2015.¹⁸ Notably, the effect of the ICT revolution on US productivity was short lived, and had petered out by 2005, before the Great Recession.¹⁹

¹⁶ A decline in Canada's employment ratio during the 2008-17 period reduced the average growth rate of GDP per capita by almost 0.5 percent per annum, partly offsetting productivity growth that averaged 1.1 percent during the period.

¹⁷ Statistics Canada, "Multifactor Productivity, Value-added, Capital Input and Labour Input in the Aggregate Business Sector and Major Sub-sectors, by Industry," CANSIM database, table 383-0021 (Ottawa: Statistics Canada). The productivity data in figure 3 refer to the business sector, while the per capita GDP growth rates in figure 2 refer to the entire economy. A productivity growth accounting breakdown since 1961 is available only for the business sector, which comprises a little less than 85 percent of total GDP.

¹⁸ Byrne, Fernald, and Reinsdorf, "Does the United States Have a Productivity Slowdown or a Measurement Problem?" appendix, <https://www.brookings.edu/wp-content/uploads/2016/03/byrneappendixspring16bpea.pdf>.

¹⁹ A. Murray, "What Explains the Post-2004 U.S. Productivity Slowdown?" *International Productivity Monitor* 34 (Spring 2018): 81-109.

Figure 3. Labour productivity growth by component,¹ Canada, 1961-2016

Source: Statistics Canada, CANSIM table 383-0021.

¹ Based on the average annual rates in the business sector.

What happened? At least three fundamental factors have been at play in ways that vary across sectors and over time. First, and most important, the innovations that powered the second industrial revolution matured to the point where further increases of productivity were harder and harder to come by.²⁰ To keep productivity growing at a constant rate, the absolute increment of growth must increase with every passing year as the base level grows. This is both the magic and the curse of exponential growth. Without a fresh infusion of productivity-enhancing innovation, productivity growth is bound to decline.²¹

Information technology was expected to provide the required impetus, and thus the period of rapid ICT innovation from about 1970 onward is sometimes called the third industrial revolution. But the results so far have disappointed. The application of ICT had a major effect on office and logistics productivity for a decade after the mid-1990s, primarily in the United States, but once the systems were widely deployed, the rate of further productivity growth in those activities slowed dramatically. Instead, much of ICT innovation over the past 15 years has focused on the smart phone and apps that have powered the social media revolution. This has created an impression of break-neck innovation, but it has not had a commensurate effect on economic productivity or on jobs and income growth. It might turn out that the productivity impetus of innovations related to, for example, cloud computing and early applications of artificial intelligence is simply delayed pending wider implementation and a “learning period.”²²

²⁰ R. Gordon, *The Rise and Fall of American Growth* (Princeton, NJ: Princeton University Press, 2016).

²¹ The advanced countries of the West have been the innovation leaders since the first industrial revolution. But as China, India and other less-developed countries attain education levels at least on a par with those of the West, they will double or triple the pool of human inventive and innovative talent. Moreover, their populations will approach the innovation challenge from different historical and cultural perspectives. A vast new supply of innovation eventually can be expected.

²² B. van Ark, “The Productivity Paradox of the New Digital Economy,” *International Productivity Monitor* 31

A second growth-retarding factor has been the marked slowdown in the diffusion of innovation from firms at the global technological frontier. Analysis by the Organisation for Economic Co-operation and Development (OECD) of company-level data shows that there was no reduction over the 2001-09 period in the average productivity growth of “frontier firms” – the most productive 100 companies in each sector of the world economy.²³ But there has been a growing gap in productivity growth between firms at the global frontier and the far more numerous productivity laggards. The reasons for this decoupling are unclear, but one might speculate that productivity growth is increasingly the result of scale and network effects combined with highly specialized and tacit (that is, uncodified) knowledge that is inherently more difficult for firms that are not at the frontier to appropriate and master. If so, this would imply an increasing concentration of economic power in a relatively small number of leading transnational firms, of which Canada has relatively few.

A third factor dampening productivity growth has been the widespread trend of weaker business investment as a share of GDP. This has reduced the flow of embodied innovation into the economies of the developed countries. Weaker investment reflects overall lowered business expectations regarding longer-term growth prospects – or “secular stagnation,” in the words of former US Treasury Secretary Larry Summers.²⁴ Factors include slow-growing, aging populations and the concentration of income in fewer hands at the top, both of which reduce domestic consumption growth. The expectation of slower productivity growth also lowers the anticipated rate of return on investment, thus curbing the incentive to invest.

Looking forward, however, all is not bleak. In prospect is a fourth industrial revolution based on a suite of technologies, including artificial intelligence, AI-powered robotics, the “Internet of Things,” 3-D printing and synthetic biology, among others.²⁵ There is a heated debate among techno-optimists and pessimists as to when, and to what extent, these developments will coalesce to ignite a new era of rapid productivity growth, but until the anticipated next revolution arrives and establishes a significant presence in the world economy, there is little likelihood that the trend of slowing productivity growth in the advanced countries will be reversed.²⁶

Canada, however, has an opportunity for an intervening period of stronger productivity growth if this country’s business sector can close the anomalously large productivity gap relative to the United States that has opened up since the mid-1980s. In that context, it is encouraging that, during the 2010-16 period, business productivity growth in Canada (1.05 percent per year) significantly exceeded that in the United States (0.51 percent per year).²⁷

(Fall 2016): 3-18.

²³ D. Andrews, C. Criscuolo, and P. Gal, “Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries” (Paris: Organisation for Economic Co-operation and Development, 2015).

²⁴ L. Summers, “Secular Stagnation Even Truer Today,” *Wall Street Journal*, May 25, 2017, <http://larrysummers.com/2017/06/01/secular-stagnation-even-truer-today/>.

²⁵ K. Schwab, *The Fourth Industrial Revolution* (New York: Crown, 2017).

²⁶ P. David, “The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox,” *American Economic Review* 80 (no. 2, 1990): 355-61. The full effect of electrical machinery on productivity took decades to achieve in view of the industrial reorganization, complementary investment and “learning” required. An analogous lag effect can be expected with the technologies of the fourth industrial revolution.

²⁷ W. Gu and M. Willox, “Productivity Growth in Canada and the United States, Recent Trends and Determinants” (paper prepared for the CSLS-Productivity Partnership Workshop on “Explaining Canada’s Post-2000 Productivity Performance,” Montreal, May 31-June 2, 2018), 17. <http://www.csls.ca/events/cea2018/gu.pdf>.

THE PARADOX OF CANADA'S ECONOMIC PERFORMANCE

Innovation, through its determinative effect on productivity, is the prime source of the per capita growth of GDP. Yet, paradoxically, Canada has a very long record of solid economic performance despite much-lamented weak innovation rankings according to virtually all the standard indicators. Some evidence follows.

Table 1 places Canada in the context of a representative peer group of 20 advanced countries, and shows that it falls roughly in the middle of the pack in most respects.²⁸ The striking feature of the table is how closely bunched the countries are on most of the basic indicators.²⁹ For example, according to the United Nations Human Development Index (HDI) – a composite of life expectancy, education and per capita income – the lowest-ranked country among the 20 (Spain) has an HDI that is 93.1 percent of that of the top-ranked (Norway). Similarly, the annual “competitiveness” ranking by the World Economic Forum (WEF) placed Canada 12th in 2017 among the peer group, at 91.3 percent of the leader (Switzerland), a position that has varied little over the past decade. Again, most of the advanced countries are closely ranked, moving forward in tight formation much like the peloton at the front of a bicycle race. This is due to the web of economic relationships related to trade, investment and information networks that exist among countries at a similar stage of development. These transnational relationships tend to sustain a similar overall level of performance except if severely disrupted by war or political upheaval. An important consequence is that, if productivity slows in the leading country (currently the United States in most respects), it will also tend to slow in the close followers.

The WEF also ranks countries on a composite index of “innovativeness,” and here Canada is currently near the bottom of its peer group, at about 80 percent of the leaders (Switzerland and the United States), and its ranking has been deteriorating in recent years. Comparable indicators such as the Global Innovation Index show similar results.³⁰ These multidimensional, semi-qualitative metrics are consistent with Canada’s dismal and deteriorating business R&D spending, which, relative to GDP, has been falling farther behind the OECD average for the past 15 years.³¹ R&D in Canadian advanced manufacturing and services industries has not filled the gap created by the eclipse of Nortel, BlackBerry and other telecom equipment suppliers and by reduced R&D in the foreign-owned pharmaceutical sector.

²⁸ The 20 countries consist of the G7 and 13 others that, by virtue of a combination of size and/or stage of development, can reasonably be compared with Canada. Left out are very small countries such as Iceland, Luxembourg and Singapore, as well as several members of the OECD that are at an earlier stage of development.

²⁹ Media reports on international comparisons invariably highlight the rank order and ignore the underlying metric. This is usually misleading, since a country can easily rise or fall several ranks relative to its peers based on statistically insignificant differences in the value of the metric that is being ranked. Rank ordering delivers striking headlines, however, and is thus effective in drawing attention, but it is much less useful analytically.

³⁰ S. Dutta, B. Lanvin, and S. Wunch-Vincent, eds., *Global Innovation Index 2018: Energizing the World with Innovation* (Ithaca, NY; Fontainebleau, France; Geneva: Cornell University, INSEAD and WIPO, 2018). <https://www.globalinnovationindex.org/>. The 2018 index ranked Canada 13th among the 20 comparators, and 6th among the G7, at 77.5 percent of the top country (Switzerland).

³¹ Council of Canadian Academies, *Competing in a Global Innovation Economy*.

Table 1. A performance scorecard: Canada and other industrialized countries¹

	World Economic Forum					
	Average annual growth of population (%) (1996-2016)	Average annual growth of GDP per capita (%) (1996-2016)	Human Development Index ² (2015)	Disposable income inequality Gini ³ (2014)	Competitiveness % of top score (2017)	Innovativeness % of top score (2017)
Canada	1.02	1.43	96.9	31.3	91.3	80.2
United States	0.93	1.37	96.9	39.4	99.8	100.0
United Kingdom	0.60	1.44	95.8	35.6	94.0	87.5
Germany	0.11	1.26	97.5	28.9	96.4	97.1
France	0.58	1.00	94.5	29.7	88.4	84.0
Italy	0.33	0.15	93.4	32.6	77.5	68.0
Japan	0.02	0.72	95.2	33.0	93.7	92.3
Norway	0.89	0.99	100.0	25.7	92.2	86.1
Denmark	0.43	0.91	97.4	25.6	92.0	88.1
Sweden	0.58	1.97	96.1	27.4	94.2	94.5
Finland	0.56	1.63	94.2	25.7	93.7	97.8
Ireland	1.31	2.98	97.2	29.8	88.1	80.8
Netherlands	0.46	1.38	97.4	30.5	96.6	95.4
Belgium	0.53	1.22	94.3	26.6	89.2	85.1
Austria	0.46	1.25	94.1	27.4	89.6	86.4
Switzerland	0.83	1.07	98.9	29.7	100.0	100.0
Spain	0.76	0.93	93.1	34.4	80.2	63.9
Australia	1.42	1.70	98.9	33.7	88.6	77.7
New Zealand	1.16	1.61	96.4	34.9	91.6	80.6
South Korea	0.59	3.48	94.9	30.2	86.5	82.1
Canada's rank order						
Among the G7	1st	2nd	2nd (tie)	3rd	5th	6th
Among the 20	3rd	8th	8th (tie)	13th	12th	17th

Sources: United Nations Human Development Index; World Economic Forum; Groningen Growth and Development Center.

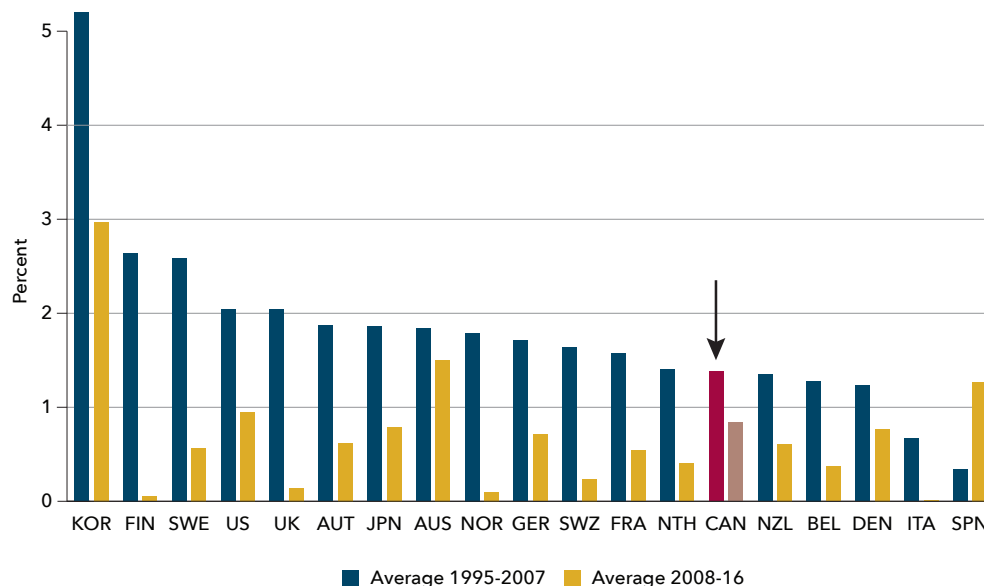
¹ Green indicates the highest value in the column, and red indicates the lowest value.

² As a percentage of Norway's.

³ The Gini coefficient is the most commonly used measure of income inequality. It ranges between 0, which is when everyone's income is identical, and 1, which is when all the income goes to one person.

Recall, however, that R&D is only one input into the innovation process, and is significant in only a small segment of the economy – primarily advanced manufacturing and certain knowledge-intensive services. A far more telling innovation metric is productivity growth. It is comprehensive, it measures outcomes and it is directly connected to what really matters: the growth of average living standards. Figure 4, which portrays the productivity growth of Canada's peer countries over two periods, 1995-2007 and 2008-16, shows that Canada was near the back of the group in the former period, but picked up somewhat in relative terms in the latter.

Figure 4. Average annual growth rate of labour productivity,¹ selected OECD countries, 1995-2016



Source: OECD, https://stats.oecd.org/Index.aspx?DataSetCode=PDB_GR.

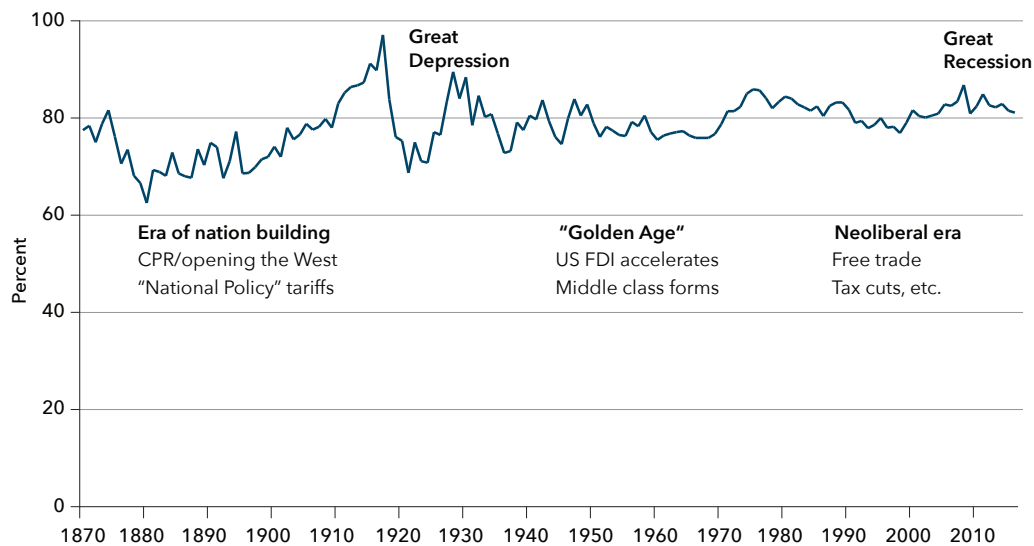
¹ GDP per hour worked.

Most significant is the decline during the latter period of average productivity growth in all of these countries except Spain.

Despite dismal productivity growth in recent decades, Canada's per capita GDP growth has held up remarkably well in *relative* terms ever since Confederation in 1867. Figure 5, based on exceptionally thorough historical analysis by the Groningen Growth and Development Centre in the Netherlands, traces Canada's real GDP per capita relative to that of the United States from 1870 to 2016.³² Remarkably, the ratio remained roughly constant throughout the period at about 80 percent of the US level, with Canada gaining significant ground in the latter part of the nineteenth century and the early years of the twentieth, and again from the late 1960s to the mid-1970s before falling back to approximately the long-term average.

The mathematical implication of this roughly constant ratio of the *level* of Canadian and US per capita GDP is that the rate of *growth* of Canada's per capita GDP essentially has matched that of the United States for a century and a half in the face of wars, depressions, technological revolutions and many oscillations of the ideological pendulum between left and right. The significance of the equality of the two countries' trend growth rates cannot be overstated, since, within limits, it is the rate of growth of GDP, not its absolute level, that people feel and to which business managers and investors respond. It is the promise of growth, or fear of the lack of

³² J. Bolt, R. Inklaar, H. de Jong, and J. Luiten van Zanden, *Rebasing "Maddison": New Income Comparisons and the Shape of Long-Run Economic Development* (Groningen, Netherlands: University of Groningen, Groningen Growth and Development Centre, January 2018), https://www.rug.nl/ggdc/html_publications/memorandum/gd174.pdf.

Figure 5. Real GDP per capita, Canada as a percentage of United States, 1870-2016

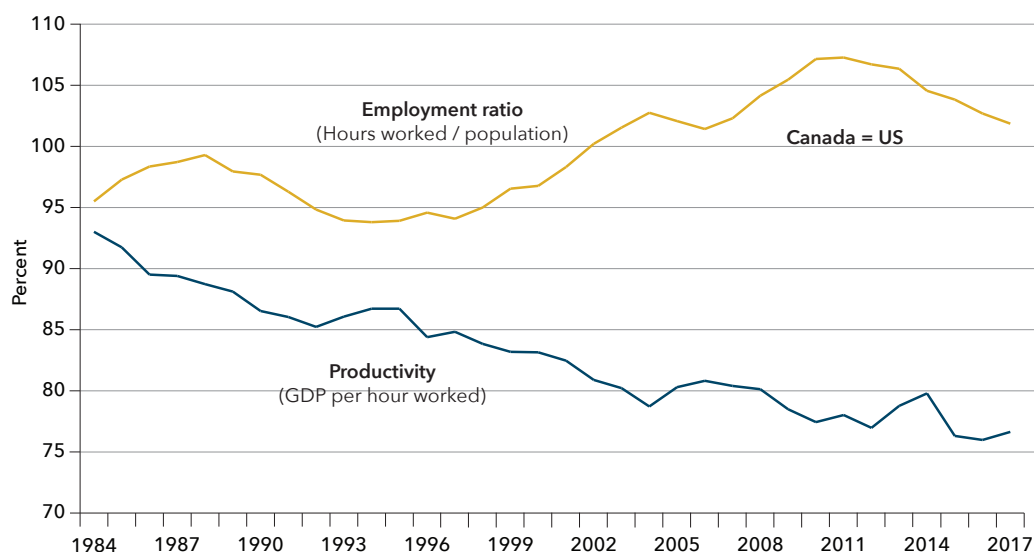
Source: Groningen Growth and Development Centre.

it, that largely determines both consumer and business confidence. Of course, Canadians are well aware that Americans are richer on average and always have been, but the distribution of disposable income is more unequal in the United States than in Canada, so the median income disparity between the two is less than the average income disparity.

The bottom line is that because raw economic performance can be assessed by the rate of growth of real GDP per capita, it follows that Canada's economic performance has equalled that of the United States, on average, for as long as comparable records have existed. How can that be? If labour productivity drives per capita GDP and Canada's productivity growth has fallen well behind that of the United States since the mid-1980s, how has Canada's per capita GDP growth nevertheless kept up? The answer lies in Canada's relatively better trend in labour utilization. For most of the period from 1995 until recently, employment as a percentage of total population (the employment ratio) grew more rapidly in Canada than in the United States, thus offsetting the effect of weaker labour productivity on per capita GDP growth (figure 6). Productivity grew in both countries, although much more rapidly in the United States; the employment ratio actually has declined significantly in the United States since 2000 and in Canada since 2006. (The employment ratio had been increasing in both countries since the 1970s as the baby boom generation matured and as women increasingly entered the workforce.)

Looking forward, the problem is that growth of the employment ratio is inherently limited, and will be impeded by Canada's aging population. This will leave productivity growth, and thus innovation, as essentially the only future source of long-run growth of Canada's average living standards.

Figure 6. Components of GDP per capita, Canada as a percentage of United States, 1984-2017



Source: Centre for the Study of Living Standards, "Income and Productivity Data," Ottawa, <http://www.csls.ca/data.asp>.

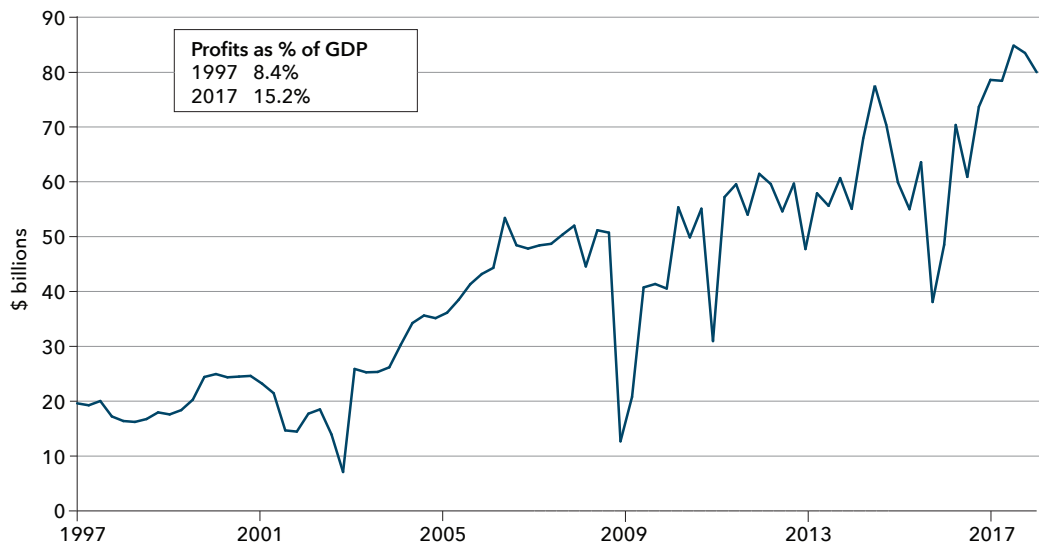
THE PERFORMANCE OF CANADIAN BUSINESS

GDP and related productivity statistics are the aggregated result of millions of tangible decisions taken by individual Canadian businesses for the direct or indirect purpose of earning a profit. In this micro-context, the decision whether to innovate concerns means, not ends. Innovation, by definition, requires departure from the tried and true, and therefore entails risks and costs that need to be weighed against the status quo alternative. So if the status quo is already delivering satisfactory profitable growth, the incentive to innovate will be diminished, other things being equal.

The aggregate profitability of Canadian business has been on an upward trend for at least the past 20 years both in absolute dollars and as a percentage of GDP. The pre-tax operating profit of all incorporated businesses grew at an average rate of 6.1 percent between 1997 and 2017.³³ Meanwhile, the average effective business tax rate declined almost continuously from 36 percent of taxable income in 2000 to 24 percent in 2014 before increasing slightly to 25 percent in 2016.³⁴ Combined, these trends delivered average annual growth of 7.6 percent for net after-tax business profit between 1997 and 2017, increasing from 8.4 percent to 15.2 percent of GDP despite the severe 2008-09 recession (figure 7). Virtually all major sectors of the economy experienced robust profitability during this period, with the notable exception of mining and oil and gas extraction, which slumped sharply during

³³ Statistics Canada, "Quarterly Statement of Changes in Financial Position and Selected Financial Ratios, by Industry," CANSIM database, table 187-0002 (Ottawa: Statistics Canada).

³⁴ Statistics Canada, "Financial and Taxation Statistics for Enterprises, by Industry Type," CANSIM database, table 180-0003 (Ottawa: Statistics Canada). The average effective tax rate includes all taxes – both federal and provincial, including income and other taxes – paid by business, expressed as a percentage of taxable income. The average business income tax rate declined from 33.7 percent of taxable income in 2000 to 23.7 percent in 2016.

Figure 7. Corporate net quarterly profits after tax, Canada, 1997-2017

Source: Statistics Canada, CANSIM table 187-0002.

the recession and as oil prices declined. At the opposite end of the spectrum, the finance and insurance sector has accounted for roughly 30 percent of total business profit growth since the late 1990s.³⁵

Business profitability, in fact, has been buoyant in most of the highly developed countries over the past three decades, during which labour's share of GDP has declined as capital's complementary share increased.³⁶ This is the result of deep forces in the world economy related to the globalization and automation of production, which, in combination, have reduced the bargaining power of labour across a wide swath of industries, resulting in wage stagnation.³⁷ At the same time, the market-friendly political consensus that developed in the 1980s made governments reluctant to intervene to mitigate the effect of global economic forces on domestic labour markets. It has been a very good time for business, but less so for the median wage earner.

Canadian business, on the whole, has been successful riding the global wave of rising profitability, despite anemic productivity growth overall and a correspondingly weak commitment to innovation relative to business in other developed countries. The reason appears to be that Canadian business has benefited broadly from global wage moderation since the 1980s, as well as in certain sector-specific ways – for example, from Canada's relative

³⁵ Statistics Canada, "Quarterly Statement of Changes in Financial Position and Selected Financial Ratios, by Industry," CANSIM database, table 187-0002 (Ottawa: Statistics Canada)

³⁶ Between 1990 and 2009, labour compensation as a percentage of national income decreased in 26 of 30 advanced countries, with a median decline from 66.1 percent to 61.7 percent; see International Labour Organization and Organisation for Economic Co-operation and Development, "The Labour Share in G20 Economies" (report prepared for the G20 Employment Working Group, Antalya, Turkey, February 26-27, 2015).

³⁷ D.A. Green, W.C. Riddell, and F. St-Hilaire, "Income Inequality in Canada: Driving Forces, Outcomes and Policy," in *Income Inequality: The Canadian Story*, The Art of the State 5, ed. D.A. Green, W.C. Riddell, and F. St-Hilaire (Montreal: Institute for Research on Public Policy, 2016), 1-73.

global strength in the highly profitable financial industry. As long as Canada's "innovation-light" business strategy continues to generate the kind of overall results summarized in figure 7, most Canadian businesses will have little incentive to change.

CANADA'S LOW-INNOVATION EQUILIBRIUM

Canada has uniquely enjoyed an exceptionally tight relationship with the world's leading economy and innovator, initially Britain and then the United States. The economic logic of this circumstance has resulted in a durable pattern of comparative advantage where, in effect, Canada has traded commodities for technologies. In a 1971 report, the now-defunct Science Council of Canada put the matter this way:

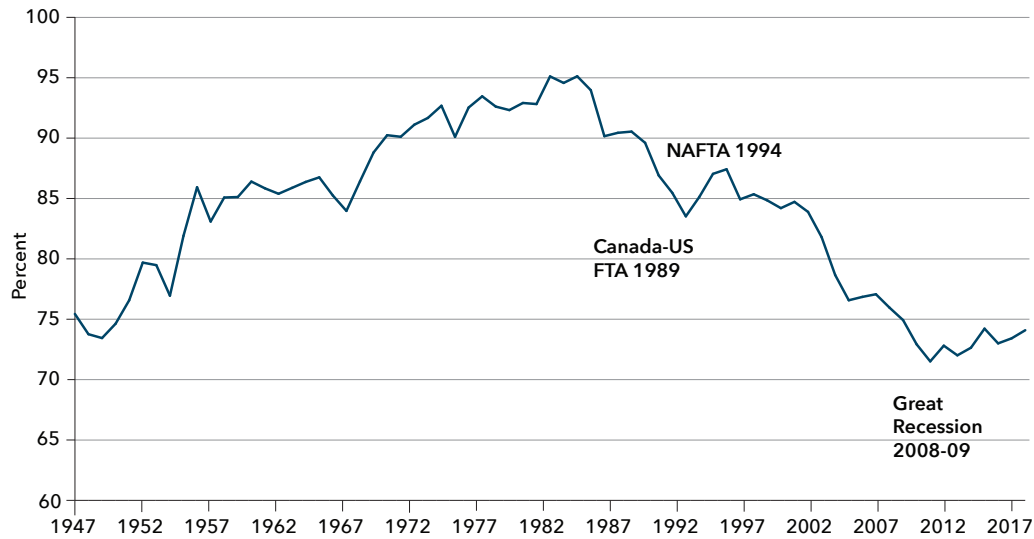
Most industrially developed countries arrived at their present strengths by gradually developing an infrastructure of technology-based industries. In contrast, the development of secondary industry in Canada...was greatly influenced by our proximity to the highly-developed industrial complex in the United States. There developed a tendency to import technology in the form of finished components or design specifications...It is characterized by a continuous flow of information to the recipient who does not need to possess the technology in depth because he is not concerned with its advancement or fundamental modification.³⁸

The United States emerged from the Second World War as by far the global economic and technological leader. There followed a progressively tighter integration of the US and Canadian economies via US direct investment, complemented by formal policy initiatives such as the 1965 Auto Pact and defence production sharing. Although this intensified Canada's dependence on US technology and other forms of business innovation, the bargain was highly beneficial for Canada. During the so-called "Golden Age" from the end of the war until the early 1970s, the gap between Canada's per capita GDP and that of the United States was closing. Moreover, Canadian business productivity was also growing more rapidly than that of its neighbour (figure 8) due to faster growth in capital invested per worker, even though Canadian innovation, as proxied by MFP, continued to lag. The productivity catch-up then stalled and reversed sharply beginning in the mid-1980s, primarily because Canada was much less specialized in the innovation-leading ICT sectors – the third industrial revolution – that, directly or indirectly, have been the main drivers of productivity growth for the past 30 years.³⁹

The 1989 Canada-US Free Trade Agreement and the 1994 North American Free Trade Agreement were expected to enhance Canada's economic development by greatly expanding export opportunities, therefore boosting productivity and competitiveness owing to economies of scale and specialization. Although export sales did increase

³⁸ Science Council of Canada, "Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing," Report 15 (Ottawa: Science Council of Canada, October 1971), 28.

³⁹ G. Cetté, C. Clerc, and L. Bresson, "Contribution of ICT Diffusion to Labour Productivity Growth: The United States, Canada, the Eurozone, and the United Kingdom, 1970-2013," *International Productivity Monitor* 28 (Spring 2015): 81-8.

Figure 8. Labour productivity,¹ Canada as a percentage of United States, 1947-2017

Source: Centre for the Study of Living Standards, "Income and Productivity Data," Ottawa, <http://www.csls.ca/data.asp>.

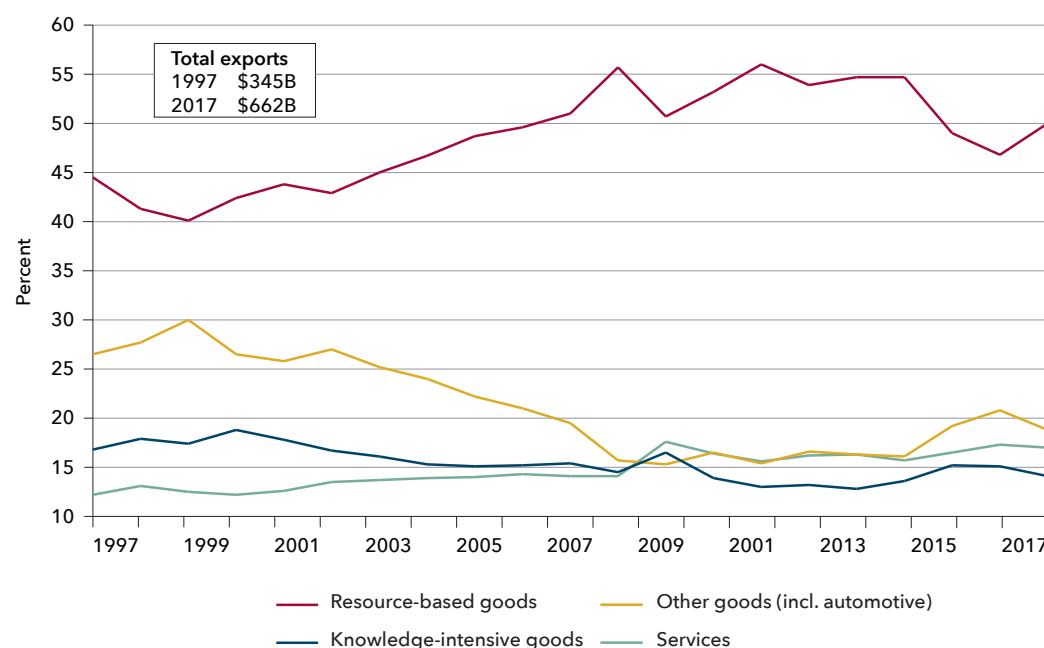
¹ GDP per hour worked in the business sector.

spectacularly, particularly as the Canadian dollar depreciated between 1991 and 2002, exports did not move very far up the value chain.⁴⁰ It would appear instead that the two trade deals, by furthering the specialization associated with comparative advantage, led to an increase in Canada's traditional orientation toward commodities and less-technology-intensive products – or at least did not diminish that orientation (figure 9). And contrary to expectations, Canadian business productivity has lagged far behind that of the United States, falling from 95 percent of the US level in the mid-1980s to about 75 percent currently.⁴¹ The Canadian economy nevertheless discovered a way to keep pace with US growth through relatively better utilization of labour, while the bottom line of Canadian business as a whole has remained strong thanks, as noted, to very subdued wage pressure and significant reductions in the average business tax rate.

So there is really no mystery why Canada is rated an innovation laggard among the advanced economies. Canadian business, in the aggregate, has behaved rationally in acquiring innovation from the world leader and next-door neighbour – in effect, a "buy versus make" decision – and has been only as innovative as it has needed to be. It is as simple as that. And yet, for decades, policy-makers and pundits (including the writer) have been lamenting Canada's innovation shortcomings, wrongly predicting that the sky was about to fall and puzzling over why Canada is so much better at generating knowledge than commercializing it. It is time to stop puzzling. We know why.

⁴⁰ J. Stanford, "Is More Trade Liberalization the Remedy for Canada's Trade Woes?" in *Redesigning Canada's Trade Policies for New Global Realities*, The Art of the State 6, ed. S. Tapp, A. Van Assche, and R. Wolfe (Montreal: Institute for Research on Public Policy, 2017), 525-42.

⁴¹ D. Wolfe, "Introduction," in R. Harris, *Trade, Industrial Policy and International Competition*, 2nd ed. (Montreal; Kingston, ON: McGill-Queen's University Press, 2015). Harris, an influential advocate of the two trade agreements, stresses that trade liberalization needs to be complemented with a focused industrial policy.

Figure 9. Share of exports by category, Canada, 1997-2017

Source: Statistics Canada, CANSIM table 380-0070.

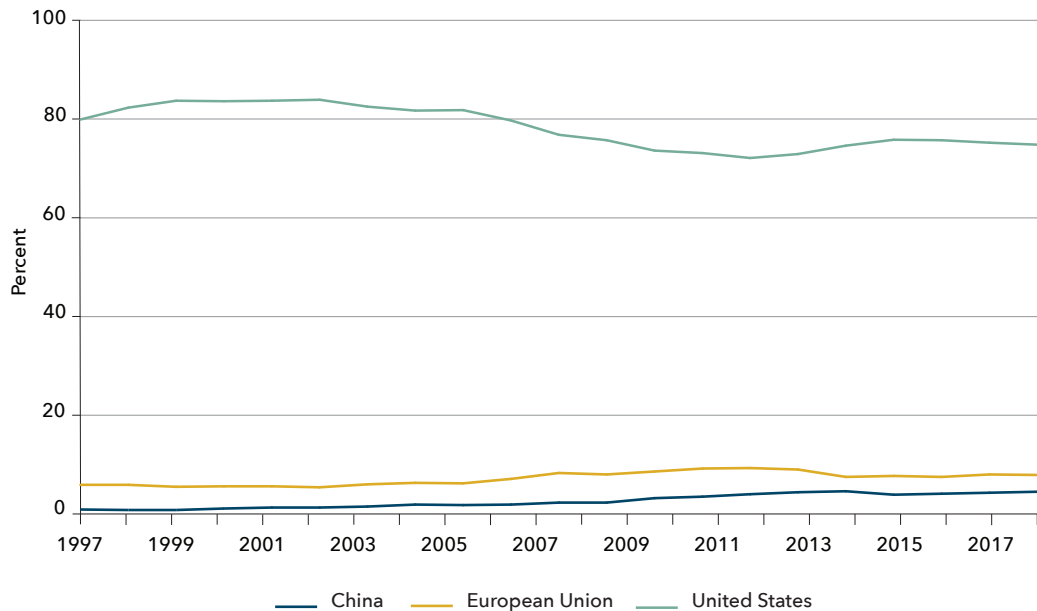
Yet we continue to fret about Canada's lacklustre innovation performance, in part because it represents a forgone opportunity to do even better than it has – accepting bronze when it should be going for gold.⁴² More fundamentally, Canadians should fret because the two underlying factors most responsible for the country's continuing prosperity, despite a weak commitment to innovation, are unsustainable. First, the employment ratio can no longer be expected to contribute much to per capita growth, and is more likely to be a drag. This leaves productivity, and therefore innovation, as the only driver of higher average living standards, including the public resources to support social policies. Second, the growth of business profitability cannot continue to rely indefinitely on meagre wage growth and falling tax rates. Sooner, rather than later, profit growth and trade competitiveness will need to be driven by stronger productivity – which is to say, by innovation.

FOUR GLOBAL MEGATRENDS

The challenge confronting Canada's traditional low-innovation business strategy is magnified by four megatrends that will shape the world economy and the associated political environment in the foreseeable future: globalization, technology, environmental sustainability and population aging.⁴³

⁴² A. Lacavera and K. Fillion, *How We Can Win: And What Happens to Us and Our Country If We Don't* (Toronto: Random House Canada, 2017).

⁴³ P. Nicholson, "Canada's Low-Innovation Equilibrium: Why It Has Been Sustained and How It Will Be Disrupted," *Canadian Public Policy* 42 (S1, 2016): S39-S45.

Figure 10. Share of exports¹ by destination, Canada, 1997-2017

Source: Statistics Canada, CANSIM table 228-0069.

¹ Balance of payments basis.

Globalization

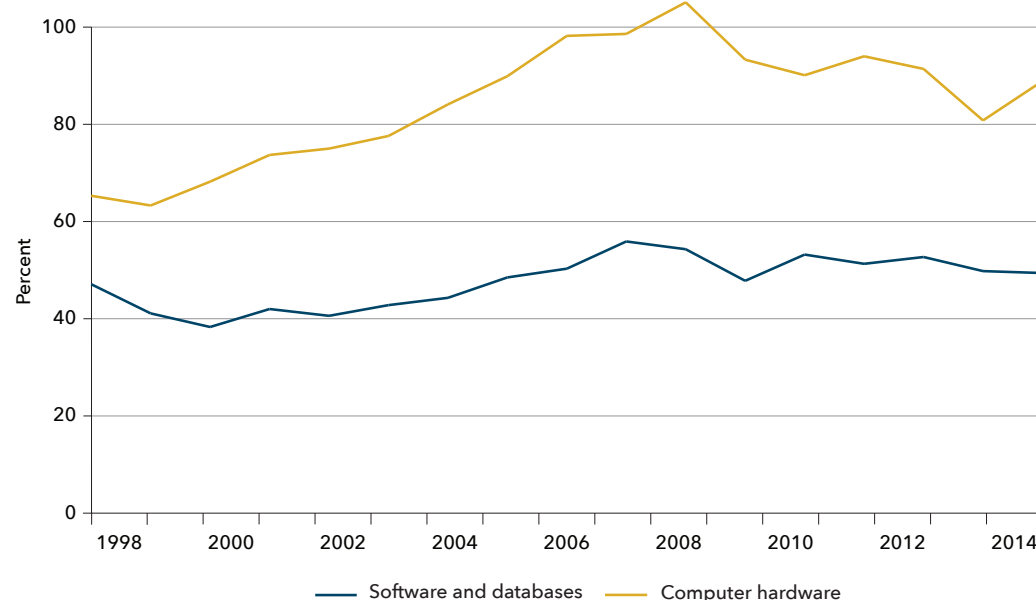
The United States, by virtue of history and geography and despite ups and downs, is bound to remain Canada's principal economic partner. But the locus of global growth will continue to move toward Asia. Consequently, the greatest economic opportunity is shifting from a market (North America) where Canada has enjoyed unique advantages of geography, language and business culture to markets where it has little established position and faces potent competition from well-positioned firms in Japan, South Korea, Australia, Europe and, not least, the United States itself. Canadian business on the whole, but always with notable exceptions, has not developed a global trading perspective; consequently, Canada has few multinationals of scale, even in the resource sectors. The relative lack of global trade engagement puts Canadian business at a disadvantage in acquiring the "innovation" that increasingly will originate in China and other rapidly developing regions as rising levels of education and economic sophistication bring huge new populations into the global pool of innovators. Meanwhile, Canada's outsized dependence on the US market remains largely undiminished (figure 10). This is a growing risk in view of protectionism and/or increasing competition from both the east and south. To maintain Canada's position in the US market and to develop a much stronger place in high-growth markets, Canadian exporters need to become more innovative and outward looking.

Technology

Information technology is transforming virtually every aspect of economic and social behaviour, and is the platform on which virtually all other leading technologies depend. It is spearheading what promises to be a fourth industrial revolution. Indeed, a tipping point already appears to have been reached where genuinely useful artificial

intelligence – in the form of, for example, driverless cars, flexible robots and query-response based on natural language – finally promises to replace countless tasks that until recently were believed to require uniquely human capabilities. No business model will be immune. Although Canadians are among the leaders in digital skills, Canadian businesses, particularly small and mid-sized firms, invest much less per worker in ICT than do their counterparts in the United States and several other advanced countries. The gap is especially large in software and databases, where Canadian investment per worker averages only about half the US level (figure 11). This is of concern because software is now the leading edge of ICT-based innovation and likely to be the principal driver of future productivity growth.⁴⁴

Figure 11. Investment in information and communications technologies per job, Canada as a percentage of United States,¹ 1998-2014



Centre for the Study of Living Standards, "Database of Information and Communication Technology (ICT) Investment and Capital Stock Trends: Canada vs United States," Ottawa, <http://www.csls.ca/data/ict2015.asp>.

¹ C\$ converted to US\$ at purchasing power parity.

Sustainability

Canada, as steward of a vast territory and a resource-based economy, bears a dual ethical and commercial responsibility to be among the world leaders in the transition to environmentally sustainable growth. The threat to resource-based pros-

⁴⁴ J. Thomas, "Explaining Industry Differences in IT Investment per Worker Between Canada and the United States, 2002-2013," CSLS Research Reports 2016-01 (Ottawa: Centre for the Study of Living Standards, March 2016). The investment gap is particularly concentrated in two sectors: Information and Cultural Industries (North American Industry Classification System [NAICS] 51) and Professional, Scientific and Technical Services (NAICS 54). Several plausible hypotheses might explain most of the investment gap – for example, the smaller average size of firms in Canada, Canada's lower incidence of management training and the greater rate of replacement of workers by IT in the United States than in Canada – but further investigation of the responsible factors is needed.

perity is twofold: first, from growing public opposition to practices perceived to be unsustainable and, second, from the development of innovative substitutes for natural resources in response to high prices, concern over security of supply and the desire to reduce environmental impact. In both cases, the threats can be mitigated and transformed into new market opportunities, but only through innovation. It is uncertain, however, whether the potent incentive to innovate created by this nexus of threat and opportunity will be sufficient to overcome the inertia of a status quo sustained by a hard-nosed conviction that, no matter what, global demand for Canadian resources will remain strong throughout corporate planning horizons.

Population aging

Population growth projections by Statistics Canada, under a range of low to high assumptions regarding fertility and immigration, imply that the working-age population (those ages 15 to 65) as a proportion of the total will decline at an average annual rate of 0.4 percent over the next two decades.⁴⁵ This would be a significant economic drag on Canada's annual growth of real GDP per capita, which has averaged 1.4 percent since 1997.⁴⁶ Other things being equal, business will find labour markets tightening and governments will feel pressure on the tax base combined with growing demands for health care and other services associated with an aging population. The net effect on the labour market, however, is hard to predict, since many of today's jobs are vulnerable to automation – indeed, the larger worry currently concerns technological unemployment. Although the transition to a more automated future will create major disruptions in the job market, history suggests that humans will find new ways to re-allocate their time productively, as was the case when agriculture was mechanized and when shrinking manufacturing employment was more than made up by jobs in services. In any event, Canadian business will face a growing challenge to innovate, either to stay at the leading edge of automation or to find ways to increase productivity if the labour supply contracts.

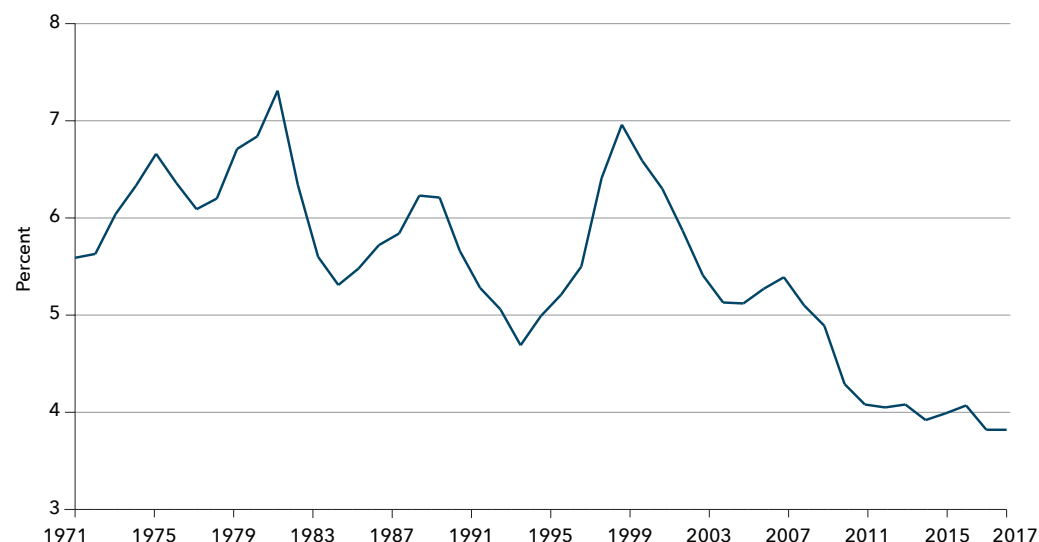
These four megatrends, which are already well established and gaining momentum, are of particular significance for the strategy of Canadian business in view of Canada's outsized reliance on the US market, lagging investment in information technology, the prominent environmental footprint of the Canadian economy and the productivity imperative implied by demographic changes. Together, these trends will profoundly disrupt Canada's low-innovation equilibrium.

How well positioned to respond is Canadian business? The trend of investment in innovation is not encouraging. Figure 12 shows that investment in machinery and equipment, which embodies innovation in the capital goods sector, has declined

⁴⁵ Statistics Canada, "Projected Population, by Projection Scenario, Age and Sex, as of July 1," CANSIM database, table 052-0005 (Ottawa: Statistics Canada).

⁴⁶ The demographic drag on the employment ratio is insensitive to population growth assumptions within relatively wide bounds. The effect could be mitigated for a time by an increase in the labour force participation rate (currently 65 percent for ages 15 and over) or in average hours worked per job (currently about 1,700), or by raising the effective retirement age. Although these offsetting adjustments – particularly a higher retirement age – might occur in response to pressures on income, most Canadians would greatly prefer stronger productivity and associated wage growth.

Figure 12. Business investment in machinery and equipment as a percentage of GDP, Canada, 1971-2017



Source: Statistics Canada, CANSIM table 380-0064.

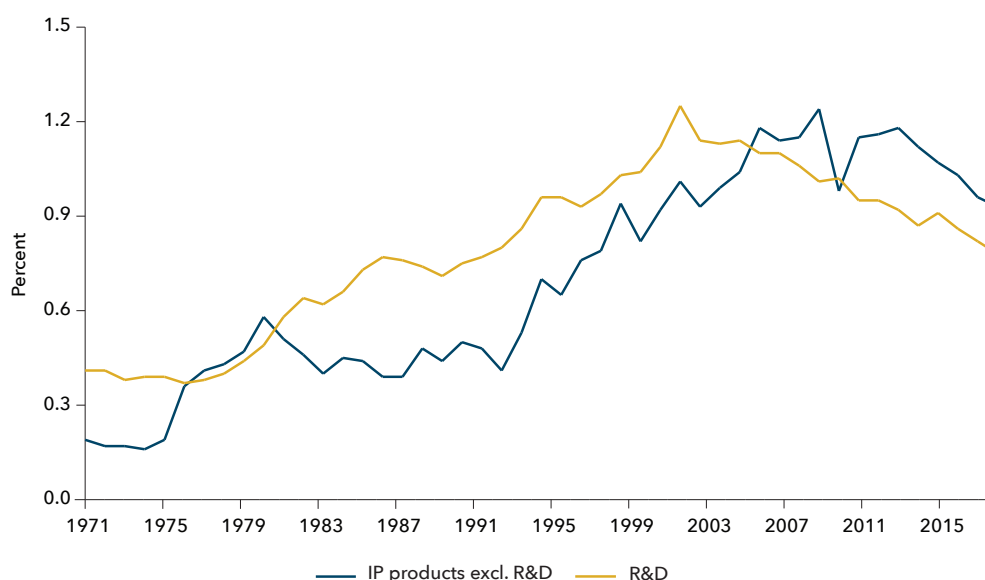
significantly as a percentage of GDP since 2000 despite rock-bottom borrowing costs and, until 2011, a strengthening Canadian dollar. This investment weakness reflects in part manufacturing's declining share of the economy and, since 2014, the effect on energy sector investment of sharply lower oil prices. But as knowledge-intensive services have grown, one might expect investment in "intellectual property [IP] products"⁴⁷ to have increased steadily in relation to GDP. Indeed, that was the case until about 2000 for business R&D and until 2007 for other IP products (figure 13). Since then, however, the trends have reversed, meaning that both hard and soft types of business investment in innovation have been declining relative to GDP for at least 10 years.⁴⁸ Although there are many exceptions to these trends at both the industry and individual enterprise levels, they do not invalidate the message conveyed by the aggregate trends.

It will not be easy for Canadian business as a whole to make the transition from the low-innovation business strategy to which it has become adapted with great success for well over a century. This multigenerational experience has deeply imbued a set of skills, assumptions

⁴⁷ Statistics Canada defines IP products as "the result of research, development, investigation or innovation leading to knowledge that the developers can market or use to their own benefit because use of the knowledge is restricted by means of legal or other protection." Examples include R&D, computer software and databases, mineral exploration and evaluation. https://www.statcan.gc.ca/eng/nea/gloss/gloss_i#Intellectualpropertyproducts.

⁴⁸ US investment trends in machinery and equipment and IP products have been broadly similar to those in Canada but at a significantly higher level relative to GDP. For example, in 2016, US investment in the former was 5.6 percent of GDP compared with 3.9 percent in Canada, and 4.1 percent in the latter compared with 1.7 percent in Canada. Moreover, the percentage of US investment in IP products has been growing since 2006, while declining in Canada. (US data are from the Department of Commerce, Bureau of Economic Analysis; Canadian data are from Statistics Canada, "Gross Domestic Product, Expenditure-based, Canada, Quarterly (x 1,000,000)," CANSIM, table 380-0064 (Ottawa: Statistics Canada).

Figure 13. Investment in intellectual property products as a percentage of GDP, Canada, 1971-2017



Sources: Statistics Canada, CANSIM table 380-0064.

and habits that constitute the Canadian business culture and that will require powerful incentives to change. By far the most influential incentive will come from the market itself, reflecting the challenging environment outlined above. But public policy also has an essential role to play through the influence of government on market forces and on setting conditions that will give Canadian companies the best chance to succeed.

CONCEPTUALIZING INNOVATION POLICY

Innovation policy ideally would encompass all the means by which government deliberately attempts to foster new or better ways of creating significant value. This covers a lot. In practice, innovation policy has been interpreted much more narrowly, and usually has been restricted to domains in which scientific and technological discovery and their application are prominent. A broader conception is needed. In the words of Jan Fagerberg, one of the leading scholars of innovation policy, "All policy instruments that influence innovation in a non-trivial way need to be taken into account. Moreover, a broad definition of innovation is required, including not only the first occurrence of a new product or process but the entire process from the creation of new products, processes and ways to do things to their diffusion and use. These definitional choices follow logically from the premise that the purpose of innovation policy is to contribute to economic prosperity and welfare."⁴⁹

The problem with such a broad conception, however, is that it encompasses virtually the entire array of policy and programs that affect economic performance – those related, for example, to taxation, capital markets, trade, regulation of competition

⁴⁹ Fagerberg, "Innovation Policy," 16.

and intellectual property, public infrastructure, labour markets and immigration, research, education and more. Given the siloed manner in which governments are organized, such a comprehensive scope of innovation policy is presently impractical. The latest renaming of the federal government's "industry" ministry – Innovation, Science and Economic Development (ISED) – is a step in the right direction owing to the explicit inclusion of economic development, but in practice the department's responsibilities remain closer to the traditional purview of innovation policy. The required whole-of-government scope nevertheless can be communicated via clear and repeated statements of priority from the top, supported by tangible actions – as the current federal government has done in the case of gender equality, for example. Every relevant ministry should be made accountable for specific responsibilities in respect of innovation policy and especially for collaborating to make the whole greater than the sum of the parts.

Innovation policy cannot be made in a vacuum; it will be conditioned by a jurisdiction's particular history, political culture and exigent circumstances. History matters a lot and induces a path dependency in policy-making. In Canada, innovation policy is constrained by industrial structure and by the fact that Canada has been mostly a taker, rather than a maker, of technology. Encouraging the rapid diffusion of innovation should therefore be a particularly high priority. Political culture also has a powerful influence on the art of the possible in innovation policy-making – for example, by setting the balance between laissez-faire and interventionist approaches, which usually places Canada in the pragmatic middle. Finally, a dynamic innovation policy will need to address the big challenges and opportunities of the day, which demands a focus on the four megatrends outlined above. Within this broad compass, there will always be more specific issues to tackle – such as meeting commitments to reduce greenhouse gas emissions, helping Canada's advanced manufacturers become leaders in the suite of technologies associated with the fourth industrial revolution and striking the best balance between innovation and stability in the financial sector.

As innovation policy has become a preoccupation in all economically advanced countries, Canada might learn important lessons from their experience.⁵⁰ Australia, for example, is a highly relevant comparator by virtue of its resource-heavy economy, federal structure, common language and comparable size. The experience of the Nordic countries is also likely to be relevant given their resource intensity (Norway, Finland) and industrial sophistication (Sweden, Denmark) combined with an innovative policy culture. But this experience needs to be filtered through the lens of Canada's particular history, political culture and specific priorities. Policy lessons from other jurisdictions cannot simply be "fork lifted" into the Canadian context. And the most important point is that the impact of innovation policy depends far less on the policy ideas themselves than on the effectiveness of their implementation.

⁵⁰ See, for example, K. Izsák, P. Markianidou, and S. Radošević, *Lessons from a Decade of Innovation Policy: What Can Be Learnt from the INNO Policy TrendChart and the Innovation Union Scoreboard*, Final Report (Brussels: European Union, June 2013); and J. Edler, P. Cunningham, A. Gök, and P. Shapira, *Impacts of Innovation Policy: Synthesis and Conclusions* (Manchester: Manchester University, Manchester Business School, Manchester Institute of Innovation Research, June 2013).

TWO ERAS OF INNOVATION POLICY

The period since the end of the Second World War can be divided into two eras characterized by very different economic policy philosophies and by dramatically different outcomes in terms of productivity and growth of GDP.⁵¹

The first period, from the late 1940s through the early 1970s, was a Golden Age for the advanced industrial countries. Postwar rebuilding, together with the maturation of the second industrial revolution, powered three decades of unprecedented and widely shared prosperity. During this era, the application of Keynesian economic policies to smooth the business cycle, innovative social policies to enhance welfare and income security, and science and technology (exemplified by the Manhattan Project) to win the war combined to inspire faith in the benefits that an activist state could provide.

Then, in the early 1970s and for reasons that are still debated, the virtuous circle turned vicious: productivity and GDP growth nosedived, inflation soared and public faith in government ebbed. This gave rise to the second era, beginning in the early 1980s following the elections of Margaret Thatcher and Ronald Reagan with a pledge to curb the overreach of activist government in favour of much greater reliance on the private sector and market forces. The “markets-know-best” policy approach, which has been dubbed “neoliberalism,” was to become the de facto consensus among OECD countries, and is only recently being questioned in the aftermath of the 2008-09 recession and the persistence of sluggish productivity growth.

Canada has been an exemplary exponent of the neoliberal policy paradigm: restoring fiscal balance after 1995, embracing free trade, privatizing Crown enterprises, cutting taxes as well as direct business subsidies and reducing regulation to permit the freer play of market forces, although protection has remained in some key sectors. In the subdomain of science and technology policy, Canada’s market-oriented approach has emphasized:

- tax-based subsidies for R&D – the Scientific Research and Experimental Development (SR&ED) Program – to address a presumed market failure that leads business to underinvest in R&D. The tax-based approach also avoids the temptation for government to pick winners;
- a sharp reduction in direct grants and subsidies to support business R&D; and
- significantly increased support for university research, especially from 1997 through 2007, combined with numerous initiatives to encourage much greater R&D collaboration between business and academia, along with a continuing long-term decline of in-house government science.⁵²

⁵¹ The history of innovation policy in Canada has been exhaustively documented; see, for example, G.B. Doern, D. Castle, and P. Phillips, *Canadian Science, Technology and Innovation Policy* (Montreal; Kingston, ON: McGill-Queen’s University Press, 2016); and B. Smardon, *Asleep at the Switch: The Political Economy of Federal Research and Development Policy since 1960* (Montreal; Kingston, ON: McGill-Queen’s University Press, 2014).

⁵² A. Sulzenko, “Canada’s Innovation Conundrum: Five Years after the Jenkins Report,” IRPP Report (Montreal: Institute for Research on Public Policy, June 2016).

Canada's neoliberal approach has produced several notable successes: the sharp decline and stabilization of government debt as a percentage of GDP, booming exports, a robust increase in corporate profits and the success of Canadian academic research in joining the ranks of global leaders in quality and volume. In terms of more fundamental innovation metrics, however, outcomes have disappointed. Most significantly, as noted, productivity growth has been exceptionally weak for 30 years – particularly the MFP component, which captures the effect of innovation (other than innovation embodied in capital investment, which has also fallen as a share of GDP). As well, there has been little increase in trade diversification toward new higher-technology goods and services, the number of Canadian-owned multinationals has declined and business R&D spending has fallen relative to GDP almost continuously since 2001, in sharp contrast with an increase on average for the OECD countries.

Measured by productivity and GDP growth, the contrast in Canada between the Golden Age and the neoliberal period is striking. This is not to say that policy activism in the former and deference to market forces in the latter have been mainly responsible for the very different outcomes – larger forces were also at play. Moreover, some neoliberal reforms, particularly regarding fiscal discipline, were necessary and have been effective. But events have shown that a dogmatic faith in neoliberalism is unjustified.⁵³ Markets do not always know best, and the risk of government failure is not always greater than the risk of market failure.

The conclusion to be drawn from the past 70 years of economic history in the West is that a pragmatic, less ideological approach to economic and innovation policy is needed. The change in outlook nevertheless will require deliberate effort, since the neoliberal paradigm is deeply embedded in the mindset of many senior economic policy-makers.

NEEDED: A NEW TAKE ON INNOVATION POLICY

Canadian innovation policy has not delivered as expected. The heavy emphasis on R&D is clearly producing diminishing returns; Canada's international standing on innovation metrics is, if anything, deteriorating; and, most significantly, its productivity growth has been weak relative to other advanced nations for decades. Faced with an impending demographic drag on GDP growth and megatrends in the world economy that demand innovative responses by Canadian business, the situation has become urgent. Yet Canadian business will inevitably need time to successfully move away from its embedded low-innovation habits. The challenge is made more difficult by the fact that market pressure, although of growing concern for many companies, has not yet reached the tipping point necessary to bring about a fundamental shift to innovation as a core business strategy. What is needed is a more potent incentive for Canadian firms to adopt such a strategy rather than just pay lip service to it.

⁵³ M. Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths* (London: Anthem Press, 2013).

Traditionally, federal innovation policy has emphasized “supply-push” measures. These include support for academic research and training to develop ideas and produce qualified people; financial support for inputs – such as R&D and venture capital investment – into the innovation process; and the mobilization and diffusion of knowledge through the National Research Council, various departmental programs and Statistics Canada.⁵⁴ Although these and other established policy instruments will continue to be necessary, they are clearly not sufficient to induce the hoped-for innovative response from the business sector.⁵⁵ It is now widely recognized in innovation policy circles that more “demand-pull” measures are needed to complement such supply-side measures and to stimulate business innovation more effectively.⁵⁶

There is considerable definitional ambiguity about how to differentiate between demand-side and supply-side measures.⁵⁷ I define supply-side measures as those that strengthen a company’s *capacity* to innovate, and demand-side measures as those that increase the *market incentive* to innovate. This choice of a demand-side definition – which focuses on the business enterprise – is motivated by the need to create, through public policy, effective incentives to shift business behaviour away from its low-innovation habit. Thus, what are needed are demand-side policy measures that provide strong incentives for businesses to innovate, either to seize new or expanded market opportunities (carrots) or to meet stronger competition (sticks). It is also the case that strong demand for innovation will motivate firms to enhance their innovation capacity (by developing specific skills or new processes, for example) in order to meet that demand. And the incentive to innovate would be increased if the costs of inputs into the innovation process (supply factors) are lowered. Thus, since supply-side and demand-side factors inevitably interact, a more effective policy would coordinate initiatives on both sides to amplify the incentive to innovate.

Demand-side innovation policies

Following are the principal categories of demand-side measures that have been implemented in various jurisdictions, the main rationales for their use and some caveats that constrain their implementation and therefore define the challenge for innovation policy-makers.

⁵⁴ Innovation Canada, *A Call to Action, Review of Federal Support for Research and Development – Expert Panel Report*, (“Jenkins Report”) (Ottawa: Industry Canada, 2011).

⁵⁵ Direct federal spending in support of business innovation in 2016 totalled \$1.46 billion spread across almost 70 programs and subprograms and consisting of a mixture of grants and repayable and non-repayable contributions. See Treasury Board Secretariat, “Horizontal Business Innovation and Clean Technology Review (Ottawa, 2017), <https://open.canada.ca/data/en/dataset/4112e654-b080-4ce0-a4e4-d739e8f274f7>). In addition, the SR&ED tax credit represented a “tax expenditure” of \$2.7 billion in 2016 to support business R&D.

⁵⁶ See, for example, Organisation for Economic Co-operation and Development, Directorate for Science, Technology and Innovation, *Demand-side Innovation Policies* (Paris: OECD, 2011); and European Commission, Directorate-General for Research and Innovation, *Supply and Demand Side Innovation Policies: Final Report* (Brussels: European Commission, February 2015).

⁵⁷ A much-cited definition of demand-side policy is “all public action to induce innovation and/or speed up the diffusion of innovation through increasing the demand for innovation, defining new functional requirements for products and services and/or improving user involvement in innovation production”; see J. Edler, “Review of Policy Measures to Stimulate Private Demand for Innovation: Concepts and Effects,” Nesta Working Paper 13/13 (London: National Endowment for Science, Technology and the Arts, November 2013). The focus of demand-side innovation policy in the European literature is the user/customer. The business sector is treated as being wholly on the supply side – that is, the supplier of innovation in response to user demand/need.

Public procurement

In Canada, the public sector is the largest purchaser of goods and services, and can therefore move markets.⁵⁸ In other countries, such as the United States, the United Kingdom and France, defence procurement has played a key role in demand-side innovation policy and in the development of many advanced industries. Canada certainly could do more in this regard.⁵⁹ Targeted public procurement, in addition to providing innovative solutions to public sector needs, can create an incentive for companies to innovate to meet stringent requirements. By becoming an early, demanding customer, the public sector can also help provide market validation for suppliers and enable them to compete in the global market. There are, however, major challenges to implementing such measures. For one, procurement is normally expected to meet the “best value for money” test, which favours low-cost, established suppliers. For another, innovation-oriented procurement implies adding an extra layer of consideration in the process that might result in purchasing delays and in any event would require public officials to be well trained to connect procurement needs with opportunities to encourage innovative suppliers. As well, trade agreements limit the extent to which Canadian governments may favour domestic suppliers. In practice, however, the most significant challenge is that the mission of the procuring agent rarely includes promotion of innovation per se, so procurers are likely to be reluctant to add a consideration that might increase costs and divert attention from their primary accountability.

Export facilitation

The prospect of increased export sales is a potentially powerful incentive for Canadian companies to innovate to become more globally competitive. And their willingness to bear the risk and cost of innovation will increase with the scale of the potential market reward. Public policy already plays a key role through trade agreements and the promotion of Canadian products in target markets. The policy challenge, however, is that high-value trade in innovative products often entails competition for market share that induces conflict over subsidies and protectionism of various kinds, as the Canadian aerospace industry has frequently encountered.

Encouraging user demand

Governments can design incentives to increase customer demand for innovative goods and services. Typically, such incentives relate to a public policy objective other than innovation per se – for example, rebates or other forms of subsidies on energy-efficient equipment, labelling requirements and other measures to raise consumer awareness and enable informed customer choice, which then induce suppliers to innovate. Potential downsides of such incentives, however, include the cost of subsidies relative to their benefit and the risk of encouraging suboptimal technologies. Moreover, the benefit of most user-oriented incentives could “leak” to suppliers in other jurisdictions, which would blunt any innovation policy objective.

⁵⁸ Public procurement by all governments in Canada is approximately \$120 billion, of which about 13 percent (more than \$15 billion) is in the federal sphere; see Organisation for Economic Co-operation and Development, *Government at a Glance* (Paris: OECD, 2015), 136; and Innovation, Science and Economic Development Canada, “Why Sell to the Government” (Ottawa, 2018), <https://canadabusiness.ca/government/selling-to-governments/why-sell-to-the-government/>.

⁵⁹ Special Adviser to the Minister of Public Works and Government Services, *Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities* (Ottawa, February 2013).

Regulation

Regulation to achieve various public policy objectives can have a potent effect, either positive or negative, on the incentive to innovate. On the positive side, for example, putting a price on carbon induces innovation to lower greenhouse gas emissions, gas mileage standards encourage innovation in the auto industry and new building codes lead to considerable innovation in the construction and materials industries. But regulation sometimes can inhibit innovation – for example, where new concepts cannot be tested in a realistic environment because they would violate some regulation. This kind of constraint is frequently encountered in the financial sector, and has led, initially in the United Kingdom, to the concept of a “regulatory sandbox” that allows a new product to be tried on a limited basis without the prevailing regulatory constraint.⁶⁰ This concept should be given wider application. The use of regulation as an explicit instrument of innovation policy, unfortunately, faces many of the same challenges as do public procurement and consumer incentives, particularly as the regulating agency rarely has the promotion of innovation as an explicit objective, and therefore is likely to resist any initiative that risks compromising the agency’s primary mission.

Intellectual property protection

Protection of intellectual property is essential to sustain the incentive to innovate in certain industries, especially where IP is expensive to produce but easy to replicate, as in the case of drug development and in any activity where the “recipe” comprises most of the value. Unfortunately, taking advantage of different countries’ IP systems has become a sophisticated aspect of international competition, and in this regard Canada arguably has not maintained adequate defences.⁶¹ To help address this concern, the federal government recently launched a new strategy to facilitate access to IP and to support development of IP expertise and legal advice to Canada’s innovation community.

Competition policy

Market competition is usually the most potent incentive to induce an innovative response from business.⁶² Competition policy, as a regulatory matter, should therefore be seen as a key element of a comprehensive innovation policy.⁶³ Policy regarding foreign direct investment, foreign ownership more generally and import protection can all affect competition profoundly in some prominent Canadian industries, such as banking, telecommunications and certain agricultural products. In each of these cases, there are legitimate competing objectives, but too rarely is explicit consideration given to their effect on the incentive for affected Canadian companies to become more innovative. To the extent that insulation from increased competition has led to companies in these sectors being less innovative, it has also reduced their potential to grow, and made them more vulnerable as technological changes inevitably undermine and circumvent protective barriers.

⁶⁰ Canadian Securities Administrators, “CSA Regulatory Sandbox” (Montreal: CSA, 2009), https://www.securities-administrators.ca/industry_resources.aspx?id=1588.

⁶¹ J. Castaldo, “Jim Balsillie on How Canada Is Doing Innovation Wrong – and How to Fix It,” *Canadian Business*, October 7, 2016.

⁶² There can be cases where too much competition fragments a market and reduces profitability below the point where the affected businesses are willing or able to incur the cost and risk of investing in innovation. But by far the more frequent concern of public policy is with too little competition, not too much.

⁶³ P. Boothe, “Compete to Win: The Wilson Panel Report Six Years Later” (Ottawa: Canadian Council of Chief Executives, March 2015).

The foregoing examples do not exhaust the spectrum of demand-side policy measures. The literature on the subject also includes the role of standards-setting bodies, the use of “prizes” to encourage innovative solutions to specific challenges and the creation of innovative capacity in response to major public initiatives. The Manhattan and Apollo Projects in the United States, which produced the atom bomb and put men on the moon, and in Canada, the pioneering creation of a satellite-based communications system and the development of the CANDU reactor, which gave early impetus to the space and nuclear industries, are examples of the latter.

The bottom line on demand-side innovation policy

The bottom line is that demand-side innovation policy, by creating new market opportunities and/or intensifying competition, can *directly* affect the profit-seeking behaviour of firms and prompt them to innovate. The main challenge is that most demand-side measures act through agents of government that do not have promotion of business innovation as an explicit and accountable objective. Innovation policy, which should be interpreted broadly because of its profound link to productivity and GDP growth, must therefore be seen ultimately as a whole-of-government responsibility.

As a practical matter of government organization, day-to-day accountability should be assigned to a particular ministry – in the current federal context, Innovation, Science and Economic Development Canada, together with a cabinet committee and mirror group of officials. Similar approaches have been tried in the past, beginning in 1979 with the Ministry of State for Economic Development, but without success, apparently because the prime minister of the day was not prepared to force the various line departments to bend their priorities in service of the cross-government objective. Having learned from that experience, demand-side innovation policy can be really effective going forward, only if there is unswerving commitment, clearly communicated, from the top.

THE FEDERAL INNOVATION STRATEGY TODAY

The Trudeau government’s innovation strategy has been set out in a series of initiatives introduced in the 2016 through 2018 budgets, which clearly identify the business enterprise as the central actor.⁶⁴ Specifically, the federal government has recognized the need to streamline its bewildering cobweb of business support programs, which will be consolidated under four “flagships”: the Industrial Research Assistance Program (IRAP), the Strategic Innovation Fund (to support large business R&D projects), regional development agencies and the Trade Commissioner Service. The strategy includes a welcome recognition, signalled by the new prominence given IRAP and the regional development agencies, of the need to focus intensively on technology adoption by small and medium-size businesses. Promoting the diffusion of innovation is where supply-side government support could be

⁶⁴ The 2018 budget also responded to the recommendations of the Fundamental Science Review undertaken by an expert panel chaired by David Naylor. The government has pledged \$3.2 billion over five years of new funding for fundamental research.

most effective in boosting productivity growth. Indeed, innovation policy needs to put even greater emphasis on broadening the range of measures to encourage the uptake of innovation throughout the economy.⁶⁵

The new federal strategy is light on the demand side and is largely limited to an expanded innovation procurement program, Innovative Solutions Canada, to be modelled on the long-standing Small Business Innovation Research program in the United States; a regulatory reform agenda to support innovation and business investment; and a new intellectual property strategy. These are steps in the right direction, but they have been only modestly funded as the government feels its way forward from an almost exclusive reliance on supply-side measures. Accordingly, the Institute for Research on Public Policy's research program on demand-side innovation policy will not want for important work to do or for an engaged audience in government.

The centrepiece of the current federal innovation strategy is a \$950-million, five-year "supercluster" initiative that features five sector-based collaborations focused on ocean industries, use of artificial intelligence in supply chains, advanced manufacturing, protein industries and digital technologies.⁶⁶ It is well established that innovative activity thrives in certain geographic agglomerations, or clusters: vibrant innovation ecosystems of specialized talent, anchor companies and a web of suppliers whose concentration generates spill-over benefits beyond the contributions of the individual players.⁶⁷ US examples include Silicon Valley, Hollywood and Wall Street; in Canada, examples include the aerospace cluster in the Montreal area, the oil and gas industry in Alberta and the ICT-related hive of activity centred on Waterloo, Ontario. Once an embryonic cluster forms, often due to a confluence of somewhat random factors, it feeds on itself as strength attracts strength.

Ottawa's supercluster initiative seeks to foster this dynamic by stimulating collaboration among businesses, academic institutions and nongovernmental organizations in regions where relatively strong sectoral agglomerations already exist. The program is neither purely supply side nor demand side; rather, it is inherently a mixture of both that seeks to strengthen the "connective tissue" within existing innovation ecosystems by stimulating partnerships among businesses themselves and with researchers to address significant business opportunities and challenges. Government funding provides the catalyst, but will be matched at least one-for-one by private sector participants.⁶⁸

Superclusters exemplify the contemporary trend in innovation policy, particularly in Europe, to focus on strengthening the performance of the innovation system as a whole by

⁶⁵ M. Draghi, "Moving to the Frontier: Promoting the Diffusion of Innovation" (address at the joint conference by the European Central Bank and the MIT Lab for Innovation Science and Policy, Frankfurt-am-Main, March 13, 2017).

⁶⁶ Innovation, Science and Economic Development Canada, "Canada's New Superclusters" (Ottawa, 2018), <https://www.ic.gc.ca/eic/site/093.nsf/eng/00008.html>.

⁶⁷ M. Delgado, M. Porter, and S. Stern, "Clusters, Convergence, and Economic Performance," NBER Working Paper 18250 (Cambridge, MA: National Bureau of Economic Research, July 2012).

⁶⁸ Canada's supercluster program is broader in sectoral scope but very similar in objectives and design to the National Network for Manufacturing Innovation in the United States (now Manufacturing USA), with that program's "Institutes" being analogous to the individual superclusters. See Manufacturing USA, *Annual Report 2016* (Washington, DC: Department of Commerce, 2017), <https://www.manufacturingusa.com/sites/prod/files/Manufacturing%20USA-Annual%20Report-FY%202016-web.pdf>.

intervening to improve the system's linkages, rather than concentrating on the individual actors.⁶⁹ Canada's supercluster program – and variants currently being undertaken in, for example, Norway and Australia – are important experiments that represent a new take on past efforts to promote clusters.⁷⁰ If the new types of cluster policies are to be effective, they will need to build on already well-established areas of strength – which Canada's five selected superclusters appear to do – and, most crucially, they will need continuing senior-level support from a critical number of business participants. The challenge, however, is that collaborative innovation is not a habit that comes easily. Once the initial blush of enthusiasm wears off, executives' attention will tend to return to the day-to-day pressures of business as usual. Without sustained senior engagement from several companies in a supercluster, the agenda inevitably will lose business relevance, to be replaced by the priorities of researchers.

WILL THIS TIME BE DIFFERENT?

In concluding this paper one must ask whether the current federal government's innovation strategy, or its future iterations, are likely to be more successful than the generations of previous attempts to dislodge the Canadian economy from its low-innovation equilibrium. Skepticism is justified in view of an observation made almost 50 years ago by the Senate Special Committee on Science Policy chaired by Maurice Lamontagne: "Since 1916 the main objective of science policy has been to promote technological innovation by industry...Almost every decade since the 1920s has witnessed renewed attempts by successive governments to achieve it but, on the whole, they have all failed. What progress has been made in this respect results almost exclusively from the initiative of industry itself."⁷¹ Nothing has changed in the half-century since to warrant a fundamentally different conclusion.

Canada's low-innovation equilibrium has been durable because it has been successful, despite itself, in the two ways that count most. First, the business sector as a whole has found ways to sustain healthy profitability; second, the per capita growth of the Canadian economy has kept pace with its principal comparator, that of the United States. Consequently, there has been little sustained commercial or political pressure to address fundamentally the underlying innovation weakness in the economy. Apart from episodic panics during recessions, or when commodity prices plunge or the United States turns protectionist, economic growth policy has usually been a back-burner issue in Canada.

Where, then, is the incentive to change? The political incentive to focus more intensively on innovation policy arises from the fact that Canada's future economic growth will need to rely on stronger productivity, and therefore on innovation, as the impetus supplied by Canada's employment ratio continues to fade. The business incentive to

⁶⁹ Organisation for Economic Co-operation and Development, *Governance of Innovation Systems*, vol. 1, *Synthesis Report* (Paris: OECD, 2015).

⁷⁰ D. Wolfe, "Cluster Policies and Cluster Strategies: Lessons from the ISRN National Study" (report presented at the Annual Policy Day of the Innovation Systems Research Network, Montreal, April 30, 2008).

⁷¹ Senate Special Committee on Science Policy, *A Science Policy for Canada*, vol. 1, *A Critical Review: Past and Present* (Ottawa, 1970), 102, <http://www.albertasenate.ca/flashblocks/data/BT%20Science%20and%20Technology/Science%20Policy%20Vol%201.pdf>.

put innovation at the core of its strategy is manifest in the four megatrends related to globalization, technology, sustainability and population aging. What is unknowable is how quickly and painfully the consequences of those megatrends will materialize to spur more innovation-focused business strategies. Until that happens, the federal government's innovation strategy will be pushing uphill. As long ago as 1972, the dilemma was described authoritatively by V.O. Marquez, then the chief executive officer of Northern Electric: "It is uncertain whether any incentive plan to stimulate the growth of domestic technology and innovation, or to make corporations expand aggressively into foreign markets, can deliver significant success when applied to companies in which the drive to do these things has not already been forced to emerge because of exposure to a real stimulus from the economic environment."⁷²

So will this time be different? The only honest answer is "maybe." It depends on when the irresistible forces emanating from the global economy meet the immovable object that is Canada's ingrained low-innovation habit, and on how that interaction plays out sector by sector. In the meantime, it is the job of policy-makers to look forward and perceive the big picture, and then to convey and test that perception with business, whose focus is narrower but deeper. The six sectoral Economic Strategy Tables established by the federal government in 2017 provide such a forum for innovation strategy development, and represent a promising way to amplify the relevance and effect of policy measures on both the supply and demand sides.

In view of the evidence summarized in this paper, the federal government should push forward with greater urgency to develop a more ambitious and comprehensive innovation policy, recognizing that innovation is the ultimate source of Canadians' prosperity. In implementing that policy, the government should be guided by five broad principles:

- The objective of innovation policy is to promote economic growth overall: it therefore must be approached from a whole-of-government perspective.
- Business is the primary vector of innovation in the economy: innovation policy must therefore aim first to influence business strategy.
- There is a proactive role for government, not only to correct market failures but also to mobilize innovation to achieve articulated national goals.
- Innovation policy requires a system perspective, with measures that help the elements of Canada's innovation system interact more collaboratively and efficiently.
- Innovation policy needs rebalancing to increase emphasis on measures that (a) enhance the demand for innovation and (b) promote broader and more rapid uptake of innovation by businesses of all sizes and in all sectors of the economy.

⁷² V.O. Marquez, "Building an Innovative Organization – Wanted: Small Catastrophes," *Business Quarterly* (University of Western Ontario) 37 (no. 4, 1972): 40-7.



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