Canada’s Low-Innovation Equilibrium: Why It Has Been Sustained and How It Will Be Disrupted

PETER NICHOLSON
Inaugural President, Council of Canadian Academies, Ottawa, Ontario

The paper begins with some basic innovation definitions and quickly reviews evidence of the relatively weak innovation performance of Canadian business. The core of the paper develops a thesis that explains why Canadian industry, on the whole, has not emphasized innovation in its business strategies but has prospered nonetheless. This raises the question of whether Canada’s low-innovation equilibrium can persist in the face of tectonic forces related to globalization, technology, and sustainability that require innovative responses from enterprises worldwide and, not least, from Canada.

Keywords: low-innovation equilibrium, small catastrophes, globalization, technology, sustainability, policy

Since 1916 … the main objective of Canadian 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.

So concluded in 1970 the Senate Special Committee on Science Policy chaired by Maurice Lamontagne in a report that still stands as the most thorough analysis of the role of science and technology policy—what today we would call “innovation policy”—in support of Canada’s economic performance (Senate Special Committee on Science Policy 1970). In the more than four decades since Lamontagne’s report, nothing has changed to alter the essential truth of its conclusion.

As we reflect on the role of innovation in achieving sustainable prosperity, it is important first to understand why, for the past hundred years, policies to foster business innovation in Canada have been puzzlingly ineffective, at least relative to their main objective. The purpose of this paper is to propose an explanation and then to suggest how the conditions that have sustained Canada’s low-innovation equilibrium are being altered in ways that will greatly increase the incentive for Canadian industry to become more innovative and, as a corollary, for public policy to foster business innovation to become more effective.

Innovation Defined
Innovation can be understood simply and intuitively as “new or better ways of doing valued things.” The “new” ways often create entirely new markets or socio-cultural phenomena—the steam engine, the automobile, the micro-chip, the limited liability corporation, the
shopping mall, rock ‘n’ roll, Facebook. Such novelty is relatively rare but can be world-changing. Meanwhile, the “better” ways refer to the continuous improvements that follow big breakthroughs. This ubiquitous incremental process is typical of the vast majority of innovative activity and is principally responsible for productivity growth. The definition also speaks of innovation in the context of “doing valued things,” suggesting that its scope encompasses the totality of human needs and wants. Moreover, because what is valued typically varies among individuals and groups, and over time, the consequences of innovation might be good or bad depending on circumstances; consider the splitting of the atom.

It must be emphasized that the impact of an innovation is due almost entirely to its diffusion—the speed and extent of its adoption and adaption by users. For example, a new production technique like six-sigma quality control might have been first developed within a single organization, but its impact has been enormously amplified by replication in countless businesses, each of which could count it as an innovation when first applied. It is therefore important to distinguish between innovations that are “first in the world” and those that are first in an enterprise or in a particular market. The world-firsts get all the attention, but the diffusion of innovation is where the bulk of the value is created. Canada, for example, can never account for more than a small share of world-first innovations (roughly proportional to our population). We must therefore rely heavily on efficient diffusion—quickly adopting the best the world has to offer and then continually improving and adapting it to Canadian conditions.

**Canadian Innovation Performance Assessed**

Generations of analysts, pundits, politicians, and many business leaders themselves have decried the comparatively poor innovation track record of Canadian business (Smardon 2014). This is a blanket evaluation based on averages and in comparison with other advanced countries, and is often relative specifically to the United States. There are of course a great many exceptionally innovative businesses in Canada; it is just that there are relatively fewer than in many of the OECD group of countries. This essential qualifier must be borne in mind when interpreting subsequent references to business innovation performance—I refer to relative average performance with the implicit acknowledgement that there are many exceptions.

The evidence of sub-par business innovation in Canada is compelling and is based on a broad array of quantitative and qualitative indicators and on their consistent pattern over long periods (The Expert Panel on Business Innovation 2009). For example: business spending on research and development (R&D) as a percentage of GDP has always lagged behind the OECD average, is now only about half the US level, and has been on an unprecedented declining trend since the “tech crash” in 2001. Related indicators of patenting and employment of researchers with advanced degrees are also below those of most peer countries. International competitiveness surveys, such as those carried out annually by the World Economic Forum (2016) and others, give Canada at most a middling ranking in terms of innovation. “Innovative” is not a prominent feature of this country’s global brand.

Perhaps most tellingly, the growth of Canada’s labour productivity (GDP per hour worked) in the business sector has been relatively anemic for the past 30 years, with the effect that our productivity has declined from more than 90 percent of the US level in 1984 to just over 70 percent in 2012, as illustrated in Figure 1. Statistics Canada has compared labour productivity growth in Canada and the United States since the early 1960s and has shown that the slower average growth in Canada has been due to persistently weaker growth of multifactor productivity (MFP) (Baldwin and Gu 2013). This is a somewhat abstract statistic that measures the part of labour productivity growth that is not accounted for by changes either in workforce quality (e.g., years of experience and education level) or in capital per worker. Although the interpretation of MFP is debated, it certainly captures the impact on labour productivity growth of innovation in business models, processes, workplace

![Figure 1: Labour Productivity: Canada as Percentage of United States](https://utpjournals.press/doi/pdf/10.3138/cpp.2015-019 - Friday, December 06, 2019 3:44:06 PM - IP Address:52.11.211.149)
organization, and other intangible aspects of working smarter.3

Notwithstanding the lack of consensus as to the best measure of “innovation,” Canada’s persistently weak MFP growth, combined with the R&D numbers and expert opinion surveys, constitute broadly acknowledged evidence that the innovation performance of Canadian business is persistently sub-par.

The question, too little asked, is why? If it is true that innovation tends to enhance business performance—and there is really no doubt that in most cases it does—then what have so many Canadian businesses been missing? Do they really not know where their best interests lie? An individual company may of course get its strategy wrong, and the market usually takes care of such mistakes, but the same cannot be said of the entire Canadian business sector, and over more than a century. No—the fact is that Canadian business has behaved rationally in pursuing strategies that have been light on innovation. In so doing, most firms have adapted profitably to the incentives and constraints generated within the North American economy over more than a century. This history, which has been too little acknowledged in contemporary analysis, sets the context in which Canada’s innovation performance needs to be understood.

Canada is partnered economically, either explicitly or implicitly, with the United States, a nation ten times its size that was also the twentieth century’s economic leader and innovation dynamo. This unique partnership has had profound consequences for Canadian business strategy and has shaped this country’s business culture and attitude to innovation (CCA 2013).

The relevant context is summarized qualitatively in Figure 2. The North American economy (apart from Mexico) is depicted as a rectangle, the base of which represents the spectrum of activities that dominate the Canada–US economic relationship, ranging from resource extraction at one end to sophisticated end-user products at the other. The vertical dimension signifies the relative specialization of each country across the activities arrayed on the base. The diagonal line separating the two countries represents conceptually the enduring complementarity of the two economies. The diagram depicts the fact that much of Canada’s business sector occupies niches that either are “upstream” or play subsidiary roles in integrated continental value chains. This is obvious in the case of resources (both raw and lightly processed) but also true of several other important industries—for example, automotive, chemicals, pharmaceuticals, computers, and several large retailers like Sears and Wal-Mart.

The unique relationship between Canada and the United States has had two principal and enduring implications for Canadian business strategies in respect of innovation.

The first is that the branch-plant structure typical of many of Canada’s trade-exposed industries has effectively truncated the strategic scope of a great many Canadian-based businesses (Rao, Tang, and Wang 2004). In such cases, the parent company, usually a US multinational, sets the overall strategy including the business model, the approach to marketing, product development (and thus decisions regarding R&D), organizational design, management practices, and the global allocation of the corporation’s resources.4

The subsidiaries are constrained to operate within this strategic framework, with local management responsible for efficient implementation. Innovation strategy in such cases is focused on adapting equipment and business methods to local conditions, achieving defined objectives more cost-effectively, and in some cases winning mandates in competition with other units of the corporate family. Canadian companies often excel at what might be called “plant-floor innovation”—efficiently employing equipment and intellectual property from an American or other foreign parent. For example, several Canadian auto-assembly plants have been among the productivity leaders in the North American industry. Unfortunately, such superior performance is not typical of most manufacturing and service-sector industries in Canada. Our companies tend to match or exceed US productivity levels only in industries where Canada is among the global leaders (e.g., many resource-extraction and -processing sectors) or where there has been long-standing deep integration with the US industry (e.g., transportation equipment). While these high-performing sectors are significant, they are not sufficient to dominate the aggregate productivity performance of the business economy overall.

The second principal implication of Canada’s adjacency to the US colossus is that our exporters focus heavily on provision of intermediate goods or services...
to the American market. While Canada may think of itself as a trading nation, the reality is that a preponderance of our exports and imports are flows back and forth within integrated continental value chains, often inside a single corporation. Consequently, Canadian business strategies have been far less globally oriented than is typically the case for other small-to-mid-size countries such as the Scandinavian nations, the Netherlands, Korea, and Switzerland and also less than the others in the G-7.5

In the Canada–US partnership, most of the innovating occurs in the huge American market where products and business practices are developed and to which Canadian suppliers and customers respond. Consequently, the innovation strategies required of Canadian exporting firms are very often tightly circumscribed—for example, oriented to meeting, in a cost-efficient way, specifications set by a US business customer, rather than innovating to meet the needs of customers, including end users, in a variety of challenging overseas markets.6 In fact, Canadian firms have rarely been successful in consumer markets, even in the neighbouring United States, though there have been a few exceptions, such as BlackBerry (for a time) and TD Bank.

**A Low-innovation Equilibrium**

The economic relationship between Canada and the United States, despite its stunting effect on Canadian business strategies, has been enormously beneficial. Canadian firms on the whole, and for more than a century, have prospered thanks to their unique opportunity to be pulled along by the lead horse in the world economy. Although the relationship has engendered a certain dependency, it has been, and continues to be, profitable.7 There has thus been little sustained pressure on Canadian business as a whole to change a formula that has worked so well. Consequently, Canadian companies have been only as innovative as they have needed to be. For most, it has been easier and cheaper—after all, innovation is risky and therefore costly—to rely on American innovation, accessed through subsidiaries and/or close relationships with US corporate customers and through investment in leading-edge capital equipment, usually sourced abroad.8

The result is that Canadian business has been able to prosper in a low-innovation equilibrium. This explains why Canadian business has not changed its approach to innovation despite a century of effort by successive governments to stimulate a stronger commitment. There is really no mystery. The incentives embedded in the North American economy, as outlined above, have been vastly more powerful than those emanating from government policy. The bottom line is this: the behaviour of Canadian business with regard to innovation will not change unless there is a substantial change in the conditions that have sustained the low-innovation equilibrium.

Why should we worry? Canada’s business economy has consistently delivered one of the world’s highest standards of living. And while our productivity growth has been weak since the mid-1980s, job creation has been the most robust in the G-7 with the result that Canada’s growth in per capita GDP has matched that of the United States on average since 1991.9

Canadian pundits nevertheless regularly express an anxiety that our underlying economic weakness will finally be exposed and the good life will suffer. The contemporary version of this narrative (to which I have often contributed) points to 30 years of dismal productivity growth and a relative dearth of innovative Canadian companies at a time when “innovation” has become almost universally regarded as the key to business competitiveness, especially in high-wage countries.10

**Disrupting the Low-innovation Equilibrium**

Is Canada’s prosperity no longer sustainable? Since the Cassandras have been proven wrong so many times in the past, skepticism is justified. But complacency is not. That is because the conditions that have sustained our low-innovation equilibrium are being disrupted by three tectonic movements of global scale:

- the rising prominence of Asia and other emerging regions, both economically and geopolitically;
- the rapid development and diffusion of transformative, general-purpose technologies—notably information technology, but also bio- and nanotechnologies;
- the sustainability movement, headlined by a growing anxiety regarding climate change, but motivated more generally by the realization that material- and energy-intensive growth, reliant on contemporary technology, cannot be sustainably achieved for a world of nine billion or more.

These three megatrends, which are still gaining momentum, are of particular significance for Canadian business strategy, in view of the country’s out-sized reliance on the North American market; our lagging investment in information technology; and the prominent environmental footprint of our economy. A severe disruption of Canada’s comfortable low-innovation equilibrium appears to be in prospect.

**Emerging Economies**

While the United States will remain our principal economic partner and will be an economic powerhouse for the foreseeable future, the locus of global growth is destined to continue to move toward Asia.11 Consequently, the greatest economic opportunity is shifting...
Canada has enjoyed unique advantages of geography, language, and business culture (namely North America) to markets where we have little established position and where we face potent competition from well-positioned firms in Japan, Korea, Australia, Europe, and, not least, the United States itself. Canadian business on the whole, but with notable exceptions, has not developed a global trading perspective. The dearth of Canadian multinationals, even in the resource sectors, is one striking consequence. If Canada is to compete effectively in the emerging global growth markets—where we lack established access to the new supply networks, let alone to end users—we will have to develop a much larger stable of globally oriented multinationals, much as the Scandinavians, Swiss, Dutch, and Koreans—countries that lacked an adjacent colossus to depend on—were long ago compelled to do.

**Transformative Technologies**

Transformative technologies are arguably the new vector of human evolution. Information technology is transforming, at breakneck speed, virtually every aspect of economic and social behaviour. This is rooted in the continuing exponential improvement in the performance-to-cost ratio of microelectronics and related technologies. A tipping point appears to have been crossed in which computer power is now a global commodity resident in the “cloud,” and genuinely useful artificial intelligence finally promises to replace countless tasks that until very recently were believed to require uniquely human capabilities—e.g., driverless cars, flexible robots, query-response based on natural language. No business model will be immune.

Fortunately, Canadians are among the leaders in digital skills, our supporting infrastructure is good (though not world-leading), and we have considerable business strength in many sectors of the information and communications technology (ICT) industry. Nevertheless, Canadian businesses, particularly small to mid-size companies (SMEs), 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: Canadian investment per worker averages only about 45 percent of the US level, as seen in Figure 3. This gap is larger than the well-publicized Canada-US difference in business R&D spending and is of concern because software is now the leading edge of ICT-based innovation and is a crucial driver of productivity growth.

The reasons for the comparatively low ICT investment by Canadian SMEs are not well understood. But it would be consistent with the more general thesis as to the comparatively weak innovation propensity of Canadian companies, one effect of which is that the diffusion of the latest information technology is considerably slower in Canada than in the United States. In view of the radically transformative effect of ICT, this would put the lagging Canadian businesses at a growing competitive disadvantage. More innovation-focused strategies are required.

**Sustainability**

Canada, both as steward of a vast territory and as a major producer of many natural resources, bears a dual ethical and commercial responsibility to be among the world leaders in the transition to environmentally sustainable growth. The widespread vilification of the “tar sands”—recently symbolized by the US rejection of the Keystone pipeline—may be a harbinger of increasing global activism as the deleterious impacts of growth become more visible and urgent. Canada’s resource economy is destined to be at the epicentre of these issues.

The threat to resource-based prosperity is twofold: first, from growing public opposition to practices perceived to be “dirty” or unsustainable; and second, from substitutes that are developed in response to high prices or concern over security of supply, or to reduce environmental impacts. In both cases the threats can be mitigated and transformed into new market opportunities, but only through innovation. The potent incentive to innovate created by this nexus of threat and opportunity still may not be sufficient to overcome the inertia of a status quo that is sustained by ingrained habits born of long-term success, despite recurrent downturns.

There are hopeful signs that Canadian resource companies are investing more in home-grown innovation—for example, R&D spending has increased sharply in the oil and gas industry, at least before the recent price
The thesis of this paper can be summarized as follows:

Summary and Conclusion
The thesis of this paper can be summarized as follows:

- Canadian business as a whole, but always with notable exceptions, displays a weak commitment to innovation compared particularly with the United States, but also with many other industrialized countries of all sizes.
- Evidence of sub-par innovation is found throughout the Canadian business economy and has been observed for more than a century.
- The extent and persistence of the phenomenon imply that Canada’s weak innovation propensity is in fact a rational, profitable adaptation to the incentives and constraints prevalent in the North American economy. Canadian business has been only as innovative as it has needed to be.
- Canada’s low-innovation equilibrium has been sustained by a unique complementary relationship with the United States in which Canada’s position has primarily been “upstream,” or in a subsidiary role, in integrated North American value chains while the United States did most of the innovating and provided market scale.
- The result has been profitable for Canadian business, but dependency on the United States has led to truncated business strategies—light both on innovation and on trade beyond North America.
- Looking forward, can these long-standing conditions still be counted on to sustain Canada’s prosperity?
- Three global megatrends are combining powerfully to disrupt Canada’s low-innovation equilibrium: the rise of Asia, the revolutionary transformations created by information technology, and the imperative to make growth environmentally sustainable. Each is challenging Canadian business to become more innovative.

Will the challenge be met with sufficient vigour and before too much opportunity is lost? The jury is out. The habits embedded over a century have created a business culture in Canada that cannot easily be changed. What may be needed, as wryly observed in a brilliant 1972 article by V.O. Marquez, are “small catastrophes,” disruptive enough to dislodge complacency but not fatal.

Public policy cannot of course deliberately engineer a catastrophe. But it can help through (a) well-targeted spending—e.g., on infrastructure that complements private investment, on precompetitive research and demonstration, and on the development of twenty-first-century workforce skills; and (b) challenging regulation—e.g., to encourage “green” innovation, amplify the new incentives emanating from the global market. But the lesson of Canada’s history is that public policies to promote business innovation will have little impact on Canadian business strategy unless businesses themselves decide they have to become more innovative to prosper, or even to survive.

Notes
1 R&D is an input to the innovation process and is performed by businesses (primarily in manufacturing and knowledge-based services) that account for only about 20 percent of the economy in advanced countries. The widespread fixation on R&D spending in innovation-policy discussion is therefore somewhat misplaced. R&D is not itself a measure of innovation, and even if it were, it would not capture the innovation taking place daily in the majority of the economy. There is nevertheless some correlation between R&D spending and other indicators of innovation.
2 The measurement of labour productivity depends on the measurement of output of goods and services (real GDP). Although there are methodological difficulties, particularly in measuring the output of services, these difficulties are less important in making year-to-year growth estimates or in comparing productivity trajectories between countries such as Canada and the United States that use very similar methods to measure output.
3 An example that illustrates the nature of an increase in MFP: When a fast-food chain installs a drive-thru window, sales volume (output) typically increases significantly relative to a modest one-time capital investment plus some ongoing extra labour. The additional output per hour, over and above the capital and labour inputs, shows up statistically as increased MFP. The increase is due to the organizational/process innovation of the drive-thru window, as a result of which the customer’s car substitutes for seats in the restaurant, throughput is speeded up, and customer choice is enhanced.
4 These higher-order corporate activities are the kind whose effects on productivity growth are subsumed within MFP growth. One might speculate that persistently weak MFP growth in Canada is due in part to the fact that Canadian
It is not being suggested that the United States is in decline, but rather that several parts of Asia are finally on the path toward convergence with the OECD group, and this implies that the former will, for many years to come, be growing faster than the latter. The demographic weight of Asia adds greatly to the pull of that market. For Canada, there will continue to be many attractive opportunities south of the border, but the Canadian economy will suffer if our companies concentrate only on the slower-growth parts of the world (and this includes Western Europe). Innovators tend to be more attracted to areas where new opportunities are expanding most rapidly.

The cost of a “unit of performance” of logic circuits, data transmission, and data storage has been cut in half roughly every two years for decades. While the present technology paradigm may be nearing its limit in terms of engineering economics, two or three more doublings of performance relative to cost can be foreseen. Today’s performance is already at such a high level that each doubling creates qualitatively new possibilities. There is also the prospect that the present silicon-based computing technology will be followed by “quantum” computing, thus opening up hitherto inaccessible fields of analysis.

References


