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The Business of Innovation in Canada: Challenges and Responses

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THE BUSINESS OF INNOVATION IN CANADA: CHALLENGES AND RESPONSES

1 INTRODUCTION

Canada is a very prosperous country, largely as a result of having a stable governance structure, an abundance of sought-after natural resources, and sound legal and financial systems. Recent studies, however, suggest that Canada's innovation performance lags behind that of other developed nations, which will affect the prosperity Canadians enjoy.

Innovation is defined by the Organisation for Economic Co-operation and Development (OECD) as:

> 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.[1]

Innovation is the key driver of productivity growth.[2] Productivity growth, in turn, allows more to be done with the same quantity of resources, which is important for economic growth and prosperity. Unfortunately, for decades, Canada has lagged behind its major trading partners (e.g., the United States) in this area; specifically, at 0.6%, Canada's labour productivity growth was less than half of the OECD average of 1.5% for the years 2000 to 2009.[3] Multifactor productivity growth (a measure of how effectively labour and capital are employed jointly to produce output) is another area in which Canada does not perform as well as the United States.[4]

If the challenge of poor productivity growth is not addressed, Canada's future economic growth and relatively high standard of living will be in jeopardy. Hence, innovation is a very important public policy concern, and in recent years, the federal government has placed increased focus on trying to improve Canada's innovation performance.

This paper examines the current state of innovation in Canada, summarizes recent reports that address some of the country's key challenges in this area, and discusses how the federal government has responded to these challenges.

2 CANADA'S INNOVATION PERFORMANCE

How does innovation in Canada compare with that of other developed nations? The answer is complicated because of the complexity of trying to measure innovation performance, as there is no internationally accepted, single standard method to do so. It should be noted that the OECD has tried to develop improved methods of innovation performance measurement, by studying the traditional measures of innovation performance in concert with new measures that capture linkages between actors and processes; the climate for collaboration in a jurisdiction; and contributing

components, such as entrepreneurship and economic conditions. However, this OECD innovation strategy is an experiment in progress, and will continue to be developed over time.[5] In this paper, traditional OECD methods of innovation performance measurement will be employed.

As research and development (R & D)[6] is a key building block of innovation, measures of R & D funding are often used as proxy measures of innovation when comparing one jurisdiction's innovation performance with another's. In fact, experts have stated that "investment by businesses in R & D is a key input to many kinds of innovation,"[7] and that "productivity growth, in turn, is primarily the result of innovation."[8] Given that R & D can lead to innovation, and innovation is a key driver of productivity growth, investing in R & D is one of the paths that may be followed to address Canada's continuing poor productivity performance.

The following measures can be used to compare investment in R & D across jurisdictions:

- The percentage of a country's gross domestic product (GDP) that is devoted to R & D. This is known as Gross Domestic Expenditure on R & D (GERD)[9] as a percentage of GDP, or "R & D Intensity."
- The value of total business investment in R & D as a percentage of GDP. This is known as Business Enterprise Expenditure on R & D (BERD) as a percentage of GDP.[10]
- Investment in Information and Communications Technology (ICT) as a percentage of total commercial capital investment. This is also considered an important measure of innovation performance, given the importance of ICT in the knowledge economy.[11]

GERD, BERD, and ICT investment can be considered innovation "inputs," as they are investments intended to spur and create innovation. In contrast, there are also measures of innovation "outputs," such as the number of patents filed in an economy. [12] In fact, commentators have observed that "a key measure of innovative capacity and processes is patenting."[13]

Recent studies from the OECD show how Canada compares with other developed nations where some of these indicators of innovation performance are concerned (see Table 1). Most of this OECD data is current to 2009. In the meantime, Statistics Canada has reported that Canada's 2010 GERD expenditures were $29.2 billion, including planned business R & D spending of $14.8 billion, representing the largest contributor to overall R & D expenditures.[14]

Table 1 – OECD Measures of Canada's Innovation Performance, Various Years

Measure (Year)	OECD Rank	Canada's Performance
GERD/GDP (2009)	15th of 37	1.92% – Below the OECD average of 2.33%; below Canada's 2004 level[a]
BERD/GDP (2009)	20th of 37	1.00% – Below the OECD average of 1.62%; below Canada's 1999 level
ICT investment/Total commercial capital investment (2009)	9th of 20	16.99% – Slightly below the OECD average of 17.04%; same relative position as in 2007.
Percentage of high and medium-high technology patents/All patenting activity (2007–2009)	6th of 22	56.7% – Higher than the OECD average of 50.1%

Notes: a. This measure is taken from Statistics Canada, *Gross Domestic Expenditures on Research and Development in Canada (GERD) and the Provinces: National Estimates 1997 to 2008 and Provincial Estimates 2002 to 2006*, Catalogue no. 88-221-X, 2008, p. 7.

Source: OECD iLibrary, *OECD Science, Technology and Industry Scoreboard 2011*.

Although Table 1 shows that Canada does well in terms of high and medium-high technology patents, innovation performance in the areas of GERD, BERD, and ICT investment is below the OECD average, especially for BERD. According to the OECD, Israel, Finland and Sweden lead the GERD and BERD categories; the United States, Sweden and Denmark lead in ICT investment.[15] Why do these countries outperform Canada in these areas? The answer, as stated previously, is not easy to articulate. The following sections will address some of the underlying reasons for Canada's relatively weak innovation performance.

3 THE SCIENCE AND TECHNOLOGY STRATEGY

Partly to address Canada's poor innovation performance, in 2007 the Government of Canada presented *Mobilizing Science and Technology to Canada's Advantage,* which outlined the government's science and technology (S & T) policy, and its intended results:

> Canada can and must do more to turn our ideas into innovations that provide solutions to environmental, health, and other important social challenges, and to improve our economic competitiveness. [16]

Past governments have also attempted to address Canada's R & D, innovation, and productivity gaps; examples are the creation of the Canada Foundation for Innovation (CFI) and increased investments in the three federal granting agencies.[17] The present government's efforts began in Budget 2006, and continued with the 2007 S & T strategy, whose expected outcomes include increased private sector commitment to innovation.[18]

These were the stated policy goals of the 2007 strategy:

- Entrepreneurial Advantage: Promoting turning inventions into profitable, value-added products that create growth and prosperity.

- Knowledge Advantage: Making Canada a place where important developments create benefits for health, the environment, the economy and society.
- People Advantage: Attracting the best skills from all over the world in order to help Canada to succeed in the global economy.

Since Budget 2006 (one year before the 2007 federal S & T strategy), the Government of Canada has invested almost $8 billion in additional "funding for initiatives to support science, technology and the growth of innovative firms."[19] Details of current federal expenditures on S & T will be discussed in section 5 of this paper.

4 RECENT STUDIES RELATED TO CANADA'S INNOVATION PERFORMANCE

Over the past few years, the federal government has asked several organizations and review panels to assess Canada's innovation performance. This section presents a summary of their findings and recommendations.

4.1 REPORT OF THE SCIENCE AND TECHNOLOGY INNOVATION COUNCIL

As part of the 2007 federal S & T strategy referenced earlier,[20] the Science and Technology Innovation Council was created as "an advisory body that provides the Government of Canada with external policy advice on science and technology issues."[21] Its mandate is to report on Canada's science and technology performance.[22]

In *State of the Nation, 2010 – Imagination to Innovation: Building Canadian Paths to Prosperity*,[23] the Council compared Canada's R & D performance in 2008 against that of previous years. The highlights of its assessment are as follows:

- Canada's overall investment in R & D is below the OECD average, and is lower than it was in 2006.
- In terms of developing the talent for innovation, Canada is currently in the top tier of countries, but is losing ground relative to these countries. For example, the OECD's Programme for International Student Assessment (2009) still ranks Canada within the top group of countries of the world in the areas of reading, mathematics, and science. However, Canada's ranking *within* that group is falling. Similarly, although Canada has increased its percentage of science-based doctoral candidates, the country's relative position amongst the OECD countries studied has also fallen.
- Although knowledge transfer to Canadian business has improved, overall business investment in R & D is still subpar, continuing the pattern of the past 40 years.
- Between 2000 and 2007, Canadian businesses invested 50% less in ICT and 75% less in machinery and equipment than their American counterparts. However, the following Canadian industry sectors invest more in R & D than the

OECD average: ICT; pulp and paper producers; wholesale and retail trade; financial services; communications; and business services.

- Providing about $4 billion per year in tax credits for eligible R & D work performed in Canada, Canada's Scientific Research and Experimental Development (SR & ED) Tax Incentive Program is one of the most generous programs of its type in the world.
- The federal government provides more R & D support to businesses via indirect programs than through direct grants or procurement. While the report found there was insufficient evidence to determine the superiority or inferiority of indirect R & D support programs, it stated that countries with higher BERD tend to favour more direct funding programs.[24]

Overall, the report concluded that Canada must do more to develop and leverage its talent pool, and to encourage investment in leading-edge technologies. Moreover, it stated that Canadian industry must integrate innovation into their business strategies and that Canadian governments must do the same for their policy strategies.

4.2 COUNCIL OF CANADIAN ACADEMIES: REPORT OF THE EXPERT PANEL ON BUSINESS INNOVATION

The Council of Canadian Academies (CCA) is an independent organization that was set up through a federal government endowment in 2005. It supports science-based expert panel assessments to inform public policy in Canada.[25] In 2007, the Government of Canada tasked the CCA with conducting an assessment of the innovation performance of Canadian business.

In 2009, the Expert Panel on Business Innovation presented its report, entitled *Innovation and Business Strategy: Why Canada Falls Short*. The report identified innovation as "the key driver of labour productivity growth (increased output per hour worked) and the main source of national prosperity."[26] To that end, the panel examined innovation as an economic process rather than a science and engineering activity.

4.2.1 THE FINDINGS OF THE CCA EXPERT PANEL

The panel made the following findings:

- Canada's productivity problem is "a business innovation problem."[27]
- Canada's poor productivity growth is related to Canada's lagging behind countries like the United States in business investment in R & D, machinery and equipment, and ICT.
- Innovation as a primary business strategy is determined by factors such as:

> (i) particular characteristics of the firm's sector; (ii) the state of competition; (iii) the climate for new ventures; (iv) public policies that encourage or inhibit innovation; and (v) business ambition (i.e., entrepreneurial aggressiveness and growth orientation).[28]

The relative importance of the factors will vary according to sector and during the life cycle of firms.

- Canada's economy has two structural characteristics that help explain the country's challenges in becoming an innovation leader:
  - In the value chain, Canadian firms are often "upstream" – much economic activity is used to extract and/or process raw materials for use "downstream" in value-added activities such as manufacturing and assembly. Hence, in the part of the process where innovation can have more impact (e.g., the development of new products), Canada does not have a strong presence. In other words, since too many Canadian firms lack exposure to end users, they may also lack "innovation ambition."
  - Canada's domestic marketplace does not create a strong enough incentive for businesses to invest in innovation, given the country's small population and large landmass.

4.2.2 The Recommendations of the CCA Expert Panel

The panel made the following recommendations:

- Canada must encourage both new venture financing and commercialization of innovation; also, more must be done to transform Canada's strong university research into commercially viable products.
- Canada must aim to strengthen managerial capacity through improved training of business managers, in order to build upon and better leverage existing research capacity (business and academic), with the goal of commercializing the results of R & D.

It should also be noted that the expert panel drew attention to the importance of "industry clusters," which are geographic regions with a strong concentration of like-minded firms and stakeholders. This concentration, in turn, tends to draw other like-minded firms and individuals to the region, further increasing research and output capacity; moreover, it allows for increased collaboration among players. In short, the report found that clusters encourage innovation, but that Canada does not have enough of them.

4.3 Report of the Expert Panel on the Review of Federal Support to Research and Development

In 2010, the Government of Canada tasked a panel of experts to "provide recommendations on maximizing the effect of federal programs that contribute to innovation and create economic opportunities for business."[29] The panel was asked to make recommendations that did not change current federal funding levels or currently regulated federal research requirements.

On 17 October 2011 the panel presented *Innovation Canada: A Call to Action* (also known as the "Jenkins Report," after its chair, Tom Jenkins). The report highlighted the importance of innovation as a solution to the longstanding problem of Canada's poor productivity performance.

As the panel found that "Canada's subpar productivity growth is largely attributable to relatively weak business innovation," [30] the report made several recommendations to the Government of Canada for advancing Canada's position to be an innovation leader, including:

- Create the Industrial Research and Innovation Council by converging some 60 federal business innovation programs (presently administered by 17 departments) into one common administration. This concept is referred to as the "service concierge" model.
- Simplify the SR & ED program by limiting eligible expenses to labour costs. The panel suggested that this change may encourage more small businesses to use the program by simplifying the assessment, application and reporting requirements for them.
- Leverage the $15 billion the federal government spends annually on procurement[31] by integrating innovation into government contract requirements. The panel suggested that innovation could be used as a criterion in bid evaluation.
- Allow the National Research Council Canada (NRC) to be diversified into several large, focused non-profit centres which would each collaborate with businesses, universities and the provinces in areas of specialization.
- Increase the seed money available for innovative, high-growth firms through additional funding to the Business Development Bank of Canada. The panel suggested that this change will help reduce "intellectual capital flight" by foreign investors, whereby non-Canadian business owners transfer intellectual property and skills out of Canada.
- Empower an "innovation champion" who will promote innovation within the Cabinet, and liaise with other levels of government to improve the coordination of innovation policy, program design and implementation.

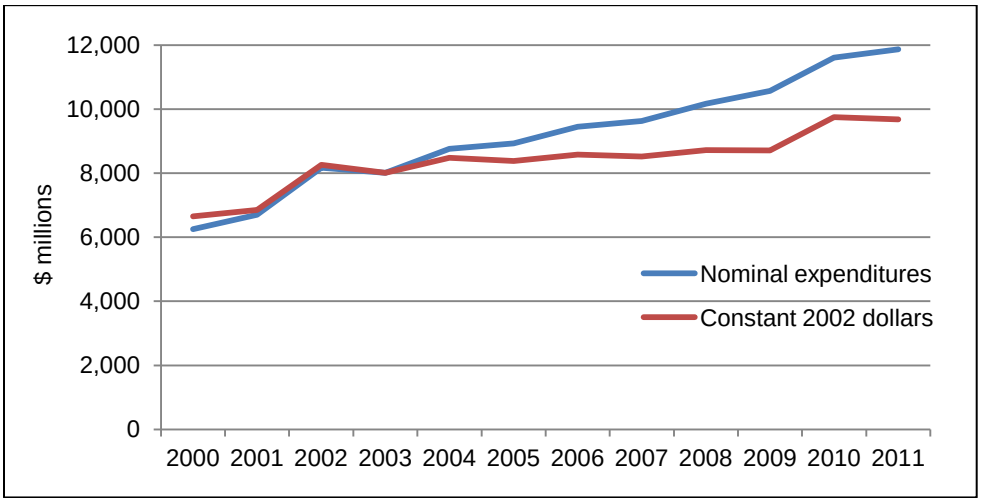
Budget 2012 introduced several changes to how business-based R & D programs would be funded and administered, including changes to NRC's Industrial Research Assistance Program, the SR & ED Tax Incentive Program, and venture capital funding. Many of these changes were in response to recommendations made in the Jenkins Report.

5 FEDERAL GOVERNMENT SUPPORT

5.1 FEDERAL EXPENDITURES ON S & T

Adjusting for inflation, federal S & T spending increased by 47% during the 10-year period between 1999–2000 and 2009–2010 (see Figure 1).

Figure 1 – Federal Expenditures on Science and Technology, 2000–2011



Source: Figure prepared by the author using data obtained from Statistics Canada, "Federal expenditures – On science and technology, research and development and related scientific activities in current dollars and in constant 2002 dollars," Table 1-1, *Federal Scientific Activities 2011/2012*, Catalogue no. 88-204-X, 2011.

Figure 1 shows that at $11.9 billion, 2010–2011 federal S & T funding was 41.18% higher than it was 10 years ago, adjusting for inflation. However, Figure 1 also shows that real growth in such funding has been relatively flat since the mid 2000s, with one sharp increase observed in 2009, which was mostly attributable to the economic stimulus spending proposed in Budget 2009.[32]

5.2 BUDGET 2012

Partly in response to the findings of the aforementioned expert review panels, and in continuing the policy mandate of the 2007 S & T strategy, the 2012 Budget committed over $900 million to "better support business innovation."[33] It included the following proposed expenditures.

Funding for business innovation:

- $400 million to help develop private venture capital funds;
- $100 million to support the venture capital activities of the Business Development Bank of Canada;
- $105 million for forestry innovation and market development; and
- over $30 million per year to make the Canadian Innovation Commercialization Program permanent, along with a new military procurement component.

Funding support for research, education and training:

- $500 million over five years for the Canada Foundation for Innovation to fund new projects, including the College–Industry Innovation Fund;

- $60 million for Genome Canada to begin a new human health applied research competition, and to continue the operation of Science and Technology Centres until 2014–2015; and
- an additional $37 million per year directed to the Natural Sciences and Engineering Research Council of Canada (NSERC), Social Sciences and Humanities Research Council of Canada (SSHRC), and Canadian Institutes of Health Research (CIHR) to help support industry–academic research partnerships.

Budget 2012 also announced plans and funding to streamline and improve the SR & ED Tax Incentive Program by working to make the program more predictable for applicants, and by removing capital as an eligible expense, while keeping salary and wages, materials, overhead expenses and contract payments as eligible expenses.

These investments may be seen as the federal government's response to some of the findings and recommendations of various review panels, particularly the Jenkins Report, as stated previously. The stated aim of Budget 2012 was to encourage the private sector to invest in additional R & D activities, and to help bridge the divide between industry and Canada's post-secondary institutions, all with the goal of helping Canadian companies become more innovative and spurring Canada to be more economically competitive.

5.3 Planned Federal S & T Spending for 2011–2012

For 2011–2012, the federal government projected S & T expenditures of $11.3 billion, a decrease of $600 million from the previous year (attributable to the winding down of stimulus spending for S & T activities). Details of the funding are as follows:[34]

- An amount of $7.1 billion is allocated for R & D activities.
- Of the over $5 billion planned for extramural funding (i.e., directed for use outside the government: for universities, businesses, etc.), $2.2 billion is targeted at institutions of higher education. Most of this amount will be delivered by the following organizations: CIHR ($868 million); NSERC ($818 million); and SSHRC ($520 million).
- Of the federal funding for R & D, $1.02 billion is allocated to Canadian businesses. This represents an increase of over 50% in business enterprise R & D funding compared to the funding provided in 2002–2003.

6 CONCLUSION

As the findings of the various expert panels tasked with examining the state of R & D and innovation in Canada conclude, Canada's weak innovation performance can generally be traced to the overall poor business investment in innovation. The panels also showed that Canada's relatively subpar productivity growth will put the nation's prosperity in jeopardy, if left unaddressed. In an effort to avoid this outcome, the

federal government continues to invest in programs to better encourage business innovation, with the goal of increasing productivity growth. The thinking is that this, in turn, will help Canada remain economically competitive.

Federal government measures introduced in recent years, such as those intended to help foster innovation in the forestry sector, may help address the challenges faced by Canada's many natural resource–based industries in leveraging their expertise in developing innovation earlier in the value chain. A similar result may be attained by implementing the measures intended to turn Canada's academic research results into commercially viable products and services, and those intended to help businesses become more innovative. The goal of all of these measures is to improve Canada's overall innovation performance, productivity growth, and economic competitiveness.

NOTES

1. Organisation for Economic Co-operation and Development [OECD], *The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data – Oslo Manual*, 3rd ed., 2005, p. 46.

2. Independent Panel on Federal Support to Research and Development [Expert Panel], "The Context of the Review," Chapter 2 in *Innovation Canada: A Call to Action*, 2011.

   The Conference Board of Canada defines *productivity* as "output per hour worked," with *output* defined as "the final product of the production activity. Output is obtained from the combination of resources such as labour, capital, materials, services and energy." Conference Board of Canada, *e-Data – Data Definitions: Output per Hour Worked*.

3. Expert Panel (2011), Figure 2.1, "Relative Level of Labour Productivity in the Business Sector, 1947–2009 (Canada as a percentage of the United States," p. 2-3.

4. Ibid., Figure 2.2, "Sources of Canada–US Gap in Average Annual Labour Productivity Growth (differences in percentage growth rates: Canada minus the US)," p. 2-4.

5. For further information about the OECD's efforts in this area, please refer to OECD, "Foreword," *Measuring Innovation: A New Perspective*, 2010.

6. The *Frascati Manual* published by the OECD defines R & D as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications." OECD, *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*, 6th ed., 2002, p. 30.

7. Expert Panel (2011), p. 2-4.

8. Ibid., p. 2-1.

9. According to the OECD, "GERD [Gross domestic expenditure on research and development] is total intramural expenditure on R & D performed on the national territory during a given period." See OECD (2002), p. 121.

10. BERD is defined as "R & D Expenditure in the Business Enterprise Sector in a given year at the regional level." See OECD, *Glossary of Statistical Terms*.

11. According to the OECD, "*ICT investment* covers the acquisition of equipment and computer software used in production for more than one year." OECD iLibrary, "Investment in ICT," in "Building Knowledge," Chapter 2 in *OECD Science, Technology and Industry Scoreboard 2011*, 2011.

12. The OECD compares various countries' patent performances through a measure of various patents filed as a percentage of filings at the European Patent Office and the United States Patent and Trademark Office. OECD iLibrary, "Patenting Activity by Sector, 2007–2009," in "Patenting firms," in "Competing in the Global Economy," Chapter 6 in *OECD Science, Technology and Industry Scoreboard 2011*, 2011.

13. Institute for Competitiveness & Prosperity, *Canada's Innovation Imperative: Report on Canada 2011*, p. 40.

14. Statistics Canada, "Science and technology," *Canada Year Book 2011*, Catalogue no. 11-402-X, 2011.

15. OECD iLibrary, "R&D Expenditure," "Business R&D," and "Investment in ICT," in "Building Knowledge," Chapter 2 in *OECD Science, Technology and Industry Scoreboard 2011*, 2011.

16. Industry Canada, "Executive Summary," Mobilizing Science and Technology to Canada's Advantage – 2007, 2007, p. 7.

17. The three granting agencies are the Natural Sciences and Engineering Research Council of Canada (NSERC); the Social Sciences and Humanities Research Council of Canada (SSHRC); and the Canadian Institutes of Health Research (CIHR).

18. Budget 2006 announced proposed new expenditures totalling $100 million for research. For further information, see Department of Finance Canada, *Budget Plan 2006*, pp. 84–85.

19. Government of Canada, "Backgrounder – Supporting Entrepreneurs, Innovators, and World-Class Research," *Budget 2012*.

20. Industry Canada (2007).

21. Science, Technology and Innovation Council, *About Us*.

22. Ibid.

23. Science, Technology and Innovation Council, *State of the Nation 2010 – Canada's Science, Technology and Innovation System*.

24. In 2011, the OECD ranked Canada second of 23 countries for which data were available with regard to tax incentives for business R & D. OECD iLibrary, "Tax incentives for business R & D," in "Unleashing Innovation in Firms," Chapter 5 in *OECD Science, Technology and Industry Scoreboard 2011*, 2011.

25. Council of Canadian Academies, *About Us*.

26. The Expert Panel on Business Innovation, *Innovation and Business Strategy: Why Canada Falls Short*, Council of Canadian Academies, 2009, p. 3.

27 Ibid., p. 11.

28. Ibid, p. 6.

29. Review of Federal Support to Research and Development, *Mandate: Expert Review Panel on Research and Development*.

30. Review of Federal Support to Research and Development, *Innovation Canada: A Call to Action*.

31. Public Works and Government Services Canada, buyandsell.gc.ca, *The Procurement Process*.

32. Department of Finance Canada, "Chapter 3 – *Advantage Canada*: Progress Toward a More Competitive Canada," *Canada's Economic Action Plan Budget 2009*.

33. Government of Canada, "Budget Plan," *Budget 2012*.

34. Statistics Canada, *Federal Scientific Activities 2011/2012*, Catalogue no. 88-204-X, 2011.